

TABLE OF CONTENTS

SPECIFICATIONS

General Requirements

NUMBER	TITLE	PAGES
	General Conditions	GC1-GC46
	Special Conditions	SC1-SC17
01005	Statement of Work (Roadway Identification and Location & quantities worksheet)	1-2
01040	Site Requirements	1-2
01300	Submittals and Certificate of Compliance	1-3
01560	Environmental Requirements	1-5
01590	Utility Relocation	1-5
	General Notes	1
TS-01	Induction loop	1-1

Deep Patch and Resurfacing

0301	Cement Stabilized Reclaimed Base Construction	1-10
0400	Hot Mix Asphalt (Appendices)	1-22
0413	Bituminous Tack	1-4
0430	Portland Cement Concrete Paving	1-19
0432	Mill Asphaltic Concrete Pavement	1-3
0652	Traffic Striping – Paint	1-4
0653	Traffic Striping – Thermoplastic	1-9

0654	Raised Pavement Markers	1-3
0868	Bituminous Adhesive for Raised Pavement Markers	1-4
0870	Paint	1-15
0886	Epoxy Resin Additives	1-3
0919	Raised Pavement Markers	1-3

2015 Macon-Bibb County LMIG Projects
General Conditions

TABLE OF CONTENTS OF GENERAL CONDITION

Article Number	Title	GC Page
ARTICLE 1.	DEFINITIONS.....	GC6
ARTICLE 2.	PRELIMINARY MATTERS.....	GC8
ARTICLE 3.	CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE.....	GC10
ARTICLE 4.	AVAILABILITY OF LANDS; PHYSICAL CONDITIONS; REFERENCE POINTS.....	GC11
ARTICLE 5.	BONDS AND INSURANCE.....	GC13
ARTICLE 6.	CONTRACTOR’S RESPONSIBILITIES.....	GC17
ARTICLE 7.	OTHER WORK.....	GC25
ARTICLE 8.	OWNER’S RESPONSIBILITIES.....	GC26
ARTICLE 9.	ENGINEER’S STATUS DURING CONSTRUCTION.....	GC26
ARTICLE 10.	CHANGES IN THE WORK.....	GC29
ARTICLE 11.	CHANGE OF CONTRACT PRICE.....	GC30
ARTICLE 12.	CHANGE OF CONTRACT TIME.....	GC34
ARTICLE 13.	WARRANTY AND GUARANTEE; TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK.....	GC35
ARTICLE 14.	PAYMENTS TO CONTRACTOR AND COMPLETION.....	GC38
ARTICLE 15.	SUSPENSION OF WORK AND TERMINATION.....	GC43
ARTICLE 16.	ARBITRATION (Omitted).....	GC45
ARTICLE 17.	MISCELLANEOUS.....	GC45

INDEX TO GENERAL CONDITIONS

A			
Acceptance of Insurance	18	--amending and supplementing	12
Access to Work	37	--definition of.....	7
Addenda--definition of.....	7	--Intent	11
Agreement--definition of	7	--Reuse of	12
All Risk Insurance.....	16	Contract Price	
Application for Payment		--Change of	31
--definition of.....	7	--definition of.....	7
--Final	44	Contract Time	
Application for Progress Payment	40	--Change of	36
--review of	40	--Commencement of	10
Arbitration.....	47	--definition of.....	7
Authorized Variations in Work.....	28	Contract Time, Change of.....	36
Availability of Lands	12	Contractor May Stop Work or Terminate.	46
Award, Notice of --defined.....	8	Contractor--definition of.....	7
B		Contractor's Continuing Obligation	44
Before Starting Construction	10	Contractor's Duty to Report Discrepancy in	
Bid--definition of	7	Documents	10
Bonds		Contractor's Fee	34
--definition of.....	7	Contractor's Fee--Cost Plus	34
Bonds and Insurance-in general.....	15	Contractor's Liability Insurance.....	15
Bonds, Delivery of	9, 15	Contractor's Responsibilities--in general ..	19
Bonds, Performance and Other	15	Contractor's Warranty of Title	40
C		Contractors--other	27
Cash Allowances.....	35	Contractual Liability Insurance.....	16
Change Order	29	Coordinating Contractor--definition of....	27
--definition of.....	7	Coordination	27
Change Orders		Copies of Documents	9
--to be executed	31	Correction or Removal of Defective Work	38
Changes in the Work	31	Correction Period, One Year.....	38
Claims, Waiver of--on Final Payment	44	Correction, Removal or Acceptance of	
Clarifications and Interpretations.....	28	Defective Work.....	38
Cleaning	23	Cost of the Work.....	32
Contract Time	10	Cost--net decrease	35
Completion	39	Costs, Supplemental.....	33
Completion, Substantial.....	42	D	
Conflict, Error, Discrepancy--Contractor to		Defective Work	
Report	10, 12	--Acceptance of.....	39
Construction Equipment , Machinery, etc.	19	--Correction or Removal of	38
Continuing Work	25	--in general.....	37
Contract Documents		--Rejecting	29
		Defective--definition of	7
		Definitions.....	7
		Delivery of Bonds	9

Determinations for Unit Prices	29
Disputes, Decisions by Engineer	29
Documents	
--Copies of	9
--Record	23
--Reuse	12
Drawings	
--definition of.....	8
E	
Easements	12
Effective Date of The Agreement--definition of.....	8
Emergencies	24
Engineer	
--definition of.....	8
Engineer's	
--Notice Work is Acceptable	44
--Recommendation of Payment	40, 44
Engineer's Decisions	30
Engineer's Responsibilities, Limitations on	30
Engineer's Status During Construction	
--in general.....	28
Equipment, Labor, Materials and.....	19
Equivalent Materials and Equipment... ..	19,20
Explorations of Physical Conditions.....	13
F	
Fee, Contractor's--Costs Plus	34,35
Field Order	
--definition of.....	8
--issued by Engineer	12, 28,29
Final Application for Payment.....	44
Final Inspection.....	43
Final Payment and Acceptance	44
Final Payment, Recommendation of.....	44
G	
General Provisions	47
General Requirements	
--definition of.....	8
--principal references to. 10, 14, 19, 20, 24	
Giving Notice.....	47
Guarantee of Work--by Contractor	36

I	
Indemnification	26
Inspection, Final.....	43
Inspections, Tests and	37
Insurance	
--Certificates of.....	10, 15
--completed operations	16
--Contractor's Liability	15
--Contractual Liability	16
--Owner's Liability.....	16
--Property.....	16
--Waiver of Rights	17
Insurance, Bonds and--in general	15
Intent of Contract Documents.....	11
Interpretations, Clarifications and.....	29
Investigations of physical conditions.....	13
L	
Labor, Materials and Equipment.....	19
Laws and Regulations	
--definition of.....	8
--general.....	22
Liability Insurance	
--Contractor's	15
--Owner's	16
Liens--definitions of.....	40
Limitations of Engineer's Responsibilities	30
M	
Materials and equipment	
--not incorporated in Work	40
Materials and Equipment	
--furnished by Contractor	19
Materials or equipment--equivalent.....	20
Miscellaneous Provisions.....	47
Multi-prime contracts.....	27
N	
Notice of Acceptability of Project	44
Notice of Award--definition of	8
Notice to Proceed	
--definition of.....	8
--giving of	10
Notice, Giving of	47
O	
Or-Equal Items.....	19,20

Other contractors.....	27
Other work	27
Other Work	
Owner May Correct Defective Work.....	39
Owner May Stop Work.....	38
Owner May Suspend Work, Terminate	45
Owner--definition of	8
Owner's Duty to Execute Change Orders .	35
Owner's Liability Insurance	16
Owner's Representative	
--Engineer to serve as	28
Owner's Responsibilities--in general	27
Owner's Separate Representative at site ...	28
P	
Partial Utilization	42
--definition of.....	8
--Property Insurance	18
Patent Fees and Royalties	22
Payments to Contractor	
--in general.....	40
--when due	40, 44
--withholding	41
Payments, Recommendation of	40, 44
Performance and Other Bonds	15
Permits	22
Physical Conditions	13
--Engineer's Review.....	13
--existing structures	13
--explorations and reports.....	13
--possible document change	13
--price and time adjustments.....	13
--report of differing.....	13
--Underground Facilities.....	14
Conference	11
Pre-construction Conference.....	10
Preliminary Matters	9
Premises, Use of.....	23
Price, Change of Contract.....	31
Price, Contract--definition of	7
Progress Payment	
--Application for	40
--retainage.....	40
<i>Progress schedule</i> .	10, 11, 19, 26, 31, 46, 47
Project	
--definition of.....	8
Project Representation	

--provision for	28
Project Representative, Resident--definition of	8
Project, Starting the.....	10
Property Insurance	16
--Partial Utilization	17,18
--Receipt and Application of Proceeds ..	18
Protection, Safety and	23
Punch List	43

R

Recommendation of Payment	40, 44
Record Documents.....	23
Reference Points	14
Regulations, Laws and	22
Rejecting Defective Work.....	29
Related Work at Site	26
Remedies Not Exclusive.....	47
Removal or Correction of Defective Work	38
Resident Project Representative	
--definition of.....	8
--provision of	28
Responsibilities, Contractor's--in general .	18
Responsibilities, Engineer's--in general ...	28
Responsibilities, Owner's--in general	27
Retainage.....	40
Reuse of Documents	12
Rights of Way	12
Royalties, Patent Fees and	22

S

Safety and Protection	24
Samples	25
Schedule of Progress.....	20
Schedule of Shop Drawing submissions ..	10, 11, 25
Schedule of Values	39
Schedules, Finalizing	11
Shop Drawings.....	29
--definition of.....	8
--use to approve substitutions	21
Shop Drawings and Samples	24,25
Site, Visits to--by engineer	28
Specifications--definition of	8
Starting Construction, Before	10
Starting the Project.....	10
Stopping Work	

--by Contractor	46
--by Owner.....	38
Subcontractor	
--definition of.....	8
Subcontractors	
--in general.....	20
Subcontracts--required provisions	17, 20,21, 32
Substantial Completion	
--certification of.....	42
--definition of.....	9
Substitutes or Or-Equal Items	19
Subsurface Conditions	13
Superintendent--Contractor's	19
Supervision and Superintendence	18
Supplemental costs.....	33
Supplementary Conditions	
--definition of.....	9
--principal references to..	9, 14, 19, 22, 25, 27, 29
Supplementing Contract Documents	12
Supplier	
--definition of.....	9
--principal references to.....	20
Surety	
--consent to payment	43, 44
--Engineer has no duty to.....	30
--notice to.....	31, 46
--qualification of	15
Suspending Work, by Owner	45
Suspension of Work and Termination--in general	45
T	
Taxes--Payment by Contractor	22
Termination	
--by Contractor	47
--by Owner.....	45
Termination, Suspension of Work and--in general	45
Tests and Inspections	37
Time, Change of Contract.....	36
Time, Computation of.....	47

Time, Contract--definition of.....	7
------------------------------------	---

U

Uncovering Work.....	37
Underground Facilities	
--definition of.....	9
--not shown or indicated	14
--protection of	14, 24
Unit Price Work	
--definition of.....	9
--general.....	35
Unit Prices.....	31
Unit Prices, Determinations for	29
Use of Premises.....	22
Utility owners.....	22, 23, 26

V

Values, Schedule of	10, 11, 39
Variations in Work--Authorized.....	28
Visits to Site--by engineer	28

W

Waiver of Claims--on Final Payment	44
Waiver of Rights--by insured parties	17
Warranty and Guarantee--by Contractor ..	36
Warranty of Title, Contractor's	40
Work	
--Access to	37
--by others.....	26
--Continuing During Disputes	25
--Cost of.....	32
--definition of.....	9
--Neglected by Contractor	39
--Stopping by Owner	45
Work Directive Change	
--definition of.....	9
--principal references to... 9, 12, 13, 23, 30	
Work, Stopping by Contractor	47
Written Amendment	
--definition of.....	9
--principal references to.....	12, 31, 32
--principal references to.....	36

GENERAL CONDITIONS

ARTICLE 1. DEFINITIONS

Wherever used in these General Conditions or in the other Contract Documents the following terms have the meanings indicated which are applicable to both the singular and plural thereof:

ADDENDA Written or graphic instruments issued prior to the opening of Bids which clarify, correct or change the bidding documents or the Contract Documents.

AGREEMENT The written agreement between OWNER and CONTRACTOR covering the Work to be performed: other Contract Documents are attached to the Agreement and made a part thereof as provided therein.

APPLICATION FOR PAYMENT The form accepted by ENGINEER which is to be used by CONTRACTOR in requesting progress or final payments and which is to include such supporting documentation as is required by the Contract Documents.

BID The offer or proposal of the bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

BONDS Bid, performance and payment bonds and other instruments of security.

CHANGE ORDER A document recommended by ENGINEER, which is signed by CONTRACTOR and OWNER and authorizes an addition, deletion or revision in the Work, or an adjustment in the Contract Price or the Contract Time, issued on or after the Effective Date of the Agreement.

CONTRACT DOCUMENTS The Agreement, Addenda (which pertain to the Contract Documents), CONTRACTOR'S Bid (including documentation accompanying the Bid and any post-Bid documentation submitted prior to the Notice of Award) when attached as an exhibit to the Agreement, the Bonds, these General Conditions, the Supplementary Conditions, the Specifications and the Drawings as the same are more specifically identified in the Agreement, together with all amendments, modifications and supplements issued pursuant to paragraphs 3.4 and 3.5 on or after the Effective Date of the Agreement.

CONTRACT PRICE The moneys payable by OWNER to CONTRACTOR under the Contract Documents as stated in the Agreement (subject to the provisions of paragraph 11.9.1 in the case of Unit Price Work).

CONTRACT TIME The number of days (computed as provided in paragraph 17.2) or the date stated in the Agreement for the completion of the Work.

CONTRACTOR The person, firm or corporation with whom OWNER has entered into the Agreement.

DEFECTIVE An adjective which when modifying the word Work refers to Work that is unsatisfactory, faulty or deficient, or does not conform to the Contract Documents, or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents, or has been damaged prior to ENGINEER'S recommendations of final payment (unless responsibility for the protection thereof has been assumed by OWNER at Substantial Completion in accordance with paragraph 14.8 or 14.10).

DRAWINGS The drawings which show the character and scope of the Work to be performed and which have been prepared or approved by ENGINEER and are referred to in the Contract Documents.

EFFECTIVE DATE OF THE AGREEMENT The date indicated in the Agreement on which is becomes effective, but if no such date is indicated it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

FIELD ORDER A written order issued by ENGINEER which orders minor changes in the Work in accordance with paragraph 9.5 but which does not involve a change in the Contract Price or the Contract Time.

GENERAL REQUIREMENTS Sections of Division 1 of the Specifications.

LAWS AND REGULATIONS; LAWS OR REGULATIONS Laws, rules, regulations, ordinances, codes and/or orders.

NOTICE OF AWARD The written notice by OWNER to the apparent successful bidder stating that upon compliance by the apparent successful bidder with the conditions precedent enumerated therein, within the time specified, OWNER will sign and deliver the Agreement.

NOTICE TO PROCEED A written notice given by the OWNER to CONTRACTOR (with a copy to ENGINEER) fixing the date on which the Contract Time will commence to run and on which CONTRACTOR shall start to perform CONTRACTOR'S obligations under the Contract Documents.

PARTIAL UTILIZATION Placing a portion of the Work in service for the purpose for which it is intended (or a related purpose) before reaching Substantial Completion for all the Work.

PROJECT The total construction of which the Work to be provided under the Contract Documents may be the whole, or a part as indicated elsewhere in the Contract Documents.

RESIDENT PROJECT REPRESENTATIVE The authorized representative of ENGINEER who is assigned to the site or any part thereof.

SHOP DRAWINGS All drawings, diagrams, illustrations, schedules and other data which are specifically prepared by or for CONTRACTOR to illustrate some portion of the Work and all illustrations, brochures, standard schedules, performance charts, instructions, diagrams and other information prepared by a Supplier and submitted by CONTRACTOR to illustrate material or equipment for some portion of the Work.

SPECIFICATIONS Those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto.

SUBCONTRACTOR An individual, firm or corporation having a direct contract with CONTRACTOR or with any other Subcontractor for the performance of a part of the Work at the site.

SUBSTANTIAL COMPLETION The Work (or a specified part thereof) has progressed to the point where, in the opinion of ENGINEER as evidenced by ENGINEER'S definitive certificate of Substantial Completion, it is sufficiently complete, in accordance with the Contract Documents, so that the Work (or specified part) can be utilized for the purposes for which it is intended; or if there be no such certificate issued, when final payment is due in accordance with

paragraph 14.13. The terms "substantially complete" and "substantially completed" as applied to any Work refer to Substantial Completion thereof.

SUPPLEMENTARY CONDITIONS The part of the Contract Documents which amends or supplements these General Conditions.

SUPPLIER A manufacturer, fabricator, supplier, distributor, material man or vender.

UNDERGROUND FACILITIES All pipelines, conduits, ducts, cables, wire, man holes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems or water.

UNIT PRICE WORK Work to be paid for on the basis of unit prices.

WORK The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. Work is the result of performing services, furnishing labor and furnishing and incorporation materials and equipment into the construction, all as required by the Contract Documents.

WORK DIRECTIVE CHANGE A written directive to CONTRACTOR, issued on or after the Effective Date of the Agreement and signed by OWNER and recommended by ENGINEER, ordering an addition, deletion or revision in the Work, or responding to differing or unforeseen physical conditions under which the Work is to be performed as provided in paragraph 4.2 or 4.3 or to emergencies under paragraph 6.22. A Work Directive Change may not change the Contract Price or the Contract Time, but is evidence that the parties expect that the change directed or documented by a Work Directive Change will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Time as provided in paragraph 10.2.

WRITTEN AMENDMENT A written amendment of the Contract Documents, signed by OWNER and CONTRACTOR on or after the Effective Date of the Agreement and normally dealing with the non-engineering or non-technical rather than strictly Work-related aspects of the Contract Documents.

ARTICLE 2. PRELIMINARY MATTERS

Delivery of Bonds:

2.1. When CONTRACTOR delivers the executed Agreements to OWNER, CONTRACTOR shall also deliver to OWNER such Bonds as CONTRACTOR may be required to furnish in accordance with paragraph 5.1.

Copies of Documents:

2.2. OWNER shall furnish to CONTRACTOR up to four (4) copies (unless otherwise specified) of the Contract Documents as are reasonably necessary for the execution of the Work. Additional copies will be furnished, upon request, at the cost of reproduction.

Commencement of Contract Time; Notice to Proceed:

2.3. The Contract Time will commence to run on the thirtieth day after the Effective Date of the Agreement, or, if a Notice to Proceed is given, on the day indicated in the Notice to

Proceed. A Notice to Proceed may be given at any time within thirty days after the Effective Date of the Agreement. In no event will the Contract Time commence to run later than the seventy-fifth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier, unless otherwise specified.

Starting the Project:

- 2.4. CONTRACTOR shall start to perform the Work on the date when the Contract Time commences to run, but no Work shall be done at the site prior to the date on which the Contract Time commences to run.

Before Starting Construction:

- 2.5. Before undertaking each part of the Work, CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements. CONTRACTOR shall promptly report in writing to ENGINEER any conflict, error or discrepancy which CONTRACTOR may discover and shall obtain a written interpretation or clarification from ENGINEER before proceeding with any Work affected thereby.
- 2.6. Within ten days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), CONTRACTOR shall submit to ENGINEER for review:
 - 2.6.1. an estimated progress schedule indicating the starting and completion dates of the various stages of the Work;
 - 2.6.2. a preliminary schedule of Shop Drawing submissions; and
 - 2.6.3. a preliminary schedule of values for all of the Work which will include quantities and prices of items aggregating the Contract Price and will subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work which will be confirmed in writing by CONTRACTOR at the time of the submission.
- 2.7. Before any Work at the site is started, CONTRACTOR shall deliver to OWNER, with a copy to ENGINEER, certificates (and other evidence of insurance requested by OWNER) which CONTRACTOR is required to purchase and maintain in accordance with paragraphs 5.3 and 5.4, and OWNER shall deliver to CONTRACTOR certificates (and other evidence of insurance requested by CONTRACTOR) which OWNER is required to purchase and maintain in accordance with paragraphs 5.6 and 5.7.

Pre-construction Conference:

- 2.8. Omitted

Finalizing Schedules:

- 2.9. At least ten days before submission of first Application for Payment a conference attended by CONTRACTOR, ENGINEER and others as appropriate will be held to finalize the schedules submitted in accordance with paragraph 2.6. The finalized progress schedule will be acceptable to ENGINEER as providing an orderly progression of the Work to completion within the Contract Time, but such acceptance will neither impose on ENGINEER responsibility for the progress or scheduling of the Work nor relieve CONTRACTOR from full responsibility there for. The finalized schedule of Shop Drawing submissions will be acceptable to ENGINEER as providing a workable

arrangement for processing the submissions. The finalized schedules of values will be acceptable to ENGINEER as to form and substance.

ARTICLE 3. CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

Intent:

- 3.1. The Contract Documents comprise the entire agreement between OWNER and CONTRACTOR concerning the Work. The Contract Documents are complementary: what is called for by one is as binding as if called for by all. The Contract Documents will be construed in accordance with the law of the place of the Project.
- 3.2. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any Work, materials or equipment that may reasonably be inferred from the Contract Documents as being required to produce the intended result will be supplied whether or not specifically called for. When words which have a well-known technical or trade meaning are used to describe Work, materials or equipment such words shall be interpreted in accordance with that meaning. Reference to standard specifications, manuals or codes of any technical society, organization or association, or to the Laws or Regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code or Laws or Regulations in effect at the time of opening Bids (or, on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated. However, no provision of any referenced standard specification, manual or code (whether or not specifically incorporated by reference in the Contract Documents) shall be effective to change the duties and responsibilities of OWNER, CONTRACTOR or ENGINEER, or any of their consultants, agents or employees from those set forth in the Contract Documents, nor shall it be effective to assign to ENGINEER, or any of ENGINEER'S consultants, agents or employees, any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of paragraph 9.15 or 9.16. Clarifications and interpretations of the Contract Documents shall be issued by ENGINEER as provided in paragraph 9.4.
- 3.3. If, during the performance of the Work, CONTRACTOR finds a conflict, error or discrepancy in the Contract Documents. CONTRACTOR shall so report to ENGINEER in writing at once and before proceeding with the Work affected thereby shall obtain a written interpretation or clarification from ENGINEER.

Amending and Supplementing Contract Documents:

- 3.4. The Contract Documents may be amended to provide for additions, deletions and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways:
 - 3.4.1. a formal Written Amendment,
 - 3.4.2. a Change Order (pursuant to paragraph 10.4), or
 - 3.4.3. a Work Directive Change (pursuant to paragraph 10.1).

As indicated in paragraphs 11.2 and 12.1, Contract Price and Contract Time may only be changed by a Change Order or a Written Amendment.

- 3.5. In addition, the requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, in one or more of the following ways:
- 3.5.1. a Field Order (pursuant to paragraph 9.5),
 - 3.5.2. ENGINEER'S approval of a Shop Drawing or sample (pursuant to paragraphs 6.26 and 6.27), or
 - 3.5.3. ENGINEER'S written interpretation or clarification (pursuant to paragraph 9.4).

Reuse of Documents:

- 3.6. Neither CONTRACTOR nor any Subcontractor or Supplier or other person or organization performing or furnishing any of the Work under a direct or indirect contract with OWNER shall have or acquire any title to or ownership rights in any of the Drawings, Specifications or other documents (or copies of any thereof) prepared by or bearing the seal of ENGINEER; and they shall not reuse any of them on extensions of the Project or any other project without written consent of OWNER and ENGINEER and specific written verification or adaptation by ENGINEER.

ARTICLE 4. AVAILABILITY OF LANDS; PHYSICAL CONDITIONS; REFERENCE POINTS

Availability of Lands:

- 4.1. OWNER shall furnish, as indicated in the Contract Documents, the lands upon which the Work is to be performed, rights-of-way and easements for access thereto, and such other lands which are designated for the use of CONTRACTOR. Easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by OWNER, unless otherwise provided in the Contract Documents. If CONTRACTOR believes that any delay in OWNER'S furnishing these lands, rights-of-way or easements entitles CONTRACTOR to an extension of the Contract Time. CONTRACTOR may make a claim therefore as provided in Article 12. CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

Physical Conditions:

- 4.2. Explorations and Reports: Where soil borings, tests, or other information is included in the contract, CONTRACTOR may rely upon the accuracy of the technical data contained in such reports, but not upon non-technical data, interpretations or opinions contained therein or for the completeness thereof for CONTRACTOR'S purposes. Except as indicated in the immediately preceding sentence and in paragraph 4.2.6, CONTRACTOR shall have full responsibility with respect to subsurface conditions at the site.
- 4.2.1. Existing Structures: Reference is made to the drawings of physical conditions in or relating to existing surface and subsurface structures (except Underground Facilities referred to in paragraph 4.3) which are at or contiguous to the site that have been utilized by ENGINEER in preparation of the Contract Documents. CONTRACTOR may rely upon the accuracy of the technical data contained in such drawings, but not for the completeness thereof for CONTRACTOR'S purposes. Except as indicated in the immediately preceding sentence and in

paragraph 4.2.6, CONTRACTOR shall have full responsibility with respect to physical conditions in or relating to such structures.

4.2.2. Report of Differing Conditions: If CONTRACTOR believes that:

4.2.2.1. any technical data on which CONTRACTOR is entitled to rely as provided in paragraphs 4.2.1 and 4.2.2 is inaccurate, or

4.2.2.2. any physical condition uncovered or revealed at the site differs materially from that indicated, reflected or referred to in the Contract Documents,

CONTRACTOR shall, promptly after becoming aware thereof and before performing any Work in connection therewith (except in an emergency as permitted by paragraph 6.22), notify OWNER and ENGINEER in writing about the inaccuracy or difference.

4.2.3. ENGINEER'S Review: ENGINEER will promptly review the pertinent conditions, determine the necessity of obtaining additional explorations or tests with respect thereto and advise OWNER in writing (with a copy to CONTRACTOR) of ENGINEER'S findings and conclusions.

4.3. Possible Document Change: If ENGINEER concludes that there is a material error in the Contract Documents or that because of newly discovered conditions a change in the Contract Documents is required, a Work Directive Change or a Change Order will be issued as provided in Article 10 to reflect and document the consequences of the inaccuracy or difference.

4.4. Possible Price and Time Adjustments: In each such case, an increase or decrease in the Contract Price or an extension or shortening of the Contract Time, or any combination thereof, will be allowable to the extent that they are attributable to any such inaccuracy or difference. If OWNER and CONTRACTOR are unable to agree as to the amount or length thereof, a claim may be made therefor as provided in Articles 11 and 12.

Physical Conditions - Underground Facilities:

4.5. Shown or Indicated: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the site is based on information and data furnished to OWNER or ENGINEER by the owners of such Underground Facilities or by others. Unless it is otherwise expressly provided in the Contract Documents:

4.5.1. OWNER and ENGINEER shall not be responsible for the accuracy or completeness of any such information or data; and,

4.5.2. CONTRACTOR shall have full responsibility for reviewing and checking all such information and data, for locating all Underground Facilities shown or indicated in the Contract Documents, for coordination of the Work with the owners of such Underground Facilities during construction, for the safety and protection thereof as provided in paragraph 6.20 and repairing any damage thereto resulting from the Work, the cost of all of which will be considered as having been included in the Contract Price.

4.6. Not Shown or Indicated. If an Underground Facility is uncovered or revealed at or contiguous to the site which was not shown or indicated in the Contract Documents and which CONTRACTOR could not reasonably have been expected to be aware of,

CONTRACTOR shall, promptly after becoming aware thereof and before performing any Work affected thereby (except in an emergency as permitted by paragraph 6.22), identify the owner of such Underground Facility and give written notice thereof to that owner and to OWNER and ENGINEER. ENGINEER will promptly review the Underground Facility to determine the extent to which the Contract Documents should be modified to reflect and document the consequences of the existence of the Underground Facility, and the Contract Documents will be amended or supplemented to the extent necessary. During such time, CONTRACTOR shall be responsible for the safety and protection of such Underground Facility as provided in paragraph 6.20. CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, to the extent that they are attributable to the existence of any Underground Facility that was not shown or indicated in the Contract Documents and which CONTRACTOR could not reasonably have been expected to be aware of. If the parties are unable to agree as to the amount or length thereof, CONTRACTOR may make a claim therefor as provided in Articles 11 and 12.

Reference Points:

- 4.7. OWNER shall provide engineering surveys to establish reference points for construction which in ENGINEER'S judgment are necessary to enable CONTRACTOR to proceed with the Work. CONTRACTOR shall be responsible for laying out the Work (unless otherwise specified in the General Requirements), shall protect and preserve the established reference points and shall make no changes or relocations without prior written approval of OWNER. CONTRACTOR shall report to ENGINEER whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points by professionally qualified personnel.

ARTICLE 5. BONDS AND INSURANCE

Performance and Other Bonds:

- 5.1. CONTRACTOR shall furnish performance and payment Bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all CONTRACTOR'S obligations under the Contract Documents. These Bonds shall remain in effect at least until one year after the date when final payment becomes due, except as otherwise provided by Law or Regulation or by the Contract Documents. CONTRACTOR shall also furnish such other Bonds as are required by the Special Conditions. All Bonds shall be in the forms prescribed by the Law or Regulation or by the Contract Documents and be executed by such sureties as are amend in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff Bureau of Accounts, U.S. Treasury Department. All bonds signed by and agent must be accompanied by a certified copy of authority to act. All payment and performance bonds shall be increased by the amount of any increase in the Contract Price, at the direction of the Owner and/or in compliance with Laws and Regulations.
- 5.2. If the surety on any Bond furnished by CONTRACTOR is declared a bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of paragraph 5.1.

CONTRACTOR shall within five days thereafter substitute another Bond and Surety, both of which must be acceptable to OWNER.

CONTRACTOR'S Liability Insurance:

- 5.3. CONTRACTOR shall purchase and maintain such comprehensive general liability and other insurance as is appropriate for the Work being performed and furnished and as will provide protection from claims set forth below which may arise out of or result from CONTRACTOR'S performance and furnishing of the Work and CONTRACTOR'S other obligations under the Contract Documents, whether it is to be performed or furnished by CONTRACTOR, by any Subcontractor, by anyone directly or indirectly employed by any of them to perform or furnish any of the Work, or by anyone for whose acts any of them may be liable:
- 5.3.1. Claims under workers' or workmen's compensation, disability benefits and other similar employee benefit acts;
 - 5.3.2. Claims for damages because of bodily injury, occupational sickness or disease, or death of CONTRACTOR'S employees;
 - 5.3.3. Claims for damages because of bodily injury, sickness or disease, or death of any person other than CONTRACTOR'S employees;
 - 5.3.4. Claims for damages insured by personal injury liability coverage which are sustained (a) by any person as a result of an offense directly or indirectly related to the employment of such person by CONTRACTOR, or (b) by any other person for any other reason;
 - 5.3.5. Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom;
 - 5.3.6. Claims arising out of operation of Laws or Regulations for damages because of bodily injury or death of any person or for damage to property; and
 - 5.3.7. Claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

The insurance required by this paragraph 5.3 shall include the specific coverages and be written for not less than the limits of liability and coverages provided in the Special Conditions, or required by law, whichever is greater. The comprehensive general liability insurance shall include completed operations insurance. All of the policies of insurance so required to be purchased and maintained (or the certificates or other evidence thereof) shall contain a provision or endorsement that the coverage afforded will not be cancelled, materially changed or renewal refused until at least thirty days' prior written notice has been given to OWNER and ENGINEER by certified mail. All such insurance shall remain in effect until final payment and at all times thereafter when CONTRACTOR may be correcting, removing or replacing defective Work in accordance with paragraph 13.12. In addition, CONTRACTOR shall maintain such completed operations insurance for at least two years after final payment and furnish OWNER with evidence of continuation of such insurance at final payment and one year thereafter.

Contractual Liability Insurance:

- 5.4. The comprehensive general liability insurance required by paragraph 5.3 will include contractual liability insurance applicable to CONTRACTOR'S obligations under paragraphs 6.30 and 6.31.

OWNER'S Liability Insurance:

- 5.5. OWNER will normally be self-insured. Owner may purchase and maintain OWNER'S own liability insurance and, at OWNER'S option, may purchase and maintain such insurance as will protect OWNER against claims which may arise from operations under the Contract Documents.

Property Insurance:

- 5.6. Unless otherwise provided in the Special Conditions, OWNER may purchase and maintain property insurance upon the Work at the site to the full insurable value thereof (subject to such deductible amounts as may be provided in the Special Conditions or required by Laws and Regulations). This insurance may include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER and ENGINEER'S consultants in the Work, all of whom may be listed as insureds or additional insured parties, may insure against the perils of fire and extended coverage and may include "all risk" insurance for physical loss and damage including theft, vandalism and malicious mischief, collapse and water damage, and such other perils as may be provided in the Special Conditions, and may include damages, losses and expenses arising out of or resulting from any insured loss or incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers, architects, attorneys and other professionals). If not covered under the "all risk" insurance or otherwise provided in the Special Conditions, CONTRACTOR shall purchase and maintain similar property insurance on portions of the Work stored on and off site or in transit when such portions of the Work are to be included in an Application for Payment.
- 5.7. OWNER may purchase and maintain such boiler and machinery insurance or additional property insurance as may be required by the Special Conditions or Laws and Regulations which may include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER and ENGINEER'S consultants in the Work, all of whom may be listed as insured or additional insured parties.
- 5.8. If the OWNER in accordance with paragraphs 5.6 and 5.7 elects to obtain insurance and that insurance is subsequently cancelled or the owner chooses to cancel the insurance, the OWNER will notify CONTRACTOR by certified mail and will contain waiver provisions in accordance with paragraph 5.11.2.
- 5.9. OWNER shall not be responsible for purchasing and maintaining any property insurance to protect the interests of CONTRACTOR, Subcontractors or others in the Work to the extent of any deductible amounts that are provided in the Special Conditions. The risk of loss within the deductible amount will be borne by CONTRACTOR, Subcontractor or others suffering any such loss and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain if at the purchaser's own expense.
- 5.10. If CONTRACTOR requests in writing that other special insurance be included in the property insurance policy, OWNER shall, if possible, include such insurance, and the

cost thereof will be charged to CONTRACTOR by appropriate Change Order or Written Amendment. Prior to commencement of the Work at the site, OWNER shall in writing advise CONTRACTOR whether or not such other insurance has been procured by OWNER.

Waiver of Rights:

- 5.11. OWNER and CONTRACTOR waive all rights against each other for all losses and damages caused by any of the perils covered by the policies of insurance provided in response to paragraphs 5.6 and 5.7 and any other property insurance applicable to the Work, and also waive all such rights against the Subcontractors, ENGINEER, ENGINEER'S consultants and all other parties named as insureds in such policies for losses and damages so caused. As required by paragraph 6.11, each subcontract between CONTRACTOR and a Subcontractor will contain similar waiver provisions by the Subcontractor in favor of OWNER, CONTRACTOR, ENGINEER, ENGINEER'S consultants and all other parties named as insureds. None of the above waivers shall extend to the rights that any of the insured parties may have to the proceeds of insurance held by OWNER as trustee or otherwise payable under any policy so issued.
- 5.12. OWNER and CONTRACTOR intend that any policies provided in response to paragraphs 5.6 and 5.7 shall protect all of the parties insured and provide primary coverage for all losses and damages caused by the perils covered thereby. Accordingly, all such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any of the parties named as insureds or additional insureds, and if the insurers require separate waiver forms to be signed by ENGINEER or ENGINEER'S consultant OWNER will obtain the same, and if such waiver forms are required of any Subcontractor, CONTRACTOR will obtain the same.

Receipt and Application of Proceeds:

- 5.13. Any insured loss under the policies of insurance required by paragraphs 5.6 and 5.7 will be adjusted with OWNER and made payable to OWNER as trustee for the insureds, as their interest may appear, subject to the requirements of any applicable mortgage clause and of paragraph 5.13. OWNER shall deposit in a separate account any money so received, and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof and the Work and the cost thereof by an appropriate Change Order or Written Amendment.
- 5.14. OWNER as trustee shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within fifteen days after the occurrence of loss to OWNER'S exercise of this power. If such objection be made, OWNER as trustee shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If required in writing by any party in interest, OWNER as trustee shall, upon the occurrence of an insured loss, give bond for the proper performance of such duties.

Acceptance of Insurance:

- 5.15. If OWNER has any objection to the coverage afforded by or other provisions of the insurance required to be purchased and maintained by CONTRACTOR in accordance

with paragraphs 5.3 and 5.4 on the basis of its not complying with the Contract Documents, OWNER shall notify CONTRACTOR in writing thereof within ten days of the date of delivery of such certificates to OWNER in accordance with paragraph 2.7. CONTRACTOR shall provide to the OWNER such additional information in respect of insurance provided by each as the other may reasonably request. Failure by OWNER to give any such notice of objection within the time provided shall constitute acceptance of such insurance purchased as complying with the Contract Documents.

Partial Utilization - Property Insurance:

- 5.16. If OWNER finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, such use or occupancy may be accomplished in accordance with paragraph 14.10; provided that no such use or occupancy shall commence before the insurers providing the property insurance have acknowledged notice thereof and in writing effected the changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be cancelled or lapse on account of any such partial use or occupancy.

ARTICLE 6. CONTRACTOR'S RESPONSIBILITIES

Supervision and Superintendence:

- 6.1. CONTRACTOR shall supervise and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences and procedures of construction, but CONTRACTOR shall not be responsible for the negligence of others in the design or selection of a specific means, method, technique, sequence or procedure of construction which is indicated in and required by the Contract Documents. CONTRACTOR shall be responsible to see that the finished Work complies accurately with the Contract Documents.
- 6.2. CONTRACTOR shall keep on the Work at all times during its progress a competent resident superintendent, who shall not be replaced without written notice to OWNER and ENGINEER except under extraordinary circumstances. The superintendent will be CONTRACTOR'S representative at the site and shall have authority to act on behalf of CONTRACTOR. All communications given to the superintendent shall be as binding as if given to the CONTRACTOR.

Labor, Materials and Equipment:

- 6.3. CONTRACTOR shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. CONTRACTOR shall at all times maintain good discipline and order at the site. Except in connection with the safety or protection of persons or the Work or property at the site or adjacent thereto, and except as otherwise indicated in the Contract Documents, all Work at the site shall be performed during regular working hours, and CONTRACTOR will not permit overtime work or the performance of Work on Saturday, Sunday or legal holiday without OWNER'S written consent given after prior notice to ENGINEER.

- 6.4. Unless otherwise specified in the General Requirements, CONTRACTOR shall furnish and assume full responsibility for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities and all other facilities and incidentals necessary for the furnishing, performance, testing start-up and completion of the Work.
- 6.5. All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract Documents. If required by ENGINEER, CONTRACTOR shall furnish satisfactory evidence (including report of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed connected, erected, used cleaned and conditioned in accordance with the instruction of the applicable Supplier except as otherwise provided in the Contract Documents; but no provision of any such instructions will be effective to assign to ENGINEER, or and of ENGINEER'S consultants, agents or employees, any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of paragraph 9.15 or 9.16.

Adjusting Progress Schedule:

- 6.6. CONTRACTOR shall submit to ENGINEER for acceptance (to the extent indicated in paragraph 2.9) adjustments in the progress schedule to reflect the impact thereon of new developments; these will conform generally to the progress schedule then in effect and additionally will comply with any provisions of the General Requirements applicable thereto.

Substitutes or "Or-Equal" or "Design Basis" Items:

- 6.7. Whenever materials or equipment are specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier the naming of the item is intended to establish the type, function and quality required. Unless the name is followed by words indicating that no substitution is permitted, materials or equipment of other Suppliers may be accepted by ENGINEER if sufficient information is submitted by CONTRACTOR to allow ENGINEER to determine that the material or equipment proposed is equivalent or equal to that named. The procedure for review by ENGINEER will include the following as supplemented in the General Requirements. Requests for review of substitute items of material and equipment will not be accepted by ENGINEER from anyone other than CONTRACTOR. If CONTRACTOR wishes to furnish or use a substitute item of material or equipment, CONTRACTOR shall make written application to ENGINEER for acceptance thereof, demonstrating that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar and of equal substance to that specified and be suited to the same use as that specified. The application will state that the evaluation and acceptance of the proposed substitute will not prejudice CONTRACTOR'S achievement of Substantial Completion on time, whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) to adapt the design to the proposed substitute and whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute from that specified will be identified in the

application and available maintenance, repair and replacement service will be indicated. The application will also contain an itemized estimate of all costs that will result directly or indirectly from acceptance of such substitute, including cost of redesign and claims of other contractors affected by the resulting change, all of which shall be considered by ENGINEER in evaluating the proposed substitute. ENGINEER may require CONTRACTOR to furnish at CONTRACTOR'S expense additional data about the proposed substitute.

- 6.8. If a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Contract Documents. CONTRACTOR may furnish or utilize a substitute means, method, sequence, technique or procedure of construction acceptable to ENGINEER, if CONTRACTOR submits sufficient information to allow ENGINEER to determine that the substitute proposed is equivalent to that indicated or required by the Contract Documents. The procedure for review by ENGINEER will be similar to that provided in paragraph 6.7.1 as applied by ENGINEER and as may be supplemented in the General Requirements.
- 6.9. ENGINEER will be allowed a reasonable time within which to evaluate each proposed substitute. ENGINEER will be the sole judge of acceptability, and no substitute will be ordered, installed or utilized without ENGINEER'S prior written acceptance which will be evidences by either a Change Order or an approved Shop Drawing. OWNER may require CONTRACTOR to furnish at CONTRACTOR'S expense a special performance guarantee or other surety with respect to any substitute. ENGINEER will record time required by ENGINEER and ENGINEER'S consultants in evaluating substitutions proposed by CONTRACTOR and in making changes in the Contract Documents occasioned there by. Whether or not ENGINEER accepts a proposed substitute, CONTRACTOR shall reimburse OWNER for the charges of ENGINEER and ENGINEER'S consultants for evaluation each proposed substitute.

Concerning Subcontractors, Suppliers and Others:

- 6.10. CONTRACTOR shall not employ any Subcontractor, Supplier or other person or organization (including those acceptable to OWNER and ENGINEER as indicated in paragraph 6.8.2), whether initially or as a substitute, against whom OWNER or ENGINEER may have reasonable objection. CONTRACTOR shall not be required to employ any Subcontractor, Supplier or other person or organization to furnish or perform any of the Work against whom the CONTRACTOR has reasonable objection.
- 6.11. If the Contract Documents require the identity of certain Subcontractors, Suppliers or other persons or organizations (including those who are to furnish the principal items of materials and equipment) to be submitted to OWNER in advance of the specified date prior to the Effective Date of the Agreement for acceptance by OWNER and ENGINEER and if CONTRACTOR has submitted a list thereof in accordance with the Contract Documents, OWNER'S or ENGINEER'S acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the bidding documents or the Contract Documents) of any such Subcontractor, Supplier or other person or organization so identified may be revoked on the basis of reasonable objection after due investigation, in which case CONTRACTOR shall submit an acceptable substitute, the Contract Price will be increased by the difference in the cost occasioned by such substitution and an appropriate Change Order will be issued or

Written Amendment signed. No acceptance by OWNER or ENGINEER of any such Subcontractor, Supplier or other person or organization shall constitute a waiver of any right of OWNER or ENGINEER to reject defective Work.

- 6.12. CONTRACTOR shall be fully responsible to OWNER and ENGINEER for all acts and omissions of the Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR just as CONTRACTOR is responsible for CONTRACTOR'S own acts and omissions. Nothing in the Contract Documents shall create any contractual relationship between OWNER or ENGINEER and any such Subcontractor, Supplier or other person or organization, nor shall it create any obligation on the part of OWNER or ENGINEER to pay or to see to the payment of any moneys due any such Subcontractor, Supplier or other person or organization except as may otherwise be required by Laws and Regulations.
- 6.13. The divisions and sections of the Specifications and the identifications of any Drawings shall not control CONTRACTOR in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
- 6.14. All Work performed for CONTRACTOR by a Subcontractor will be pursuant to an appropriate agreement between CONTRACTOR and the Subcontractor which specifically binds the Subcontractor to the applicable terms and conditions of the Contract Documents for the benefit of OWNER and ENGINEER and contains waiver provisions as required by paragraph 5.11. CONTRACTOR shall pay each Subcontractor a just share of any insurance moneys received by CONTRACTOR on account of losses under policies issued pursuant to paragraphs 5.6 and 5.7.

Patent Fees and Royalties:

- 6.15. CONTRACTOR shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product or device is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of OWNER or ENGINEER its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by OWNER in the Contract Documents. CONTRACTOR shall indemnify and hold harmless OWNER and ENGINEER and anyone directly or indirectly employed by either of them from and against all claims, damages, losses and expenses (including attorneys' fees and court and arbitration costs) arising out of any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product or device not specified in the Contract Documents, and shall defend all such claims in connection with any alleged infringement of such rights.

Permits:

- 6.16. Unless otherwise provided in the Contract Documents, CONTRACTOR shall obtain and pay for all construction permits and licenses. OWNER shall assist CONTRACTOR, when necessary, in obtaining such permits and licenses. CONTRACTOR shall pay all governmental charges and inspection fees necessary for the prosecution of the Work,

which are applicable at the time of opening Bids. CONTRACTOR shall pay all charges of utility owners for connections to the Work.

Laws and Regulations:

- 6.17. CONTRACTOR shall give all notices and comply with all Laws and Regulations applicable to furnishing and performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither OWNER nor ENGINEER shall be responsible for monitoring CONTRACTOR'S compliance with any Laws or Regulations.
- 6.18. If CONTRACTOR observes that the Specifications or Drawings are at variance with any Laws or Regulations, CONTRACTOR shall give ENGINEER prompt written notice thereof, and any necessary changes will be authorized by one of the methods indicated in paragraph 3.4. If CONTRACTOR performs any Work knowing or having reason to know that it is contrary to such Laws or Regulations, and without such notice to ENGINEER, CONTRACTOR shall bear all costs arising therefrom; however, it shall not be CONTRACTOR'S primary responsibility to make certain that the Specifications and Drawings are in accordance with such Laws and Regulations.

Taxes:

- 6.19. CONTRACTOR shall pay all sales, consumer, use and other similar taxes required to be paid by CONTRACTOR in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

Use of Premises:

- 6.20. CONTRACTOR shall confine construction equipment, the storage of materials and equipment and the operations of workers to the Project site and land and areas identified in and permitted by the Contract Documents and other land and areas permitted by Laws and Regulations, rights-of-way, permits and easements, and shall not unreasonably encumber the premises with construction equipment or other materials or equipment. CONTRACTOR shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof or of any land or areas contiguous thereto, resulting from the performance of the Work. Should any claim be made against OWNER or ENGINEER by any such owner or occupant because of the performance of the Work, CONTRACTOR shall promptly settle with such other party by agreement or otherwise resolve the claim by arbitration or at law. CONTRACTOR shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold OWNER and ENGINEER harmless from and against all claims, damages, losses and expenses (including, but not limited to, fees of engineers, architects, attorneys and other professionals and court and arbitration costs) arising directly, indirectly or consequentially out of any action, legal or equitable, brought by any such other party against OWNER or ENGINEER to the extent based on a claim arising out of CONTRACTOR'S performance of the Work.
- 6.21. During the progress of the Work, CONTRACTOR shall keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the Work. At the completion of the Work CONTRACTOR shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, appliances, construction equipment and machinery, and surplus materials, and shall leave the site clean and ready for occupancy by OWNER. CONTRACTOR shall restore to original condition all property not designated for alteration by the Contract Documents.

- 6.22. CONTRACTOR shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall CONTRACTOR subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

Record Documents:

- 6.23. CONTRACTOR shall maintain in a safe place at the site one record copy of all Drawings, Specifications, Addenda, Written Amendments, Change Orders, Work Directive Changes, Field Orders and written interpretations and clarifications (issued pursuant to paragraph 9.4) in good order and annotated to show all changes made during construction. These record documents together with all approved samples and a counterpart of all approved Shop Drawings will be available to ENGINEER for reference.

Safety and Protection:

- 6.24. CONTRACTOR shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:
- 6.24.1. all employees on the Work and other persons and organizations who may be affected thereby;
 - 6.24.2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the site; and
 - 6.24.3. other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and Underground Facilities not designated for removal, relocation or replacement in the course of construction.

CONTRACTOR shall comply with all applicable Laws and Regulations of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. CONTRACTOR shall notify owners of adjacent property and of Underground Facilities and utility owners when performance of the Work may affect them, and shall cooperate with them in the protection, removal, relocation and replacement of their property. All damage, injury or loss to any property referred to in paragraph 6.20.2 or 6.20.3 caused, directly or indirectly, in whole or in part, by CONTRACTOR, any Subcontractor, Supplier or any other person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, shall be remedied by CONTRACTOR (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of OWNER or ENGINEER or anyone employed by either of them or anyone for whose acts either of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of CONTRACTOR). CONTRACTOR'S duties and responsibilities for the safety and protection of the Work shall continue until such time as all the Work is completed and ENGINEER has issued a notice to OWNER and CONTRACTOR in accordance with paragraph 14.13 that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

- 6.25. CONTRACTOR shall designate a responsible representative at the site whose duty shall be the prevention of accidents. This person shall be CONTRACTOR'S superintendent unless otherwise designated in writing by CONTRACTOR to OWNER.

Emergencies:

- 6.26. In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, CONTRACTOR, without special instruction or authorization from ENGINEER or OWNER, is obligated to act to prevent threatened damage, injury or loss. CONTRACTOR shall give ENGINEER prompt written notice if CONTRACTOR believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If ENGINEER determines that a change in the Contract Documents is required because of the action taken in response to an emergency, a Work Directive Change or Change Order will be issued to document the consequences of the changes or variations.

Shop Drawings and Samples:

- 6.27. After checking and verifying all field measurements and after complying with applicable procedures specified in the General Requirements, CONTRACTOR shall submit to ENGINEER for review and approval in accordance with the accepted schedule of Shop Drawing submissions (see paragraph 2.9), or for other appropriate action if so indicated in the Contract Documents, four copies (unless otherwise specified in the General Requirements) of all Shop Drawings, which will bear a stamp or specific written indication that CONTRACTOR has satisfied CONTRACTOR'S responsibilities under the Contract Documents with respect to the review of the submission. All submissions will be identified as ENGINEER may require. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to enable ENGINEER to review the information as required.
- 6.28. CONTRACTOR shall also submit to ENGINEER for review and approval with such promptness as to cause no delay in Work, all samples required by the Contract Documents. All samples will have been checked by and accompanied by a specific written indication that CONTRACTOR has satisfied CONTRACTOR'S responsibilities under the Contract Documents with respect to the review of the submission and will be identified clearly as to material, Supplier, pertinent data such as catalog numbers and the use for which intended.
- 6.29. Before submission of each Shop Drawing or sample CONTRACTOR shall have determined and verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar data with respect thereto and reviewed or coordinated each Shop Drawing or sample with other Shop Drawings and samples and with requirements of the Work and the Contract Documents.
- 6.30. At the time of each submission, CONTRACTOR shall give ENGINEER specific written notice of each variation that the Shop Drawings or samples may have from the requirements of the Contract Documents, and, in addition, shall cause a specific notation to be made on each Shop Drawing submitted to ENGINEER for review and approval of each such variation.
- 6.31. ENGINEER will review and approve with reasonable promptness Shop Drawings and samples, but ENGINEER'S review and approval will be only for conformance with the general design concept of the Project and for compliance with the information given in the Contract Documents and shall not extend to means, methods, techniques, sequences or procedures of construction (except where a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Contract

Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions. CONTRACTOR shall make corrections required by ENGINEER, and shall return the required number of corrected copies of Shop Drawings and submit as required new samples for review and approval. CONTRACTOR shall direct specific attention in writing to revisions other than the corrections called for by ENGINEER on previous submittals.

- 6.32. ENGINEER'S review and approval of Shop Drawings or samples shall not relieve CONTRACTOR from responsibility for any variation from the requirements of the Contract Documents unless CONTRACTOR has in writing called ENGINEER'S attention to each such variation at the time of submission as required by paragraph 6.25.2 and ENGINEER has given written approval of each such variation by a specific written notation thereof incorporated in or accompanying the Shop Drawing or sample approval; nor will any approval by ENGINEER relieve CONTRACTOR from responsibility for errors or omissions in the Shop Drawings or from responsibility for have complied with the provisions of paragraph 6.25.1.
- 6.33. Where a Shop Drawing or sample is required by the Specifications, any related Work performed prior to ENGINEER'S review and approval of the pertinent submission will be the sole expense and responsibility of CONTRACTOR.

Continuing the Work:

- 6.34. CONTRACTOR shall carry on the Work and adhere to the progress schedule during all disputes or disagreements with OWNER. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by paragraph 15.5 or as CONTRACTOR and OWNER may otherwise agree in writing.

Indemnification:

- 6.35. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER and ENGINEER and their consultants, agents, and employees from and against all claims, damages, losses and expenses, direct, indirect or consequential (including but not limited to fees and charges of engineers, architects, attorneys and other professionals and court and arbitration costs) arising out of or resulting from the performance of the Work, provided that any such claim, damage, loss or expense (a) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including the loss of use resulting therefrom and (b) is caused in whole or in part by any negligent act or omission of CONTRACTOR, and Subcontractor, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them any be liable, regardless of whether or not it is caused in part by a party indemnified hereunder or arises by or is imposed by Law and Regulations regardless of the negligence of any such party.
- 6.36. In any and all claims against OWNER or ENGINEER or any of their consultants, agents or employees by any employee of CONTRACTOR, any Subcontractor, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, the indemnification obligation under paragraph 6.30 shall not be limited in any way by any limitation on the

amount or type of damages, compensation or benefits payable by or for CONTRACTOR or any such Subcontractor or other person or organization under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts.

- 6.37. The obligations of CONTRACTOR under paragraph 6.30 shall not extend to the liability of ENGINEER, ENGINEER'S consultants, agents or employees arising out of the preparation or approval of maps, drawings, opinions, reports, surveys, Change Orders, designs or specifications.

ARTICLE 7. OTHER WORK

Related Work at Site:

- 7.1. OWNER may perform other work related to the Project at the site by OWNER'S own forces, have other work performed by utility owners or let other direct contracts therefor which may contain General Conditions similar to these. If the fact that such work is to be performed was not noted in the Contract Documents, written notice thereof will be given to CONTRACTOR prior to starting any such other work; and, if CONTRACTOR believes that such performance will involve additional expense to CONTRACTOR or requires additional time and the parties are unable to agree as to the extent thereof, CONTRACTOR may make a claim therefor as provided in Articles 11 and 12.
- 7.2. CONTRACTOR shall afford each utility owner and other contractor who is a party to such a direct contract (or OWNER, if OWNER is performing the additional work with OWNER'S employees) proper and safe access to the site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such work, and shall properly connect and coordinate the Work with theirs, CONTRACTOR shall do all cutting, fitting and patching of the Work that may be required to make its several parts come together properly and integrate with such other work. CONTRACTOR shall not endanger any work of others by cutting, excavating or otherwise altering their work and will only cut or alter their work with the written consent of ENGINEER and the others whose work will be affected. The duties and responsibilities of CONTRACTOR under this paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of CONTRACTOR in said direct contracts between OWNER and such utility owners and other contractors.
- 7.3. If any part of CONTRACTOR'S Work depends for proper execution or results upon the work of any such other contractor or utility owner (or OWNER), CONTRACTOR shall inspect and promptly report to ENGINEER in writing any delays, defects or deficiencies in such work that render it unavailable or unsuitable for such proper execution and results. CONTRACTOR'S failure so to report will constitute an acceptance of the other work as fit and proper for integration with CONTRACTOR'S Work except for latent or non-apparent defects and deficiencies in the other work.

Coordination:

- 7.4. If OWNER contracts with others for the performance of other work on the Project at the site, the person or organization who will have authority and responsibility for coordination of the activities among the various prime contractors will be identified in the Contract Documents, and the specific matters to be covered by such authority and

responsibility will be itemized, and the extent of such authority and responsibilities will be provided, in the Contract Documents. Unless otherwise provided in the Contract Documents, neither OWNER nor ENGINEER shall have any authority or responsibility in respect of such coordination.

ARTICLE 8. OWNER'S RESPONSIBILITIES

- 8.1. OWNER shall issue all communications to CONTRACTOR through ENGINEER.
- 8.2. Omitted
- 8.3. OWNER shall furnish the data required of OWNER under the Contract Documents promptly and shall make payments to CONTRACTOR promptly after they are due as provided in paragraphs 14.4 and 14.13.
- 8.4. OWNER'S duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in paragraphs 4.1 and 4.4. Paragraph 4.2 refers to OWNER'S identifying and making available to CONTRACTOR copies of reports of explorations and tests of subsurface conditions at the site and in existing structures which have been utilized by ENGINEER in preparing the Drawings and Specifications.
- 8.5. OWNER'S responsibilities in respect of purchasing and maintaining liability and property insurance are set forth in paragraphs 5.5 through 5.8.
- 8.6. OWNER is obligated to execute Change Orders as indicated in paragraph 10.4.
- 8.7. OWNER'S responsibility in respect of certain inspections, tests and approvals is set forth in paragraph 13.4.
- 8.8. In connection with OWNER'S right to stop Work or suspend Work, see paragraphs 13.10 and 15.1. Paragraph 15.2 deals with OWNER'S right to terminate services of CONTRACTOR under certain circumstances.

ARTICLE 9. ENGINEER'S STATUS DURING CONSTRUCTION

OWNER'S Representative:

- 9.1. ENGINEER will be OWNER'S representative during the construction period. The duties and responsibilities and the limitations of authority of ENGINEER as OWNER'S representative during construction are set forth in the Contract Documents and shall not be extended without written consent of OWNER and ENGINEER.

Visits to Site:

- 9.2. ENGINEER will make visits to the site at intervals appropriate to the various stages of construction to observe the progress and quality of the executed Work and to determine, in general, if the Work is proceeding in accordance with the Contract Documents. ENGINEER will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. ENGINEER'S efforts will be directed toward providing for OWNER a greater degree of confidence that the completed Work will conform to the Contract Documents. On the basis of such visits and on-site observations as an experienced and qualified design professional, ENGINEER will keep OWNER

informed of the progress of the Work and will endeavor to guard OWNER against defects and deficiencies in the Work.

Project Representation:

- 9.3. If OWNER and ENGINEER agree, ENGINEER will furnish a Resident Project Representative to assist ENGINEER in observing the performance of the Work. The duties, responsibilities and limitations of authority of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions. If OWNER designates another agent to represent OWNER at the site who is not ENGINEER'S agent or employee, the duties, responsibilities and limitations of authority of such other person will be as provided in the Contract Document.

Clarifications and Interpretations:

- 9.4. ENGINEER will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents (in the form of Drawings or otherwise) as ENGINEER may determine necessary, which shall be consistent with or reasonably inferable from the overall intent of the Contract Documents. If CONTRACTOR believes that a written clarification or interpretation justifies an increase in the Contract Price or an extension of the Contract Time and the parties are unable to agree to the amount or extent thereof, CONTRACTOR may make a claim therefor as provided in Article 11 or Article 12.

Authorized Variations in Work:

- 9.5. ENGINEER may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Time and are consistent with the overall intent of the Contract Documents. These may be accomplished by a Field Order and will be binding on OWNER, and also on CONTRACTOR who shall perform the Work involved promptly. If CONTRACTOR believes that a Field Order justifies an increase in the Contract Price or an extension of the Contract Time and the parties are unable to agree as to the amount or extent thereof, CONTRACTOR may make a claim therefor as provided in Article 11 or 12.

Rejecting Defective Work:

- 9.6. ENGINEER will have authority to disapprove or reject Work which ENGINEER believes to be defective, and will also have authority to require special inspection or testing of the Work as provided in paragraph 13.9, whether or not the Work is fabricated, installed or completed.

Shop Drawings, Change Orders and Payments:

- 9.7. In connection with ENGINEER'S responsibility for Shop Drawings and samples, see paragraphs 6.23 through 6.29 inclusive.
- 9.8. In connection with ENGINEER'S responsibilities as to Change Orders, see Articles 10,11,12.
- 9.9. In connection with ENGINEER'S responsibilities in respect of Applications for Payment, etc., see Article 14.

Determinations for Unit Prices:

- 9.10. ENGINEER will determine the actual quantities and classifications of Unit Price Work performed by CONTRACTOR. ENGINEER will review with CONTRACTOR

ENGINEER'S preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). ENGINEER'S written decisions thereon will be final and binding upon OWNER and CONTRACTOR, unless, within ten days after the date of any such decision, either OWNER or CONTRACTOR delivers to the other party to the Agreement and to ENGINEER written notice of intention to appeal from such a decision.

Decisions on Disputes:

- 9.11. ENGINEER will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. Claims, disputes and other matters relating to the acceptability of the Work or the interpretation of the requirements of the Contract Documents pertaining to the performance and furnishing of the Work and claims under Articles 11 and 12 in respect of changes in the Contract Price or Contract Time will be referred initially to ENGINEER in writing with a request for a formal decision in accordance with this paragraph, which ENGINEER will render in writing within a reasonable time. Written notice of each such claim, dispute and other matter will be delivered by the claimant to ENGINEER and the other party to the Agreement promptly (but in no event later than thirty days) after the occurrence of the event giving rise thereto, and written supporting data will be submitted to ENGINEER and the other party within sixty days after such occurrence unless ENGINEER allows an additional period of time to ascertain more accurate data in support of the claim.
- 9.12. When functioning as interpreter and judge under paragraphs 9.10 and 9.11, ENGINEER will not show partiality to OWNER or CONTRACTOR and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity. The rendering of a decision by ENGINEER pursuant to paragraphs 9.10 and 9.11 with respect to any such claim, dispute or other matter (except any which have been waived by the making or acceptance of final payment as provided in paragraph 14.16) will be a condition precedent to any exercise by OWNER or CONTRACTOR of such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any such claim, dispute or other matter.

Limitations of ENGINEER'S Responsibilities:

- 9.13. Neither ENGINEER'S authority to act under this Article 9 or elsewhere in the Contract Documents nor any decision made by ENGINEER in good faith either to exercise or not exercise such authority shall give rise to any duty or responsibility of ENGINEER to CONTRACTOR, any Subcontractor, any Supplier, or any other person or organization performing any of the Work, or to any surety for any of them.
- 9.14. Whenever in the Contract Documents the terms "as ordered", "as directed", "as required", "as allowed", "as approved", or terms of like effect or import are used, or the adjectives "reasonable", "suitable", "acceptable", "proper" or "satisfactory" or adjectives of like effect or import are used to describe a requirement, direction, review or judgment of ENGINEER as to the Work, it is intended that such requirement, direction, review or judgment will be solely to evaluate the Work for compliance with the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective shall not be effective to assign to ENGINEER any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of paragraph 9.15 or 9.16.

- 9.15. ENGINEER will not be responsible for CONTRACTOR'S means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, and ENGINEER will not be responsible for CONTRACTOR'S failure to perform or furnish the Work in accordance with the Contract Documents.
- 9.16. ENGINEER will not be responsible for the acts or omissions of CONTRACTOR or of any Subcontractor, any Supplier, or of any other person or organization performing or furnishing any of the Work.

ARTICLE 10. CHANGES IN THE WORK

- 10.1. Without invalidating the Agreement and without notice to any surety, OWNER may, at any time or from time to time, order additions, deletions or revisions in the Work; these will be authorized by a Written Amendment, a Change Order, or a Work Directive Change. Upon receipt of any such document, CONTRACTOR shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).
- 10.2. If OWNER and CONTRACTOR are unable to agree as to the extent, if any, of an increase or decrease in the Contract Price or an extension or shortening of the Contract Time that should be allowed as a result of a Work Directive Change, a claim may be made therefor as provided in Article 11 or Article 12.
- 10.3. CONTRACTOR shall not be entitled to an increase in the Contract Price or an extension of the Contract Time with respect to any Work performed that is not required by the Contract Documents as amended, modified and supplemented as provided in paragraphs 3.4 and 3.5, except in the case of an emergency as provided in paragraph 6.22 and except in the case of uncovering Work as provided in paragraph 13.9.
- 10.4. OWNER and CONTRACTOR shall execute appropriate Change Orders (or Written Amendments) covering:
 - 10.4.1. changes in the Work which are ordered by OWNER pursuant to paragraph 10.1, are required because of acceptance of defective Work under paragraph 13.13 or correcting defective Work under paragraph 13.14, or are agreed to by the parties.
 - 10.4.2. changes in the Contract Price or Contract Time which are agreed to by the parties; and
 - 10.4.3. changes in the Contract Price or Contract Time which embody the substance of any written decision rendered by ENGINEER pursuant to paragraph 9.11;provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, CONTRACTOR shall carry on the Work and adhere to the progress schedule as provided in paragraph 6.29.
- 10.5. If notice of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Time) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be CONTRACTOR'S responsibility, and the amount of each applicable Bond will be adjusted accordingly.

ARTICLE 11. CHANGE OF CONTRACT PRICE

- 11.1. The Contract Price constitutes the total compensation (subject to authorized adjustments) payable to CONTRACTOR for performing the Work. All duties, responsibilities and obligations assigned to or undertaken by CONTRACTOR shall be at his expense without change in the Contract Price.
- 11.2. The Contract Price may only be changed by a Change Order or by a Written Amendment. Any claim for an increase or decrease in the Contract Price shall be based on written notice delivered by the party making the claim to the other party and to ENGINEER promptly (but in no event later than thirty days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the amount of the claim with supporting data shall be delivered within sixty days after such occurrence (unless ENGINEER allows an additional period of time to ascertain more accurate data in support of the claim) and shall be accompanied by claimant's written statement that the amount claimed covers all known amounts (direct, indirect and consequential) to which the claimant is entitled as a result of the occurrence of said event. All claims for adjustment in the Contract Price shall be determined by ENGINEER in accordance with paragraph 9.11 if OWNER and CONTRACTOR cannot otherwise agree on the amount involved. No claim for an adjustment in the Contract Price will be valid if not submitted in accordance with this paragraph 11.2.
- 11.3. The value of any Work covered by a Change Order or of any claim for an increase or decrease in the Contract Price shall be determined in one of the following ways:
 - 11.3.1. Where the Work involved is covered by unit prices contained in the Contract Documents, by application of unit prices to the quantities of the items involved (subject to the provisions of paragraphs 11.9.1, through 11.9.3, inclusive).
 - 11.3.2. By mutual acceptance of a lump sum (which may include an allowance for overhead and profit not necessarily in accordance with paragraph 11.6.2.1).
 - 11.3.3. On the basis of the Cost of the Work (determined as provided in paragraphs 11.4 and 11.5) plus a CONTRACTOR'S Fee for overhead and profit (determined as provided in paragraphs 11.6 and 11.7).

Cost of the Work:

- 11.4. The term Cost of the Work means the sum of all cost necessarily incurred and paid by CONTRACTOR in the proper performance of the Work. Except as otherwise may be agreed to in writing by OWNER, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items and shall not include any of the costs itemized in paragraph 11.5:
 - 11.4.1. Payroll costs for employees in the direct employ of CONTRACTOR in the performance of the Work under schedules of job classifications agreed upon by OWNER and CONTRACTOR. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits which shall include social security contributions, unemployment, excise and payroll taxes, workers' or workmen's compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay

applicable thereto. Such employees shall include superintendents and foremen at the site. The expenses of performing Work after regular working hours, on Saturday, Sunday or legal holidays, shall be included in the above to the extent authorized by OWNER.

- 11.4.2. Cost of all materials and equipment furnished and incorporated in the Work, including cost of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to CONTRACTOR unless OWNER deposits funds with CONTRACTOR with which to make payments, in which case the cash discounts shall accrue to OWNER. All trade discounts, rebates and refunds and all returns from sale of surplus materials and equipment shall accrue to OWNER, and CONTRACTOR shall make provisions so that they may be obtained.
- 11.4.3. Payments made by CONTRACTOR to the Subcontractors for Work performed by Subcontractors. If required by OWNER, CONTRACTOR shall obtain competitive bids from Subcontractors acceptable to CONTRACTOR and shall deliver such bids of OWNER who will then determine, with the advice of ENGINEER, which bids will be accepted. If a subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work Plus a Fee, the Subcontractor's Cost of the Work shall be determined in the same manner as CONTRACTOR'S Cost of the Work. All subcontracts shall be subject to the other provisions of the Contract Documents insofar as applicable.
- 11.4.4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys and accountants) employed for services specifically related to the Work.
- 11.4.5. Supplemental costs including the following:
 - 11.4.5.1. The proportion of necessary transportation, travel and subsistence expenses of CONTRACTOR'S employees incurred in discharge of duties connected with the Work.
 - 11.4.5.2. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office and temporary facilities at the site and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost less market value of such items used but not consumed which remain the property of CONTRACTOR.
 - 11.4.5.3. Rentals of all construction equipment and machinery and the parts thereof whether rented from CONTRACTOR or others in accordance with rental agreements approved by OWNER with the advice of ENGINEER, and the costs of transportation, loading, unloading, installation, dismantling and removal thereof--all in accordance with terms of said rental agreements. The rental of any such equipment, machinery or parts shall cease when the use thereof is no longer necessary for the Work.
 - 11.4.5.4. Sales, consumer, use or similar taxes related to the Work, and for which CONTRACTOR is liable, imposed by Laws and Regulations.

11.4.5.5. Deposits lost for causes other than negligence of CONTRACTOR, any Subcontractor or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

11.4.5.6. Losses and damages (and related expenses), not compensated by insurance or otherwise, to the Work or otherwise sustained by CONTRACTOR in connection with the performance and furnishing of the Work (except losses and damages within the deductible amounts of property insurance established by OWNER in accordance with paragraph 5.9), provided they have resulted from causes other than the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of OWNER. No such losses, damages and expenses shall be included in the Cost of the Work for the purpose of determining CONTRACTOR'S Fee. If, however, any such loss or damage requires reconstruction and CONTRACTOR is placed in charge thereof, CONTRACTOR shall be paid for services a fee proportionate to that stated in paragraph 11.6.2.

11.4.5.7. The cost of utilities, fuel and sanitary facilities at the site.

11.4.5.8. Minor expenses such as telegrams, long distance telephone calls, telephone service at the site, expressage and similar petty cash items in connection with the Work.

11.4.5.9. Cost of premiums for additional Bonds and insurance required because of changes in the Work and premiums for property insurance cover age within the limits of the deductible amounts established by OWNER in accordance with paragraph 5.9.

11.5. The term Cost of the Work shall not include any of the following:

11.5.1. Payroll costs and other compensation of CONTRACTOR'S officers, executives, principals (of partnership and sole proprietorships), general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks and other personnel employed by CONTRACTOR whether at the site or in CONTRACTOR'S principal or a branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in paragraph 11.4.1 or specifically covered by 11.4.4--all of which are to be considered administrative costs covered by the CONTRACTOR'S Fee.

11.5.2. Expenses of CONTRACTOR'S principal and branch offices other than CONTRACTOR'S office at the site.

11.5.3. Any part of CONTRACTOR'S capital expenses, including interest on CONTRACTOR'S capital employed for the Work and charges against CONTRACTOR for delinquent payments.

- 11.5.4. Cost of premiums for all Bonds and for all insurance whether or not CONTRACTOR is required by the Contract Documents to purchase and maintain the same (except for the cost of premiums covered by subparagraph 11.4.5.9 above).
- 11.5.5. Costs due to the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied and making good any damage to property.
- 11.5.6. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in paragraph 11.4.

CONTRACTOR'S Fee:

- 11.6. The CONTRACTOR'S Fee allowed to CONTRACTOR for overhead and profit shall be determined as follows:
 - 11.6.1. a mutually acceptable fixed fee; or if none can be agree upon,
 - 11.6.2. a fee based on the following percentages of the various portions of the Cost of the Work:
 - 11.6.2.1. for costs incurred under paragraphs 11.4.1 and 11.4.2, the CONTRACTOR'S Fee shall be fifteen percent;
 - 11.6.2.2. for costs incurred under paragraph 11.4.3, the CONTRACTOR'S Fee shall be five percent; and if the subcontract is on the basis of Cost of the Work Plus a Fee, the maximum allowable to CONTRACTOR on account of overhead and profit of all Subcontractors shall be fifteen percent;
 - 11.6.2.3. no fee shall be payable on the basis of costs itemized under paragraphs 11.4.4, 11.4.5 and 11.5;
 - 11.6.2.4. the amount of credit to be allowed by CONTRACTOR to OWNER for any such change which results in a net decrease in cost will be the amount of the actual net decrease plus a deduction in CONTRACTOR'S Fee by an amount equal to ten percent of the net decrease; and
 - 11.6.2.5. when both additions and credits are involved in any one change, the adjustment in CONTRACTOR'S Fee shall be computed on the basis of the net change in accordance with paragraphs 11.6.2.1 through 11.6.2.4, inclusive.
- 11.7. Whenever the cost of any Work is to be determined pursuant to paragraph 11.4 or 11.5, CONTRACTOR will submit in form acceptable to ENGINEER an itemized cost breakdown together with supporting data.

Cash Allowances:

- 11.8. It is understood that CONTRACTOR has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be done by such Subcontractors or Suppliers and for such sums within the limit of the allowances as may be acceptable to ENGINEER, CONTRACTOR agrees that:

- 11.8.1. The allowances include the cost to CONTRACTOR (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the site, and all applicable taxes; and
- 11.8.2. CONTRACTOR'S costs for unloading and handling on the site, labor, installation costs, overhead, profit and other expenses contemplated for the allowances have been included in the Contract Price and not in the allowances. No demand for additional payment on account of any thereof will be valid.

Prior to final payment, an appropriate Change Order will be issued as recommended by ENGINEER to reflect actual amounts due CONTRACTOR on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

Unit Price Work:

- 11.9. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the established unit prices for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by CONTRACTOR will be made by ENGINEER in accordance with Paragraph 9.10.
- 11.10. Each unit price will be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR'S overhead and profit for each separately identified item.
- 11.11. Where the quantity of any item of Unit Price Work performed by CONTRACTOR differed materially and significantly from the estimated quantity of such item indicated in the Agreement and there is no corresponding adjustment with respect to any other item of Work and if CONTRACTOR believes that CONTRACTOR has incurred additional expense as a result thereof, CONTRACTOR may make a claim for an increase in the Contract Price in accordance with Article 11 if the parties are unable to agree as to the amount of any such increase.

ARTICLE 12. CHANGE OF CONTRACT TIME

- 12.1. The Contract Time may only be changed by a Change Order or a Written Amendment. Any claim for an extension or shortening of the Contract Time shall be based on written notice delivered by the party making the claim to the other party and to ENGINEER promptly (but in no event later than thirty days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the extent of the claim with supporting data shall be delivered within sixty days after such occurrence (unless ENGINEER allows an additional period of time to ascertain more accurate data in support of the claim) and shall be accompanied by the claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant has reason to believe it is entitled as a result of the occurrence of said event. All claims for adjustment in the Contract Time shall be determined by ENGINEER in accordance with paragraph 9.11 if OWNER and CONTRACTOR cannot otherwise agree. No claim for an

adjustment in the Contract Time will be valid if not submitted in accordance with the requirements of this paragraph 12.1.

- 12.2. The Contract Time will be extended in an amount equal to time lost due to delays beyond the control of CONTRACTOR if a claim is made therefor as provided in paragraph 12.1. Such delays shall include, but not be limited to, acts or neglect by OWNER or others performing additional work as contemplated by Article 7 or to fires, floods, labor disputes, epidemics, abnormal weather conditions or acts of God.
- 12.3. All time limits stated in the Contract Documents are of the essence of the Agreement. The provisions of this Article 12 shall not exclude recovery for damages (including but not limited to fees and charges of engineers, architects, attorneys and other professionals and court and arbitration costs) for delay by either party.

**ARTICLE 13. WARRANTY AND GUARANTEE; TESTS AND INSPECTIONS;
CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK**

Warranty and Guarantee:

- 13.1. CONTRACTOR warrants and guarantees to OWNER and ENGINEER that all Work will be in accordance with the Contract Documents and will not be defective. Prompt notice of all defects shall be given to CONTRACTOR. All defective Work, whether or not in place, may be rejected, corrected or accepted as provided in this Article 13.

Access to Work:

- 13.2. ENGINEER and ENGINEER'S representatives, other representatives or OWNER, testing agencies and governmental agencies with jurisdictional interest will have access to the Work at reasonable times for their observation, inspecting and testing. CONTRACTOR shall provide proper and safe conditions for such access.

Tests and Inspections:

- 13.3. CONTRACTOR shall give ENGINEER timely notice of readiness of the Work for all required inspections, tests or approvals.
- 13.4. If Laws or Regulations of any public body that have jurisdiction require any Work (or part thereof) to specifically be inspected, tested or approved, CONTRACTOR shall assume full responsibility therefor, pay all costs in connection therewith and furnish ENGINEER the required certificates of inspection, testing or approval. CONTRACTOR shall also be responsible for and shall pay all costs in connection with any inspection or testing required in connection with OWNER'S or ENGINEER'S acceptance of a Supplier of materials or equipment proposed to be incorporated in the Work, or of materials or equipment submitted for approval prior to CONTRACTOR'S purchase thereof for incorporation in the Work. The cost of all inspections, tests and approvals in addition to the above which are required by the Contract Documents shall be paid by OWNER (unless otherwise specific).
- 13.5. All inspections, tests or approvals other than those required by Laws or Regulations of any public body having jurisdiction shall be performed by organizations acceptable to OWNER and CONTRACTOR (or by ENGINEER if so specified).
- 13.6. If any Work (including the work of others) that is to be inspected, tested or approved is covered without written concurrence of ENGINEER, it must, if requested by

ENGINEER, be uncovered for observation. Such uncovering shall be at CONTRACTOR'S expense unless CONTRACTOR has given ENGINEER timely notice of CONTRACTOR'S intention to cover the same and ENGINEER has not acted with reasonable promptness in response to such notice.

- 13.7. Neither observations by ENGINEER nor inspections, test or approvals by others shall relieve CONTRACTOR from CONTRACTOR'S obligations to perform the Work in accordance with the Contract Documents.

Uncovering Work:

- 13.8. If any Work is covered contrary to the written request of ENGINEER, it must, if requested by ENGINEER, be uncovered for ENGINEER'S observation and replaced at CONTRACTOR'S expense.
- 13.9. If ENGINEER considers it necessary or advisable that covered Work be observed by ENGINEER or inspected or tested by others, CONTRACTOR, at ENGINEER'S request, shall uncover, expose or otherwise make available for observation, inspection or testing as ENGINEER may require, that portion of the Work in question, furnishing all necessary labor, material and equipment. If it is found that such Work is defective, CONTRACTOR shall bear all direct and indirect and consequential costs of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction, (including but not limited to fees and charges of engineers, architects, attorneys and other professional), and OWNER shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, may make a claim therefor as provided in Article 11. If, however, such Work is not found to be defective, CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction; and, if the parties are unable to agree as to the amount or extent thereof; CONTRACTOR may make a claim therefor as provided in Articles 11 and 12.

Owner May Stop the Work:

- 13.10. If the Work is defective, or CONTRACTOR fails to supply sufficient skilled workers or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, OWNER may order CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of OWNER to stop the Work shall not give rise to any duty on the part of OWNER to exercise this right for the benefit of CONTRACTOR or any other party.

Correction or Removal of Defective Work:

- 13.11. If required by ENGINEER, CONTRACTOR shall promptly, as directed, either correct all defective Work, whether or not fabricated, installed or completed, or, if the Work has been rejected by ENGINEER, remove it from the site and replace it with non-defective Work. CONTRACTOR shall bear all direct, indirect and consequential costs of such correction or removal (including but not limited to fees and charges of engineers, architects, attorneys and other professionals) made necessary thereby.

One Year Correction Period:

13.12. If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any Work is found to be defective, CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER'S written instructions, either correct such defective Work, or, if it has been rejected by OWNER, remove it from the site and replace it with non-defective Work. If CONTRACTOR does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, OWNER may have the defective Work corrected or the rejected Work removed and replaced, and all direct, indirect and consequential costs of such removal and replacement (including but not limited to fees and charges of ENGINEERS, architects, attorneys and other professionals) will be paid by CONTRACTOR. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications or by Written Amendment.

Acceptance of Defective Work:

13.13. If, instead of requiring correction or removal and replacement of defective Work, OWNER (and, prior to ENGINEER'S recommendation of final payment, also ENGINEER) prefers to accept it, OWNER may do so. CONTRACTOR shall bear all direct, indirect and consequential costs attributable to OWNER'S evaluation of and determination to accept such defective Work (such costs to be approved by ENGINEER as to reasonableness and to include but not be limited to fees and charges of engineers, architects, attorneys and other professionals). If any such acceptance occurs prior to ENGINEER'S recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and OWNER shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, OWNER may make a claim therefor as provided in Article 11. If the acceptance occurs after such recommendation, an appropriate amount will be paid by CONTRACTOR to OWNER.

OWNER May Correct Defective Work:

13.14. If CONTRACTOR fails within a reasonable time after written notice of ENGINEER to proceed to correct and to correct defective Work or to remove and replace rejected Work as required by ENGINEER in accordance with paragraph 13.11, or if CONTRACTOR fails to perform the Work in accordance with the Contract Documents, or if CONTRACTOR fails to comply with any other provision of the Contract Documents, OWNER may, after seven days' written notice to CONTRACTOR, correct and remedy any such deficiency. In exercising the rights and remedies under this paragraph OWNER shall proceed expeditiously. To the extent necessary to complete corrective and remedial action, OWNER may exclude CONTRACTOR from all or part of the site, take possession of all or part of the Work, and suspend CONTRACTOR'S services related thereto, take possession of CONTRACTOR'S tools, appliances, construction equipment and machinery at the site and incorporate in the Work all materials and equipment stored at the site for which OWNER has paid CONTRACTOR but which are stored elsewhere. CONTRACTOR shall allow OWNER, OWNER'S representatives, agents and employees

such access to the sites as may be necessary to enable OWNER to exercise the rights and remedies under this paragraph. All direct, indirect and consequential costs of OWNER in exercising such rights and remedies will be charge against CONTRACTOR in an amount approved as to reasonableness by ENGINEER, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and OWNER shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, OWNER may make a claim therefor as provided in Article 11. Such direct, indirect and consequential costs will include but not be limited to fees and charges of engineers, architects, attorneys and other professionals, all court and arbitration costs and all costs of repair and replacement of work of others destroyed or damaged by correction, removal or replacement of CONTRACTOR'S defective Work. CONTRACTOR shall not be allowed an extension of the Contract Time because of any delay in performance of the Work attributable to the exercise by OWNER of OWNER'S rights and remedies hereunder.

ARTICLE 14. PAYMENTS TO CONTRACTOR AND COMPLETION

Schedule of Values:

- 14.1. The schedule of values established as provided in paragraph 2.9 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to ENGINEER. Progress payments on account of Unit Price Work will be based on the number of units completed.

Application for Progress Payment:

- 14.2. At least twenty days before each progress payment is scheduled (but not more often than once a month), CONTRACTOR shall submit to ENGINEER for review an Application for Payment filled out and signed by CONTRACTOR covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice or other documentation warranting that OWNER has received the materials and equipment free and clear of all liens, charges, security interests and encumbrances (which are hereinafter in these General Conditions referred to as "Liens") and evidence that the materials and equipment are covered by appropriate property insurance and other arrangements to protect OWNER'S interest there in, all of which will be satisfactory to OWNER. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

CONTRACTOR'S Warranty of Title:

- 14.3. CONTRACTOR warrants and guarantees that title to Work, materials and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to OWNER no later than the time of payment free and clear of all Liens.

Review of Applications for Progress Payment:

- 14.4. ENGINEER will, within ten days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to OWNER, or return the Application to CONTRACTOR indicating in writing ENGINEER'S reasons for refusing to recommend payment. In the latter case,

CONTRACTOR may make the necessary corrections and resubmit the Application. Ten days after presentation of the Application for Payment with ENGINEER'S recommendation, the amount recommended will (subject to the provisions of the last sentence of paragraph 14.7.) become due and when due will be paid by OWNER to CONTRACTOR.

- 14.5. ENGINEER'S recommendation of any payment requested in an Application for Payment will constitute a representation by ENGINEER to OWNER, based on ENGINEER'S on-site observations of the Work in progress as an experienced and qualified design professional and on ENGINEER'S review of the Application for Payment and the accompanying data and schedules that the Work has progressed to the point indicated; that, to the best of ENGINEER'S knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under paragraph 9.10, and to any other qualifications stated in the recommendation); and that CONTRACTOR is entitled to payment of the amount recommended. However, by recommending any such payment ENGINEER will not thereby be deemed to have represented that exhaustive or continuous on-site inspections have been made to check the quality or the quantity of the Work beyond the responsibilities specifically assigned to ENGINEER in the Contract Documents or that there might not be other matters or issues between the parties that might entitle CONTRACTOR to be paid additionally by OWNER or OWNER to withhold payment to CONTRACTOR.
- 14.6. ENGINEER'S recommendation of final payment will constitute an additional representation by ENGINEER to OWNER that the conditions precedent to CONTRACTOR'S being entitled to final payment as set forth in paragraph 14.13 have been fulfilled.
- 14.7. ENGINEER may refuse to recommend the whole or any part of any payment if, in ENGINEER'S opinion, it would be incorrect to make such representations to OWNER. ENGINEER may also refuse to recommend any such payment, or, because of subsequently discovered evidence or the results of subsequent inspections or test, nullify any such payment previously recommended, to such extent as may be necessary in ENGINEER'S opinion to protect OWNER from loss because:
 - 14.7.1. the Work is defective, or completed Work has been damaged requiring correction or replacement,
 - 14.7.2. the Contract Price has been reduced by Written Amendment or Change Order,
 - 14.7.3. OWNER has been required to correct defective Work or complete Work in accordance with paragraph 13.14, or
 - 14.7.4. of ENGINEER'S actual knowledge of the occurrence of any of the events enumerated in paragraphs 15.2.1 through 15.2.9 inclusive.

OWNER may refuse to make payment of the full amount recommended by ENGINEER because claims have been made against OWNER on account of CONTRACTOR'S performance or furnishing of the Work or Liens have been filed in connection with the Work or there are other

items entitling OWNER to set-off against the amount recommended, but OWNER must give CONTRACTOR immediate written notice (with a copy to ENGINEER) stating the reasons for such action.

Substantial Completion:

- 14.8. When CONTRACTOR considers the entire Work ready for its intended use CONTRACTOR shall notify OWNER and ENGINEER in writing that the entire Work is substantially complete (except for items specifically listed by CONTRACTOR as incomplete) and request that ENGINEER issue a certificate of Substantial Completion. Within a reasonable time thereafter, OWNER, CONTRACTOR and ENGINEER shall make an inspection of the Work to determine the status of completion. If ENGINEER does not consider the Work substantially complete, ENGINEER will notify CONTRACTOR in writing giving the reasons therefor. If ENGINEER considers the Work substantially complete, ENGINEER will prepare and deliver to OWNER a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. OWNER shall have seven days after receipt of the tentative certificate during which to make written objection to ENGINEER as to any provisions of the certificate or attached list. If, after considering such objections, ENGINEER concludes that the work is not substantially complete. ENGINEER will, within fourteen days after submission of the tentative certificate to OWNER, notify CONTRACTOR in writing, stating the reasons therefor. If, after consideration of OWNER'S objections, ENGINEER considers the Work substantially complete, ENGINEER will within said fourteen days execute and deliver to OWNER and CONTRACTOR a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as ENGINEER believes justified after consideration of any objections from OWNER. At the time of delivery of the tentative certificate of Substantial Completion ENGINEER will deliver to OWNER and CONTRACTOR a written recommendation as to division of responsibilities pending final payment between OWNER and CONTRACTOR with respect to security, operation, safety, maintenance, heat, utilities, insurance and warranties. Unless OWNER and CONTRACTOR agree otherwise in writing and so inform ENGINEER prior to ENGINEER'S issuing the definitive certificate of Substantial Completion, ENGINEER'S aforesaid recommendation will be binding on OWNER and CONTRACTOR until final payment.
- 14.9. OWNER shall have the right to exclude CONTRACTOR from the Work after the date of Substantial Completion, but OWNER shall allow CONTRACTOR reasonable access to complete or correct items on the tentative list.

Partial Utilization:

- 14.10. Use by OWNER of any finished part of the Work, which has specifically been identified in the Contract Documents, or which OWNER, ENGINEER and CONTRACTOR agree constitutes a separately functioning and useable part of the Work that can be used by OWNER without significant interference with CONTRACTOR'S performance of the remainder of the Work, may be accomplished prior to Substantial Completion of all the Work subject to the following:

- 14.10.1. OWNER at any time may request CONTRACTOR in writing to permit OWNER to use any such part of the Work which OWNER believes to be ready for its intended use and substantially complete. If CONTRACTOR agrees, CONTRACTOR will certify to OWNER and ENGINEER that said part of the Work is substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. CONTRACTOR at any time may notify OWNER and ENGINEER in writing that CONTRACTOR considers any such part of the Work ready for its intended use and substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. Within a reasonable time after either such request, OWNER, CONTRACTOR and ENGINEER shall make an inspection of that part of the Work to determine its status of completion. If ENGINEER does not consider part of the Work to be substantially complete, ENGINEER will notify OWNER and CONTRACTOR in writing giving the reasons therefor. If ENGINEER considers that part of the Work to be substantially complete, the provisions of paragraphs 14.8 and 14.9 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
- 14.10.2. OWNER may at any time request CONTRACTOR in writing to permit OWNER to take over operation of any such part of the Work although it is not substantially complete. A copy of such request will be sent to ENGINEER and within a reasonable time thereafter OWNER, CONTRACTOR and ENGINEER shall make an inspection of that part of the Work to determine its status of completion and will prepare a list of the items remaining to be completed or corrected thereon before final payment. If CONTRACTOR does not object in writing to OWNER and ENGINEER that such part of the Work is not ready for separate operation by OWNER, ENGINEER will finalize the list of items to be completed or corrected and will deliver such list to OWNER and CONTRACTOR together with a written recommendation as to the division of responsibilities pending final payment between OWNER and CONTRACTOR with respect to security, operation, safety, maintenance, utilities, insurance, warranties and guarantees for that part of the Work which will become binding upon OWNER and CONTRACTOR at the time when OWNER takes over such operation (unless they shall have otherwise agreed in writing and so informed ENGINEER). During such operation and prior to Substantial Completion of such part of the Work, OWNER shall allow CONTRACTOR reasonable access to complete or correct items on said list and to complete other related Work.
- 14.10.3. No occupancy or separate operation of part of the Work will be accomplished prior to compliance with the requirements of paragraph 5.15 in respect of property insurance.

Final Inspection:

- 14.11. Upon written notice from CONTRACTOR that the entire Work or an agreed portion thereof is complete, ENGINEER will make a final inspection with OWNER and CONTRACTOR and will notify CONTRACTOR in writing of all particulars in which

this inspection reveals that the Work is incomplete or defective. CONTRACTOR shall immediately take such measures as are necessary to remedy such deficiencies.

Final Application for Payment:

- 14.12. After CONTRACTOR has completed all such corrections to the satisfaction of ENGINEER and delivered all maintenance and operating instructions, schedules, guarantees, Bonds, certificates of inspection, marked-up record documents (as provided in paragraph 6.19) and other documents--all as required by the Contract Documents, and after ENGINEER has indicated that the Work is acceptable (subject to the provisions of paragraph 14.16), CONTRACTOR may make application for final payment following the procedure for progress payments. The final Application for Payment shall be accompanied by all documentation called for in the Contract Documents, together with complete and legally effective releases or waivers (satisfactory to OWNER) of all Liens arising out of or filed in connection with the Work. In lieu thereof and as approved by OWNER, CONTRACTOR may furnish receipts or releases in full; an affidavit of CONTRACTOR that the releases and receipts include all labor, services, material and equipment for which a Lien could be filed, and that all payrolls, material and equipment bills, and other indebtedness connected with the Work for which OWNER or OWNER'S property might in any way be responsible, have been paid or otherwise satisfied; and consent of the surety, if any, to final payment. If any Subcontractor or Supplier fails to furnish a release or receipt in full, CONTRACTOR may furnish a Bond or other collateral satisfactory to OWNER to indemnify OWNER against any Lien.

Final Payment and Acceptance:

- 14.13. If, on the basis of ENGINEER'S observation of the Work during construction and final inspection, and ENGINEER'S review of the final Application for Payment and accompanying documentation--all as required by the Contract Documents, ENGINEER is satisfied that the Work has been completed and CONTRACTOR'S other obligations under the Contract Documents have been fulfilled, ENGINEER will, within ten days after receipt of the final Application for Payment, indicate in writing ENGINEER'S recommendation of payment and present the Application to OWNER for payment. Thereupon ENGINEER will give written notice to OWNER and CONTRACTOR that the Work is acceptable subject to the provisions of paragraph 14.16. Otherwise, ENGINEER will return the Application to CONTRACTOR, indicating in writing the reason for refusing to recommend final payment, in which case CONTRACTOR shall make the necessary corrections and resubmit the Application. Thirty days after presentation to OWNER of the Application and accompanying documentation, in appropriate form and substance, and with ENGINEER'S recommendation and notice of acceptability, the amount recommended by ENGINEER will become due and will be paid by OWNER to CONTRACTOR.
- 14.14. If, through no fault of CONTRACTOR, final completion of the Work is significantly delayed and if ENGINEER so confirms, OWNER shall, upon receipt of CONTRACTOR'S final Application for Payment and recommendation of ENGINEER, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by OWNER for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required in paragraph 5.1, the

written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by CONTRACTOR to ENGINEER with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

CONTRACTOR'S Continuing Obligation:

14.15. CONTRACTOR'S obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. Neither recommendation of any progress or final payment by ENGINEER, nor the issuance of a certificate of Substantial Completion, nor any payment by OWNER to CONTRACTOR under the Contract Documents, nor any use or occupancy of the Work or any part thereof by OWNER, nor any act of acceptance by OWNER nor any failure to do so, nor any review and approval of a Shop Drawing or sample submission, nor the issuance of a notice of acceptability by ENGINEER pursuant to paragraph 14.13, nor any correction of defective Work by OWNER will constitute an acceptance of Work not in accordance with the Contract Documents or a release of CONTRACTOR'S obligation to perform the Work in accordance with the Contract Documents (except as provided in paragraph 14.16).

Waiver of Claims:

14.16. The making and acceptance of final payment will constitute:

14.16.1. a waiver of all claims by OWNER against CONTRACTOR, except claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to paragraph 14.11 or from failure to comply with the Contract Documents or the terms of any special guarantees specified there in; however, it will not constitute a waiver by OWNER of any rights in respect of CONTRACTOR'S continuing obligations under the Contract Documents; and

14.16.2. a waiver of all claims by CONTRACTOR against OWNER other than those previously made in writing and still unsettled.

ARTICLE 15. SUSPENSION OF WORK AND TERMINATION

Owner May Suspend Work:

15.1. OWNER may, at any time and without cause, suspend the Work or any portion thereof for a period of not more than ninety days by notice in writing to CONTRACTOR and ENGINEER which will fix the date on which Work will be resumed. CONTRACTOR shall resume the Work on the date so fixed. CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to any suspension if CONTRACTOR makes and approved claim therefor as provided in Articles 11 and 12.

Owner May Terminate:

15.2. Upon the occurrence of any one or more of the following events:

15.2.1. if CONTRACTOR commences a voluntary case under any chapter of Bankruptcy Code (Title 11, United States Code), as now or hereafter in effect, or if CONTRACTOR takes any equivalent or similar action by filing a petition or otherwise under any other federal or state law in effect at such time relating to the bankruptcy or insolvency;

- 15.2.2. if a petition is filed against CONTRACTOR under any chapter of the Bankruptcy Code as now or hereafter in effect at the time of filing, or if a petition is filed seeking any such equivalent or similar relief against CONTRACTOR under any other federal or state law in effect at the time relating to bankruptcy or insolvency;
- 15.2.3. if CONTRACTOR makes a general assignment for the benefit of creditors;
- 15.2.4. if a trustee, receiver, custodian or agent of CONTRACTOR is appointed under applicable law or under contract, whose appointment or authority to take charge of property of CONTRACTOR is for the purpose of enforcing a Lien against such property or for the purpose of general administration of such property for the benefit of CONTRACTOR'S creditors;
- 15.2.5. if CONTRACTOR admits in writing an inability to pay its debts generally as they become due;
- 15.2.6. if CONTRACTOR persistently fails to perform the Work in accordance with the Contract Documents (including, but no limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the progress schedule established under paragraph 2.9 as revised from time to time);
- 15.2.7. if CONTRACTOR disregards Laws or Regulations of any public body having jurisdiction;
- 15.2.8. if CONTRACTOR disregards the authority of ENGINEER; or
- 15.2.9. if CONTRACTOR otherwise violates in any substantial way any provisions of the Contract Documents;

OWNER may, after giving CONTRACTOR (and the surety, if there be one) seven days' written notice and to the extent permitted by Laws and Regulations, terminate the services of CONTRACTOR, exclude CONTRACTOR from the site and take possession of the Work and of all CONTRACTOR'S tools, appliances, construction equipment and machinery at the site and use the same to the full extent they could be used by CONTRACTOR (without liability to CONTRACTOR for trespass or conversion), incorporate in the Work all materials and equipment stored at the site or for which OWNER has paid CONTRACTOR but which are stored elsewhere, and finish the Work as OWNER may deem expedient. In such case CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds the direct, indirect and consequential costs of completing the Work (including but not limited to fees and charges of engineer, architects, attorneys and other professionals and court arbitration costs) such excess will be paid to CONTRACTOR. If such costs exceed such unpaid balance, CONTRACTOR shall pay the difference to OWNER. Such costs incurred by OWNER will be approved as to reasonableness by ENGINEER and incorporated in a Change Order, but when exercising any rights or remedies under this paragraph OWNER shall not be required to obtain the lowest price for the Work performed.

- 15.3. Where CONTRACTOR'S services have been so terminated by OWNER, the termination will not affect any rights or remedies of OWNER against CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of moneys due CONTRACTOR by OWNER will not release CONTRACTOR from liability.

- 15.4. Upon seven days' written notice to CONTRACTOR and ENGINEER, OWNER may, without cause and without prejudice to any other right or remedy, elect to abandon the Work and terminate the Agreement. In such case, CONTRACTOR shall be paid for all Work executed and any expense sustained plus reasonable termination expenses, which will include, but not be limited to, direct, indirect and consequential costs (including, but not limited to, fees and charges of engineer, architects, attorneys and other professionals and court and arbitration costs).

Contractor May Stop Work or Terminate:

- 15.5. If, through no act or fault of CONTRACTOR, the Work is suspended for a period of more than ninety days by OWNER or under an order of court or other public authority or ENGINEER fails to act on any Application for Payment within thirty days after it is submitted, or OWNER fail for thirty days to pay CONTRACTOR any sum finally determined to be due, then CONTRACTOR may, upon seven days' written notice to OWNER and ENGINEER, terminate the Agreement and recover from OWNER payment for all Work executed and any expense sustained plus reasonable termination expenses. In addition and in lieu of terminating the Agreement, if ENGINEER has failed to act on an Application for Payment or OWNER has failed to make any payment as aforesaid, CONTRACTOR may upon seven days' written notice to OWNER and ENGINEER stop the Work until payment of all amounts then due. The provisions of this paragraph shall not relieve CONTRACTOR of the obligations under paragraph 6.29 to carry on the Work in accordance with the progress schedule and without delay during disputes and disagreements with OWNER.

ARTICLE 16. ARBITRATION (Omitted)

ARTICLE 17. MISCELLANEOUS

Giving Notice:

- 17.1. Whenever any provision of the Contract Documents require the giving of written notice, it will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

Computation of Time:

- 17.2. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.
- 17.3. A calendar day of twenty-four hours measured from midnight to the next midnight shall constitute a day.

General:

- 17.4. Should OWNER or CONTRACTOR suffer injury or damage to person or property because of any error, omission or act of the other party or of any of the other party's employees or agents or others for whose acts the other party is legally liable, claim will be made in writing to the other party within a reasonable time of the first observance of

such injury or damage. The provisions of this paragraph 17.3 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or repose.

- 17.5. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto, and, in particular but without limitation, the warranties, guarantees and obligations imposed upon CONTRACTOR by paragraphs 6.30, 13.1, 13.12, 13.14, 14.3 and 15.2 and all of the rights and remedies available to OWNER and ENGINEER thereunder, are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee or by other provisions of the Contract Documents, and the provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right and remedy to which they apply. All representations, warranties and guarantees made in the Contract Documents will survive final payment and termination or completion of the Agreement.

END OF GENERAL CONDITIONS

SPECIAL CONDITIONS

Table of Contents of Special Conditions

SC. 01	Abbreviations
SC. 02	Workmen's Compensation Insurance
SC. 03	Public Liability, Property Damage, and Automobile Insurance
SC. 04	Indemnification
SC. 05.	Assignments
SC. 06	Borings
SC. 07	Line and Grade
SC. 08	Environmental Requirements
SC. 09	Omitted
SC. 10	Traffic Safety
SC. 11	Shop Drawings
SC. 12	Working Facilities and Easements
SC. 13	Program and Method of Construction
SC. 14	Overtime Work
SC. 15	Work in Inclement Weather
SC. 16	Intoxicating Liquors and Drugs
SC. 17	Sanitary Measures
SC. 18	Water Supply
SC. 19	Water-Tight Structures
SC. 20	Measures and Weights
SC. 21	Planimeter
SC. 22	Dimensions and Elevations
SC. 23	Lights and Protection
SC. 24	Sewage and Water Flows
SC. 25	Use of Streets
SC. 26	Obstructions Encountered
SC. 27	Cleaning and Rounding of Streets
SC. 28	Existing Conduits, Sewers, Pipes, and Drains
SC. 29	Protecting Existing Buildings and Structures
SC. 30	Connections to Existing Structures
SC. 31	Monuments and Landmarks
SC. 32	Aid to the Injured
SC. 33	Storing of Materials
SC. 34	Protection of Equipment
SC. 35	Temporary Light and Heat
SC. 36	Electric Power
SC. 37	Unnecessary Noise
SC. 38	Existing Trees, Shrubbery, and Lawns
SC. 39	Cleaning Up
SC. 40	Mill and Shop Tests and Inspection
SC. 41	Insufficiency of Safety Precautions
SC. 42	Use of Sewers or Structures
SC. 43	Administration of Overtime Work by Resident Engineering Force

SC. 44	Rights Reserved
SC. 45	Social Security Tax
SC. 46	Restoration
SC. 47	Public Convenience and Safety
SC. 48	Selling of Timber
SC. 49	Cooperation with Governmental Departments, Public Utilities, Etc.

(Section SC. 01) ABBREVIATIONS:

ANSI	-	American National Standards Institute
AREA	-	American Railway Engineering Association
ASTM	-	American Society of Testing Materials
ACI	-	American Concrete Institute
AWWA	-	American Water Works Association
AWS	-	American Welding Society
AISI	-	American Iron and Steel Institute
AISC	-	American Institute of Steel Construction
UL	-	Underwriter's Laboratories, Inc.
AASHTO	-	American Association of State Highway & Transportation Official
NEMA	-	National Electrical Manufacturers Association
IEEE	-	Institute of Electrical and Electronic Engineers
ASME	-	American Society of Mechanical Engineers
OSHA	-	Occupational Safety and Health Administration

(Section SC. 02) WORKMEN'S COMPENSATION INSURANCE:

This Contract shall be null and void and of no effect unless the Contractor shall, before entering upon the performance thereof, secure Workmen's Compensation Insurance for the benefit of and keep insured, during the life of said Contract, all employees engaged thereon who are required to be insured by the laws of the State of Georgia. In case the Contractor shall subcontract any portion of the Work, he shall require that all employees of the subcontractor are properly covered by such Workmen's Compensation Insurance.

(Section SC. 03) PUBLIC LIABILITY, PROPERTY DAMAGE, AND AUTOMOBILE INSURANCE:

The Contractor shall take out and maintain during the life of this Contract the various types and amounts of insurance as required to protect the Contractor, the Owner, officials and representatives of the Owner, the Highway Departments, the Consulting Engineers, and their representatives and any subcontractor performing work covered by this Contract from claims for damages for property damages which may arise from operations under this Contract, whether such operations be by himself or by any subcontractor or by anyone directly employed by either of them.

Without restricting the obligations and liabilities assumed under the Contract Documents, the Contractor shall, at his own cost and expense, purchase and maintain in force until final acceptance of this Work, the below listed forms of insurance coverage.

Certificates in triplicate from the insurance carrier stating the limits of liability and expiration date shall be filed with the Owner before operations are begun. Such certificates shall not merely name the types of policy provided, but shall specifically refer to this Contract and shall contain a separate express statement of compliance with each of the requirements as set forth in this Section. However, the original policies for Owner's Protective Liability Insurance (Item C) shall at this time be delivered to the Owner for its possession.

All policies as hereinafter required shall be so written that the Owner will be notified of cancellation or restrictive amendment at least 30 days prior to the effective date of such cancellation or amendment.

- Item A - Workmen's Compensation and Employer's Liability Insurance as required or specified by State Law.
- Item B - Comprehensive General Liability Insurance including coverage for:
 1. Property Damage to existing structures and equipment;
 2. Direct Operations - including coverage for underground, explosion and collapse hazards;
 3. Independent Contractors;
 4. Completed Operations;
 5. Contractual Liability - Blanket or specific coverage for the indemnification agreement as set forth in the Section titled INDEMNIFICATION.
- Item C - Owner's Protection Liability Insurance - in the name of the Owner including the interest of the Consulting Engineers as additional insureds.
- Item D - Comprehensive Automotive Liability Insurance, including non-ownership and hired car coverage.
- Item E - Builder's Risk and Installation Floater

Builder's Risk: This insurance shall be written in completed value form and shall protect the Contractor, the Owner and the Consulting Engineer, the representatives of the consulting Engineer and the officials and representatives of the Owner against risks of damage to buildings, structures, and materials and equipment, excluding excavation, paving, and related work, not otherwise covered under Installation Floater Insurance, from the perils of fire and lightning, the perils included in the standard extended coverage endorsement, and the perils of vandalism and malicious mischief. The amount of such insurance shall be not less than the insurance value of the Work at completion less the value of materials and equipment insured under Installation Floater Insurance.

Equipment such as pumps, heat exchangers, compressors, tanks, motors, switchgear, transformers, panel boards, control equipment, and other similar equipment shall be

insured under Installation Floater Insurance when the aggregate value of this equipment exceeds \$10,000.

Builder's Risk Insurance shall provide for losses to be payable to the Contractor and the Owner, as their interests may appear.

Installation Floater: This insurance shall protect the Contractor, the Owner, officials and representatives of the Consulting Engineer from all insurable risks to physical loss or damage to materials and equipment not otherwise covered under Builder's Risk Insurance, while in warehouses or storage areas, during installation, during testing, and after the Work is completed. It shall be of the "all risks" type. The coverage shall be for an amount not less than the value of the materials and equipment insured under Builder's Risk Insurance.

Installation Floater Insurance shall provide for losses to be payable to the Contractor and the Owner as their interests may appear.

If the aggregate value of the equipment furnished under the Contract is less than \$10,000, such equipment may be covered under Builder's Risk Insurance and if so covered, this Installation Floater Insurance may be omitted.

Certificates of Insurance covering Installation Floater Insurance shall quote the insuring agreement and all exclusions as they appear in the policy; or in lieu of certificate, copies of the complete policy may be submitted.

- Item F - Insurance Required by Others: Such Protective and Contractual Bodily Injury Liabilities Insurance and such Protective and Contractual Property Damage Liability Insurance as shall be required by any public bodies or utility companies whose property, facilities, or right-of-way may be affected by the Work to be done under this Contract.

If any part of the Work is sublet, insurance of the same types and limits as required by above Items A, B, D, and F, shall be provided by or on behalf of the Subcontractor(s) to cover that part of the Work they have contracted to perform.

The minimum limits of liability which will be acceptable for the types of insurance required from the Contractor for this Contract are as follows:

- (a) Bodily Injury \$1,000,000/\$2,000,000
Property Damage \$500,000/\$1,000,000
- (b) Protective and Contractual Bodily Injury Liability Insurance required by Item F shall be in an amount and form as each utility company may require.
- (c) The Contractor shall take out before the work is commenced within the City's right-of-way, and keep in effect until said work is completed and accepted, liability and property damage insurance holding Macon-Bibb County harmless from any damages arising out of the operation performed

within limits stated above. The insurance policy shall be with an insurance company with a rating of "A" or better and authorized and licensed to do business in the State of Georgia.

A copy of the policy or certificate evidencing same shall be submitted to the Macon-Bibb County Engineer and approved by him before any work is commenced.

(Section SC. 04) INDEMNIFICATION:

The Contractor shall indemnify and hold harmless the Owner, officials and representatives of the Owner, the Georgia Department of Transportation and the Consulting Engineers, and their officers, representatives, agents and employees from and against all claims, damages, losses and expenses, including attorneys' fees arising out of or resulting from the performance of the Work, provided that any such claim, damage, loss, or expense is caused in whole or in part by any negligent act or omission of the Contractor, any subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder.

In any and all claims against the Owner, the officials and representatives of the Owner, or the Georgia Department of Transportation or the Consulting Engineer, or any of their officers, representatives, agents or employees by any employee of the Contractor, any subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them be liable, the indemnification obligation of the Contractor under this Section SC.04 shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for the Contractor or any subcontractor under Workmen's Compensation Acts, disability benefit acts, or other employee benefit acts.

(Section SC. 05) ASSIGNMENTS:

The Contractor shall not assign, in whole or in part, this contract or any moneys due or to become due thereunder without the written consent of the Owner.

(Section SC. 06) BORING:

Subsurface exploration borings have not been made, unless indicated elsewhere in the contract. If the bidder wishes to make borings for his own use, the Owner will make available the site of the work for such exploratory work. Cost of such work shall be at the bidder's expense.

(Section SC. 07) LINE AND GRADE:

The Owner shall establish as shown on the Contract Drawings, bench marks adjacent to the Work. Based upon the information provided by the Owner, the Contractor shall develop and make all detail surveys necessary for construction, including construction stakes, batter boards, stakes for pile locations and other working points, lines and elevations. The Contractor shall have the responsibility to carefully preserve bench marks, reference points, and stakes, and, in the case of destruction thereof by the Contractor or resulting from his negligence, the Contractor shall be responsible for any mistakes that may be caused by the unnecessary loss or disturbance of such

bench marks, reference points, and stakes.

As location of sewers may change to avoid interference with existing or proposed structures, existing surface profiles may be different than shown on the drawings.

(Section SC. 08) ENVIRONMENTAL REQUIREMENTS:

A. Air Pollution

- (1) Do not burn any material in a manner which violates legal restrictions on such operations.
- (2) Trees, stumps, brush, etc. which must be removed shall become the property of the Contractor including any merchantable timber. Neatly stacked logs may be left of the project site at locations designated by the Engineer. Stumps and brush may be buried outside all structure limits at locations designated by the Engineer.

B. Stream Pollution

Conduct all work in such a manner as to prevent stream siltation.

(Section SC. 09)

Omitted.

(Section SC. 10) TRAFFIC SAFETY:

The Contractor shall provide temporary work signals, signs, warning signs, etc. in accordance with the applicable governing authority. As a minimum, the Contractor shall comply with the "Manual on Traffic Control Devices used for Street and Highway Construction and Maintenance Operations", prepared by the Georgia Department of Transportation.

(Section SC. 11) SHOP DRAWINGS:

The Contractor, at his own expense, shall submit for the approval of the Engineer four (4) complete copies of all shop and setting drawings and schedules required for the Work, and no work shall be fabricated by the Contractor, except at his own risk, until such approval has been given. Three sets of drawings furnished by the Contractor will be returned after approval, the other set being retained by the Engineer.

The Contractor shall submit all drawings and schedules sufficiently in advance of construction requirements to allow ample time for checking, correcting, resubmitting, and rechecking; and no claim by the Contractor for delays arising from his failure in this respect will be allowed.

All shop drawings submitted, if not prepared by the Contractor, must bear the stamp of approval of the Contractor as evidence that the drawings have been checked by the Contractor. Any drawings submitted without this stamp of approval will not be considered and will be returned

to the Contractor for resubmission. If the shop drawings have variations from the requirements of the Contract Documents because of standard shop practice or other reasons, the Contractor shall make specific mention of such variation in his letter of transmittal in order that, if acceptable, suitable action will be taken for proper adjustment; otherwise the Contractor will not be relieved of the responsibility for executing the work in accordance with the Contract Documents even though such shop drawings have been approved.

Where the shop drawings as submitted by the Contractor indicate a departure from the Contract which the Engineer deems to be a minor adjustment in the interest of the Owner not involving a change in the Contract Price or extension of time, the Engineer will approve the drawing but the approval will be based on the following understanding:

The modification shown on the attached drawings is approved in the interest of the Owner to effect an improvement for the Project and is accepted with the understanding that it does not involve any change in the Contract Price or time; that it is subject generally to all Contract stipulations and covenants; and that it is without prejudice to any and all rights of the Owner under the Contract and Bond or Bonds.

The approval by the Engineer of shop drawings will be general and shall not relieve the Contractor from the responsibility for adherence to the Contract, nor shall it relieve him of the responsibility for any error which may exist.

(Section SC. 12) WORKING FACILITIES AND EASEMENTS:

The Contractor will be allowed the use of as much of the site designated for the Work as is necessary for his operations, but he must, however, provide all necessary access to any other public or private property, and the cost involved thereby shall be included in the Unit or Lump Sum Prices bid for the various Sections of the Work to be done under this Contract.

Whenever it is required as a part of this Contract to perform work within the limits of private property, easements or in rights-of-way, such work shall be done in conformity with all permits and agreements between the Owner and the owners of such, and whether or not such a condition be part of the agreement, care shall be taken to avoid injury to the premises entered, which premises shall be left in a neat and orderly condition by the removal of rubbish and the grading of surplus materials and the restoration of said private property to the same general conditions as existed at the time of entry for work to be performed under this Contract.

The contractor shall not (except after consent from the proper parties) enter or occupy with men, tools, or equipment, any land outside the rights-of-way or property of the owner.

(Section SC. 13) PROGRAM AND METHOD OF CONSTRUCTION:

The order of sequence of execution of the Work, the methods of construction, the general conduct of the work, and the general arrangement of the Work to be installed shall be, at all times, subject to the approval and direction of the Engineer. If any time before the commencement of, or during the progress of the Work, or any part of it, such methods, features, and appliances used or to be used appear to the Engineer as unsafe, insufficient, or improper, he may order the

Contractor to increase their safety or sufficiency, or to improve their character, and the Contractor shall conform to such orders; but the failure of the Engineer to demand any increase of such safety, sufficiency, adequacy, or any improvement shall not release the Contractor from his obligation to secure the safe conduct and quality of the work specified.

(Section SC. 14) OVERTIME WORK:

No night work or work on Saturdays, Sundays, and legal holidays requiring the presence of an Engineer or Inspector will be permitted except in case of emergency and then only to such an extent as is absolutely necessary and with the written permission of the Engineer. Should it be desired to operate an organization for regular and continuous night work, lighting, safety, and other facilities which are necessary for performing such work at night must be provided by the Contractor at his own cost and expense. This shall not excuse the Contractor from having constant attendance at the Work to be in readiness in time of emergency even to nights, Saturdays, Sundays and holidays. Should the Contractor desire to perform overtime work on this Contract, such shall be done only after approval of the Engineer, and all Resident Engineer and inspection costs must be reimbursed to the Owner by the Contractor as particularized herein.

(Section SC. 15) WORK IN INCLEMENT WEATHER:

The Contractor is presumed to have taken all difficulties due to weather conditions into consideration in preparing his Proposal and in establishing his time for completion of the Work of this Contract. He must be prepared and must take all precautions to protect all work from unfavorable weather and extremes of temperature, whether hot or cold. He shall provide approved facilities for protecting the work finished or in progress to the entire satisfaction of the Engineer. Weather will not be accepted as a justifiable reason for extension of time unless such should be abnormal.

(Section SC. 16) INTOXICATING LIQUORS AND DRUGS:

The Contractor shall neither permit nor suffer the introduction or use of intoxicating liquor nor drugs upon or about the Work specified in this Contract or upon any of the grounds occupied by him or by his employees.

(Section SC. 17) SANITARY MEASURES:

Sanitary conveniences for the use of all persons employed on Work shall be constructed and maintained by the Contractor in sufficient number, in such manner and in such places as shall be required for the project and the placement of such conveniences shall receive prior approval of the Engineer.

All necessary precautions, including the care of employees, shall at all times, be satisfactory to the local Health Department and to that of the City and County. The Contractor shall promptly and fully comply with all orders and regulations in regard to these matters.

(Section SC. 18) WATER SUPPLY:

All water for construction purposes, as well as the expense of having the water conveyed about the Work, shall be provided by the Contractor and the cost of this work shall be included in the Unit or Lump Sum Price bid for the various Items of the Work to be done under this Contract. The source, quality, and quantity of water furnished shall, at all times, be acceptable to all governing agencies and the Engineer.

(Section SC. 19) WATER-TIGHT STRUCTURES:

It is the intention of these Specifications to provide that all concrete work be mixed, deposited, and spaded carefully with the end result of obtaining concrete which is impervious to water. Leakage through concrete structures shall be sufficient reason for requiring the Contractor to uncover or to expose any portion of the Work for a thorough examination by the Engineer, after which said structure shall be repaired and again tested by the Contractor.

(Section SC. 20) MEASURES AND WEIGHTS:

To aid the Engineer in determining all quantities, the Contractor shall, whenever so requested, provide scales, equipment, and assistance for weighing or for measuring any of the materials.

It is understood and agreed that a “ton” shall mean the short ton of two thousand (2,000) pounds.

Weights and measures of quantity for payment shall be the actual weight or actual measure. No special or trade or so-termed customary allowances will be made, nor will any material which is lost or misplaced be included for payment.

(Section SC. 21) PLANIMETER:

For estimating quantities in which computation of areas by geometric methods would be comparatively laborious, it is agreed that the planimeter shall be considered an instrument of precision adapted to the measurement of such areas.

(Section SC. 22) DIMENSIONS AND ELEVATIONS:

Figured dimensions on drawings shall take precedence over measurement by scale, and detailed working drawings are to take precedence over general drawings and shall be considered as explanatory of them and not as indicating extra work.

The figures given in the Contract and Specifications or upon the Contract Drawings after the word “elevation” or an abbreviation of it, shall mean distances in feet above or below Mean Sea Level.

(Section SC. 23) LIGHTS AND PROTECTION:

The Contractor shall employ watchmen on the Work as necessary and shall, erect and

maintain such strong and suitable barriers and such lights as will effectually prevent the happening of any accident to health, limb, or property. Lights shall be maintained between the hours of one-half hour before sunset and one-half hour after sunrise.

(Section SC. 24) SEWAGE AND WATER FLOWS:

The Contractor shall furnish all the necessary equipment, shall take all necessary precautions and shall assume the entire cost of handling and properly disposing of any water, sewage, seepage, storm, surface, and flood flows which may be encountered at any time during the construction of the Work and in such manner as to not endanger or damage property. The manner of providing for these flows shall meet with the approval of the Engineer and the entire cost of said work shall be included in the Unit or Lump Sum Prices bid for the various Sections of the Work to be done under this Contract.

(Section SC. 25) USE OF STREETS:

During the progress of the Work, the Contractor shall make ample provision for both vehicular and foot traffic on any public road except for the section of road to be closed, and shall indemnify and save harmless the Owner from any expense whatsoever due to his operations over said road ways. The Contractor shall also provide free access to all driveways, fire hydrants, water and gas valves, etc., located along the line of his Work. Gutters and waterways must be kept open or other provisions made for the removal of storm water. Street intersections may be blocked but one-half at a time, and the Contractor shall lay and maintain temporary driveways, bridges, and crossings, such as in the opinion of the Engineer are necessary to reasonably accommodate the public. In the event of the Contractor's failure to comply with these provisions, the Owner may cause the same to be done, and will deduct the cost of such work from any moneys due or to become due the Contractor under this agreement, but the performance of such work by the Owner or at its instance, shall serve in no wise to release the Contractor from his general or particular liability for the safety of the public or of the Work.

No pavement cuts are to be left unfilled overnight, except in emergencies, and in such cases, adequate precautions must be exercised to protect traffic.

(Section SC. 26) OBSTRUCTIONS ENCOUNTERED:

In addition to showing the structures to be built under this Contract, the Drawings show certain information obtained by the Engineer regarding the pipes, pole lines, conduits, and other structures which exist along the lines of the Work, both at and below the surface of the ground. The Engineer and the Owner expressly disclaim any responsibility for the accuracy or completeness of the information given on the Drawings with regard to existing structures, and the Contractor will not be entitled to any extra compensation on account of inaccuracy or incompleteness of such information, said structures being indicated only for the convenience of the Contractor, who must verify the information to his own satisfaction. The giving of this information upon the Contract Drawings will not relieve the Contractor of his obligation to support and protect all pipes, conduits, and other structures which may be encountered during the construction of the Work, and to make good all damages done to such pipes, conduits, and other structures, as provided in these Specifications. The Contractor shall locate all underground

obstructions prior to excavation so as to prevent any damage to those services or other utilities. Any such damages must be repaired without delay and the cost of such repairs must be borne by the Contractor.

(Section SC. 27) CLEANING AND ROUNDING OF STREETS:

As work progresses and before the Work herein specified is accepted, the Contractor shall, upon Notice from the Engineer, thoroughly clean all streets, roads, sidewalks, and lawns free from all debris and dirt accumulating from the construction, shall open all gutters so that free drainage may be had, and on unpaved streets and roads, shall completely round up the entire roadway within the limits of the herein specified Work.

(Section SC. 28) EXISTING CONDUITS, SEWERS, PIPES, AND DRAINS:

The Contractor will be required, at his own expense, to do everything necessary to protect, support, and sustain all sewers, culverts, water, or gas pipes, service pipes, electric lights, power, telephone, or telegraph poles or conduits, and other fixtures laid across or along the site of the Work, even to the extent of using hand labor in making trench openings under or over these. The Owner as well as the company or corporation owning said pipes, poles, or conduits must be notified of the same by the Contractor, before any such fixtures are removed or modified. In case any of the said sewer, gas, or water pipes, service pipes, electric lights, power, telephone, or telegraph poles or conduits, or other fixtures be damaged, they shall be repaired by the authorities have control of the same, and the expense of said repairs shall be paid by the Contractor or deducted from moneys which are due or to become due said Contractor under this Contract. No underground or overhead facilities encountered shall be disturbed without proper authority from the owner, and then only in such manner as the owner may prescribe and approve.

Should it become necessary to change the position, or permanently or temporarily remove any electric conduits, telephone conduits, water pipes, gas pipes, or other pipes, conduits, or wires in order to clear the structure being built or to permit the Contractor to use a particular method of construction, the Contractor shall cease work if necessary, until satisfactory arrangements shall have been made by the owners of the said pipes, wires, or conduits, to properly care for or relocate the same as necessary to permit the construction work to proceed as required for the proper completion of the Contract. No claims for damages will be allowed the Contractor on account of any delay occasioned thereby. The entire cost of the changes or temporary or permanent removal of such gas, water, electric, telephone or telegraph wires, pipes, or conduits, the cost of moving, removing and/or relocating shall be borne by the Contractor and the cost thereof will be included in the Unit or Lump Sum Prices bid for the various Sections of the Proposal.

Nothing contained herein, shall, however, relieve the Contractor of doing such work at his cost and expense as is specifically included in the Contract Drawings or Specifications as a part of this Contract, such as the supporting and maintaining of all utilities encountered, removing sections of sewers and replacing with cast iron or other pipe, removing, extending and connecting to existing sewers and making changes to water mains as indicated, called for, detailed on the Drawings, or necessary and the cost of repairing any damages caused by him to any of the utilities above enumerated.

(Section SC. 29) PROTECTING EXISTING BUILDINGS AND STRUCTURES:

The Contractor shall, at his own expense, shore up and protect any buildings, bridges, or other public or private structures which may be encountered or endangered in the execution of the Work, and that may not be otherwise provided for, and he shall repair and make good any damages caused to any such property by reason of his operations. No payment will be made for said work or material except that such lumber as the Engineer may order left in place as permanent supports for these structures, shall be paid for as provided in the Specifications.

(Section SC. 30) CONNECTIONS TO EXISTING STRUCTURES:

Where, in the execution of the Work, it is necessary to relocate existing pipes, or provide and install new pipes, the Contractor shall remove all bulkheads or masonry which have been left in place in connections and at other points about the Work, and shall make proper connections, as required, to existing pipe lines and structures at the locations indicated or as necessary for the proper completion of the Work of this Contract. Also, he shall make the necessary connections at the several points in order that, on completion of his Contract, sewage, water, or gas may flow to and through the several pipes and appurtenances. No extra payment will be made for this work, but the entire cost of the same shall be included in the Unit or Lump Sum Prices bid for the various Sections of the work to be done under this Contract.

(Section SC. 31) MONUMENTS AND LANDMARKS:

Monuments or landmarks shall not be harmed or removed by the Contractor or any of his employees without the written consent of the Engineer. Any monument or landmark so removed will be replaced by the Owner at the expense of the Contractor. The cost thereof shall be retained from the moneys due or to become due the Contractor under this Agreement.

(Section SC. 32) AID TO THE INJURED:

The Contractor shall keep in his office ready for immediate use, all articles necessary for giving first aid to the injured. He shall also have standing arrangements for the immediate removal and hospital treatment of any employee who may be injured on the Work.

(Section SC. 33) STORING OF MATERIALS:

All materials and equipment required in the Work may be stored in areas directed by the Engineer, but all such materials, tools, and machinery shall be neatly and compactly piled in such a manner as to cause the least inconvenience to the property owners and the traffic. All fire hydrants must, at all time, be kept free and unobstructed and water and gas shut-off boxes, underground power and telephone line manholes must be left uncovered by such materials.

Materials, tools, and machinery shall not be piled or placed against shade trees unless such trees shall be amply protected against injury. All materials, tools, machinery, etc. stored upon public thoroughfares must be provided with sufficient warning lights at night time to alert traffic of such obstruction.

(Section SC. 34) PROTECTION OF EQUIPMENT:

During and after installation, the Contractor shall furnish and maintain satisfactory protection to all water mains and appurtenances against injury by weather, flooding, or breakage, thereby permitting all work to be left in a perfect condition at the completion of the Contract.

(Section SC. 35) TEMPORARY LIGHT AND HEAT:

The Contractor shall supply all temporary heat and light at his own expense for such period of time and at such temperature as the Engineer may direct for the proper protection and execution of the Work.

(Section SC. 36) ELECTRIC POWER:

The Contractor shall make his own arrangements for electric current or power. No special compensation will be made for cost of obtaining or purchasing but such cost shall be considered as having been included in the Unit or Lump Sum Prices bid for the various Sections of the Work to be done under this Contract.

(Section SC. 37) UNNECESSARY NOISE:

The movement and use of machinery and equipment and the handling of materials and conduct of the Work shall be such as to avoid and eliminate unnecessary noise, dirt, and dust.

(Section SC. 38) EXISTING TREES, SHRUBBERY, AND LAWNS:

When ordered by the Engineer, the Contractor shall dig up, handle, protect, and properly reset hedges, small trees, and shrubbery along the line of, or adjacent to the Work and shall take all reasonable care in this work. If damaged, they shall be replaced.

Except as otherwise permitted by the Engineer, trees shall not be disturbed and shall be protected from damage. Tree roots shall not be mutilated nor shall they be cut except by permission of the Engineer. When permitted to cut tree roots, the ends shall be cut off smooth, without splitting or shattering. The trunks of the trees shall be carefully protected from damage, and if unavoidable damage occurs, the injured portions shall be neatly trimmed and covered with an application of grafting wax. Excavating machinery, cranes, etc., shall be handled with care to prevent damage to shade trees, particularly to overhanging branches, and branches shall not be cut off except by special permission of the Engineer.

All lawns and flower beds contiguous to the Work and such as are damaged by the Contractor, shall be replaced or restored to a condition at least as good as at the time of the commencement of Work. This shall include the furnishing and placing of top soil, fertilizing, seeding, and rolling, all as required to properly replace such lawns and flower beds, and in accordance with the Specifications.

No special compensation will be made for the protecting, replacing, and resetting of existing trees and shrubbery, nor for the replacing of lawns and flower beds, but such cost shall be considered as having been included in the Unit or Lump Sum Prices bid for the various Sections

of Work to be done under this Contract.

(Section SC. 39) CLEANING UP:

On or before the date of the final estimate for the Work, the Contractor shall tear down and remove all temporary structures built by him, shall remove all construction plants used by him, and shall repair and replace all parts of existing embankments, fences, or other structures which were removed or injured by the Contractor's operations or by the employees to the Contractor; shall thoroughly clean cut all sewers, drains, pipes, manholes, inlets and miscellaneous and appurtenant structures of debris from his operations; shall rough grade all spoil areas, and shall remove all rubbish and leave the grounds in a neat and satisfactory condition.

(Section SC. 40) MILL AND SHOP TESTS AND INSPECTION:

Where the Item Specifications call for mill or shop tests, the Contractor shall furnish in triplicate copies of attested manufacturer's certificates showing details of quality or performance sufficient to demonstrate conformity to Contract requirements. Inspection and tests of materials shall be made as required by these Specifications, and the cost thereof shall be considered as having been included in the Unit or Lump Sum Prices bid for the various Sections of Work to be done under this Contract.

(Section SC. 41) INSUFFICIENCY OF SAFETY PRECAUTIONS:

If at any time, in the opinion of the Engineer, the Work is not properly lighted, barricaded, and in all respects safe, both in respect to public travel or adjacent property, public or private, and if under such circumstances the Contractor does not or cannot immediately put the same into proper and approved condition, or if the Contractor or his representative is not upon the ground so that he can be immediately notified of the insufficiency of safety precautions, then the Owner, on recommendation of the Engineer, may put the Work into such a condition that it shall be, in his opinion, in all respects safe. The Contractor shall pay all expenses of such labor and materials as may have been used for this purpose by him or by the Owner. Such action of the Engineer or Owner, or their failure to take such action, shall in no way relieve the Contractor of the entire responsibility for any cost, loss or damage by any party sustained on account of the insufficiency of the safety precautions taken by him or by the Engineer or Owner acting under authority of this Section.

(Section SC. 42) USE OF SEWERS OR STRUCTURES:

The Owner shall have the right to connect any sewer, conduit, pipe line, or structure with the Work and its appurtenances herein described, or to grant permits to make connection therewith, at any time before the Work is finally accepted. The Contractor shall not interfere with the making of such connections, and no extra allowances shall be made to said Contractor on account thereof.

(Section SC. 43) ADMINISTRATION OF OVERTIME WORK BY RESIDENT ENGINEERING FORCE:

It is the intent of the Contract that the Contractor provide sufficient work force at all times during normal working hours and days of each week to complete the Work without resort to

overtime work. The definition of normal working hours and days is an eight (8) hour day or ten (10) hour day as indicated in the General Requirements, Monday through Friday, trade recognized legal holidays excepted, during a consecutive period as agreed upon in the area of the Work, not counting the lunch period; and the definition of normal work week is the aggregate of the five (5) consecutive eight (8) or ten (10) hour days Monday through Friday inclusive, the same holidays excepted.

No overtime work on normal working days, or work on Saturdays, Sundays, or trade recognized legal holidays requiring the presence of the Engineer or an Inspector will be permitted except in case of emergency, then only to such extent as is absolutely necessary, and with the written permission of the Engineer.

Should the Contractor find it necessary to request permission to work more than the hours specified in the General Requirements in one day, or for a number of days, or to work on Saturdays, Sundays, or trade recognized legal holidays in the area of the Work, the Engineer shall have the right to deduct and retain sufficient sums, from the moneys due on any partial or conditional final payment estimate to cover the payment of additional salaries and overhead for the Engineer and such inspectors as are normally employed on the Work to administer the work of the trade, or trades, actually performing such overtime work. The amount which the Engineer may retain shall be the overtime base pay cost incurred, without benefits, times a factor of 2.0 to include overhead expenses. A minimum of four (4) hour work shall be scheduled for each occurrence.

Such sums of money as are retained by reason of this provision: for payment of overtime base pay will be paid to the employees of the Engineer by the Owner as compensation for overtime work, and the balance of such retainage shall compensate the Engineer for overhead expenses.

The Engineer will furnish the Contractor upon request, the rate of overtime base pay for the Engineer and such inspectors as are normally employed to administer the Work.

(Section SC. 44) RIGHTS RESERVED:

The Owner reserves the right to reject any or all bids, to waive informalities and to decide for himself which bid or bids be deemed in the best interest of Macon-Bibb County.

On any contract, where unit prices are required, the right is reserved to increase or decrease the quantities specified, without changing the unit prices bid.

On any unit price contract, minor revisions in grades and alignment after award of the Contract resulting in an increase or decrease in the quantities as listed in the Proposal in no way is just cause for a change in the unit prices bid. Relocation of the lines as may be required for easement or other purposes in no way effects the unit prices provided the line serves the area and purpose for which it was originally intended.

(Section SC. 45) SOCIAL SECURITY TAX:

The Contractor assumes and is liable for all State and Federal payroll or social security taxes and shall guarantee to hold the Owner harm less in every respect against same.

(Section SC. 46) RESTORATION:

The Contractor shall restore all disturbed areas to original or better condition.

(Section SC. 47) PUBLIC CONVENIENCE AND SAFETY:

The Contractor shall, at all times, conduct the Work in such a manner as to insure the least practicable obstruction to public travel. The convenience of the general public and of the residents along and adjacent to the area of the Work shall be provided for in a satisfactory manner, consistent with the operation and local conditions. "Street Closed" signs shall be placed immediately adjacent to the Work, in a conspicuous position, at such locations as traffic demands. At any time that streets are required to be closed, the Contractor shall notify law enforcement agencies, fire departments, and parties operating emergency vehicles before the street is closed and again as soon as it is opened. Access to fire hydrants and other fire extinguishing equipment shall be provided and maintained at all times.

(Section SC. 48) SELLING OF TIMBER:

The rights to all existing timber will be specified on the contract drawings. However, unless specified otherwise, all timber on private property remains the property of the private property owner while all timber on public property which must be removed to perform the contract will belong to the contractor.

**(Section SC. 49) COOPERATION WITH GOVERNMENTAL DEPARTMENTS,
PUBLIC UTILITIES, ETC:**

The Contractor shall be responsible for making all necessary arrangements with the governmental departments, public utilities, public carriers, service companies and corporations owning or controlling roadways, railways, water, sewer, gas, electrical, telephone, and telegraph facilities such as pavements, tracks, piping, wires, cables, conduits, poles, guys, etc. including incidental structures connected therewith, that are encountered in the Work in order that such items may be properly shored, supported and protected, or the Contractor may relocate them if he so desires. The Contractor shall give all proper notices, shall comply with requirements of such parties in the performance of his work, shall permit entrance of such parties on the Project in order that they may perform their necessary work, and shall pay all charges and fees made by such parties for this work.

The Contractor's attention is called to the fact that there may be delays on the Project due to work to be done by governmental departments, public utilities, and others in repairing or moving poles, conduits, etc. The Contractor shall cooperate with the above parties, in every way possible, so that the construction can be completed in the least possible time.

The Contractor shall have made himself familiar with all codes, laws, ordinances, and regulations which in any manner affect those engaged or employed in the Work, or material and equipment used in or upon the Work, or in any way affect the conduct of the Work, and no plea of misunderstanding will be considered on account of his ignorance thereof.

END OF SECTION

01005 - STATEMENT OF WORK

PART 1 - GENERAL

1.01 STATEMENT OF WORK: This is a general overview of the project. Follow details shown by the specifications and drawings, interpreted in accordance with contract clauses.

- A. Provide all labor, material, plant, equipment, supplies, and coordination required to:
 - 1. Provide the necessary patching, milling, full depth reclamation, asphalt resurfacing, striping and geotechnical testing for the roads in Macon-Bibb County designated for resurfacing.
- B. The project includes various roadways throughout Macon-Bibb.
 - 1. See attached 2019 Road Repair Project List for the detailed requirements on each road
- C. Price: Accomplish work shown for the original bid price. This includes special work times for utility outages and repair of damages. The words "at no additional cost to the Government" are implied whether stated or not.

1.02 CONTRACT SITE AND WORK RESTRICTIONS:

Work area is restricted to the area at the construction site. Provide a seven day notification prior to a road closure so that the approved detour may be publicized in the local paper or other media outlets. Any traffic detours require the submittal of a traffic control plan to the Macon-Bibb County Traffic Engineering for approval 14 days before enacting said plan. All equipment must remain on public right of way during work hours and can be stored safely on the right of way while not in use provided it does not cause a traffic flow or sight distance problem. Any offsite parking/storage on private property will require a written agreement between the owner of the private property and the contractor performing the work.

1.03 HOURS OF WORK:

- A. Standard work hours for this project are normal work hours of 8:00 AM to 5:00 PM local time, Monday through Friday. Work must stop on official City-County holidays unless specifically approved in advance.
- B. Alternate Work Hours
 - 1. If the Contractor desires to work another set of standard hours submit written request five (5) workdays before the date desired to work the different standard.
 - 2. To work special hours or days such as to continue paving until dark, request verbal approval from the Engineer at least four hours in advance.
 - 3. The Government reserves the right to refuse these requests. In addition, work requiring inspector presence such as placing concrete may not be possible outside normal hours on short notice. Digging outside of normal hours will normally not be approved. Any work outside of the

01005 - STATEMENT OF WORK

standard working hours performed without the permission of the engineer will be subject to analysis by a geotechnical engineering firm at the expense of the contractor.

C. All references to days mean calendar days unless otherwise noted.

1.04 SUBMITTALS:

A. General: Provide the following submittals in accordance with instructions found in Section 01300, Submittals and Contractor Furnished Items.

B. Material Submittals: Omitted.

PART 2 - PRODUCTS - OMITTED

PART 3 - EXECUTION

3.01 COORDINATION: The contractor shall coordinate work between different disciplines.

A. Locations shown are approximate and may be moved if approved by the Engineer.

B. Manufacturers' recommendations and/or requirements, if more stringent than the specifications and drawings, shall be followed at no additional cost to the Government.

C. Contractor must notify all affected property owners and provide documentation of said notification of the impending work at least 48 hrs prior to commencing work.

D. Contractor will be required to submit a video via thumb drive of the existing conditions of all roadways affected under this statement of work. All streets will have to be striped exactly as they are currently unless otherwise directed to do so.

Section 01005 Submittals

<u>Para #</u>	<u>Description</u>	<u>Date Required</u>	<u>Inspector Check Mark</u>
1.02	Closure Notice	7 days prior	_____
1.03 B.1	Alternate Work Hours	5 days prior	_____
3.01.D	Existing conditions	7 days prior	_____

<<<<< END OF SECTION >>>>>

PART 1 - GENERAL

1.01 UTILITY OUTAGES: Request any necessary utility outages in writing to the appropriate utility with a copy to the Engineer, a minimum of 14 days before the proposed outage. These may have to be scheduled at other than normal working hours depending on the impact to the users served by the utilities. These are at no additional cost to the Government. The contractor is responsible for working with existing utility company to relocate existing utilities at the utilities' own expense except where indicated otherwise on the drawings. The contractor is responsible for notifying the public of any impending utility outages 7 days prior to the temporary loss of said utility.

1.02 SUBMITTALS: Omitted

- A. General: Provide the following submittals in accordance with instructions found in Section 01300, Submittals and Contractor Furnished Items.
- B. Material Submittals: None required under this section.

1.03 SAFEGUARDING COMMUNICATION FACILITIES: For work that will interfere with buried fiber optics cable, aerial cable, house cable, underground cable, or other communication facilities, notify the utility and the Engineer in writing 14 days before the scheduled construction. Do no work until receiving approval.

PART 2 – PUBLIC NOTIFICATION:

The contractor will be responsible for notifying all affected parties of the construction activity a minimum of 48 hrs prior to work beginning. The notification must be in writing or in person and must include the duration of any potential inconvenience such as construction activity that will reduce the affected right of way to one lane of traffic or if the roadway will remain in a state of disrepair for some duration without construction. The contractor is responsible for the removal of any non-compliant or abandoned vehicle that may be obstructing the work site. Coordination must be made with the Macon-Bibb County Sheriff's office for said removal during the 48 hr public notification period.

PART 3 - EXECUTION

3.01 DIGGING/EXCAVATION REQUIREMENTS: Any utility location information provided for this project is for general bidding purposes only. The contractor shall determine actual locations and quantities at the site by calling the Georgia Utilities Protection Center prior to accomplishing any digging.

- A. Damage: The contractor is responsible for any damage to underground structures and utility lines identified on the drawings and any identified and marked in the field as a result of obtaining the utility location. If any underground utility whether located or not is damaged, notify the utility and the Engineer immediately. The contractor is responsible for coordinating repairs and /or relocation of utility facilities within public right of way.
- B. Cutting of Roads, Streets, and Paved Parking Areas:

- 1. Mark, barricade, and illuminate construction work on or near roads or streets which may present a traffic hazard in accordance with the Manual on Uniform Traffic Control Devices

01040 – SITE REQUIREMENTS

(MUTCD). Closures of streets, parking lots, and other traffic areas will not be permitted unless approved by the Engineer after written request 14 days before the scheduled closure & a detailed traffic control plan has been approved by the Macon-Bibb County Traffic Engineer's Office.

2. Road cuts shall be backfilled immediately after completion of associated utility work. When the road is reopened, the cut shall be filled with temporary or permanent materials to a smooth condition, or metal plates or other approved methods shall be employed to prevent discomfort or damage to vehicular traffic. Road cuts shall be permanently closed within 5 working days unless approved otherwise by the Engineer. Provide advance signage warning motorists of the condition in accordance with the MUTCD. Repair streets as shown on the drawings.

3.02 STORAGE AREA: The contractor shall obtain permission for all storage on private property. Materials stored on the county or state right of way must be obtained from the appropriate agency. Any damage to the Contractor's equipment or loss of materials or property will not incur any additional costs to the Government.

3.03 LOCATING AND IDENTIFYING UNDERGROUND LINES AND STRUCTURES:

- A. Regardless of statements in other Spec sections, provide warning tapes over new buried underground utilities and structures. Follow these requirements if the other Spec sections are less detailed and stringent.
- B. These include all underground items such as utility lines, storm drainage lines, water and sewer lines, traffic signal loops and utility pits and manholes with tops below grade. Do not proceed with any work if the proper locates have not been acquired. Positive identification of actual location and depth of the utility facilities is the sole responsibility of the contractor.
- C. Provide a warning tape of standard industrial width and thickness with imprinted words identifying the type of utility line or structure below it. Place along the length (and width if not a utility line) of the protected item at one-foot depth below grade.

3.04 SITE MAINTENANCE, CLEAN UP, AND RESTORATION

- A. Maintain the work site in a neat, orderly, and safe manner. Cut grass regularly to maintain site to community standards.
- B. Remove scrap, waste, and excess materials promptly. Provide signs, barricades, and lights as required to protect personnel.
- C. Do not allow trash and debris to accumulate and become unsightly. Sweep up and collect in contractor-maintained disposal containers daily. Dispose of collected debris weekly as a minimum.
- D. Store materials on site in a neat and orderly manner.
- E. Restore the project site to its final condition as required by the contract as soon as possible.

01040 – SITE REQUIREMENTS

F. Do not open trenches or excavations until material is on-hand or scheduled to arrive within three days. Close excavations or ditches as soon as the work has been placed, inspected, and accepted by the government.

Section 1040 Submittals

Para #	Description	Date Required	Inspector Checklist
1.01	Utility Outage Requests	14 days prior to outage	_____
3.01 B	Road/Parking Closure Request	14 days prior	_____
3.03 C	Warning Tape	21 days afterward	_____

<<<<< END OF SECTION >>>>>

01300 - SUBMITTALS AND CONTRACTOR FURNISHED ITEMS

PART 1 - GENERAL

1.01 GENERAL:

A. Basic: Provide items requiring drawings, diagrams, certifications, manufacturers' literature, data brochures, technical data, sample requests, forms, and other data as noted under each specification section.

B. Contractor Responsibility: Review, Corrections, or Comments made on the Submittals do not relieve the contractor from compliance with the requirements of the Drawings, Specifications, Addendums, and Contract Documents. By entering into this contract, the contractor agrees that the purpose of submittals is to demonstrate to the Engineer that the contractor understands the design concept and that he demonstrates his understanding by indicating which equipment and material he intends to furnish, install, and use. Review of shop drawing will be general only for basic conformance with the design concept. The Government's review of such drawings, schedules, or cuts shall not relieve the contractor from the responsibility for correcting all errors of any sort contained in the submittals. The contractor is responsible for confirming and correlating all quantities and dimensions; selecting proper fabrication processes, construction methods and installation techniques; coordinating this work with that of all other trades; and performing all work in a safe, workmanlike and satisfactory manner.

1.02 OMITTED:

1.03 SUBMITTAL INSTRUCTIONS: Submittal requirements for each specification section are listed in those respective sections. The following apply to all sections.

A. Material Submittals:

1. Complete Submissions: All items requiring submittals prior to construction activities for each section should be provided at one time unless noted otherwise or logically required. In some instances the specifications may require certain items from one or more specifications sections to be submitted at one time.
2. Submittal Checklist: The contractor shall complete a copy of the checklist provided in the submittals paragraph of each specification section. This checklist shall be provided with each submittal. Submittal information shall be arranged in order to correspond with each checklist.
3. Time: The Contractor shall have approved submittals before ordering any equipment under this contract. If equipment is ordered prior to receiving approval, it will be solely at the Contractor's risk. Under no circumstances will material be installed prior to approval of submittals. There will be no time schedule for providing material submittals unless noted elsewhere in the specifications. The Contractor will be required to manage his materials/equipment lead times and obtain approval in sufficient time to complete the work on schedule. Disapproval of incomplete or unsatisfactory submittals shall not be grounds for contract extensions. Other submittals such as as-builts, test reports, etc., shall be provided as indicated. When the word "prior" is used, it shall generally mean prior to the delivery or installation of the product at the work site or prior to the time in question of the item addressed in the specification.
4. Exceptions: If any material proposed for use on this contract deviates from the specifications, the Contractor shall submit those proposed deviations for approval along with detailed

01300 - SUBMITTALS AND CONTRACTOR FURNISHED ITEMS

justification. All exceptions and deviations shall be described in detail with each product submittal. Cost will not be considered a justification for taking exceptions unless a credit is offered to the Government.

5. Substitutions: Products provided by manufacturers other than those specified as the “design basis” shall be considered substitutions.

- a. All features of items submitted as substitutions are implied to be in full compliance with Specifications and Drawings if not specifically noted as "Exceptions."
- b. Where a design basis is referenced in Specifications and Drawings, substitutions must meet or exceed the salient features of the design basis as determined by the Engineer. Exceptions to design basis characteristics must be clearly noted as "Exceptions." The contractor must demonstrate that the product substituted is clearly equal or superior to the specified product, or else the request for substitution will be denied.
- c. Changes required to accommodate approved substitution shall be made at no additional cost to the Government.

B. Other Submittals: Other submittals such as samples, test results, spare parts, and etc. shall be provided as required by each specifications section. Provide 2 copies of each or an electronic copy unless directed otherwise.

1.04 RETURN AND DISAPPROVAL OF SUBMITTALS: The Engineer will return submittals to the Contractor within 14 days after receipt indicating approval or disapproval. Resubmittal of disapproved submittals shall be accomplished within 14 days after receipt of disapproval. Disapproval shall not be cause for time extension.

1.05 SUPERINTENDENT or MANAGER: When requested, provide name and qualifications for review. Provide the name and contact information of the person who will be the primary contact with the Government on this project until project acceptance.

1.06 TURN-IN OF IDENTIFIED EQUIPMENT, SPARE PARTS, TOOLS, AND OTHER MATERIALS: Items indicated in the Submittals section of each specifications and elsewhere, for turn-in to the Government shall be delivered as directed or in the absence of direction, before prefinal inspection. Obtain receipts from Government employees receiving the materials and deliver them to the Engineer before prefinal inspection.

1.07 Omitted

1.08 Omitted

1.09 Omitted

1.10 PRE-AWARD SUBMITTALS: Submit the following items before award, if directed.

A. Experience: Provide documentation on contractor experience relative to this project. After bid opening, the Government may examine contractor experience. The Contractor and/or named subcontractors shall have been regularly engaged in the type work of this project for at least (2) years. Include for each subcontractor the name of the business and the individual responsible for this project.

01300 - SUBMITTALS AND CONTRACTOR FURNISHED ITEMS

B. References: Provide the names, addresses and telephone numbers of at least two customers for whom similar projects were performed in the last (two) years.

1.11 Omitted

END OF SECTION

PART 1 - GENERAL

1.01 GENERAL:

- A. General Scope: This Section provides the requirements necessary to ensure that all construction projects are in environmental compliance. Major environmental program areas which may be affected include natural resources, air quality, underground storage tanks, asbestos, lead-based paint, PCBs, cultural resources, water quality, solid and hazardous wastes, and pollution prevention.
- B. Applicable Regulations and Publications: Comply with all applicable Federal, State of Georgia, any laws and regulations from other states where disposal might occur, and local laws and regulations concerning environmental compliance and pollution prevention.
- C. Ensure all products produced or generated under contract shall meet all stated performance objectives and shall not violate in any manner the environmental requirements of any applicable local, state, or federal entity. Applicable environmental requirements shall include but are not limited to a substance's toxicity, biodegradability, and volatile organic/inorganic compound content.
- D. Macon-Bibb County personnel will conduct no-notice inspections to ensure compliance with all environmental requirements.
- E. Definitions:
 - 1. Engineer-Macon-Bibb County Engineer or his or her designated representative.
 - 2. Inspector-The individual from the Macon-Bibb County Engineering Department designated to perform daily inspection of the contractor's work.
 - 3. Dust - Minute solid particles caused to be suspended by natural forces or by mechanical processes such as, but not limited to, crushing, grinding, milling, drilling, demolishing, shoveling, conveying, covering, bagging, mixing, and sweeping.
 - 4. Open Burning - Any outdoor fire from which the products of combustion are emitted directly into the open air without passing through a stack, chimney or duct.
 - 5. Solid Waste - Defined in CFR 261.2. Examples include garbage, refuse, and other discarded solid material including non-hazardous wastes resulting from industrial, commercial, and agricultural operations.
 - 6. GA EPD - Georgia Environmental Protection Division of the Department of Natural Resources.

1.02 OMITTED

1.03 SUBMITTALS:

- A. General: Provide the submittals in accordance with instructions found in Section 01300, Submittals and Contractor Furnished Items.
- B. Material Submittals: Not required under this section.

1.04 NOTIFICATIONS:

A. Provide to the Engineer all data specified herein to insure compliance with applicable environmental requirements.

1. Permits: Omitted

2. Other Submittals, Notifications, and Approvals: The following submittals, notifications, and approvals are required to maintain compliance:

a. Solid Waste Disposal: The Contractor shall provide a solid waste disposal plan stating how all materials leaving the site shall be disposed of.

(1) The plan shall certify that the Contractor shall dispose of all materials in compliance with all Federal, State of Georgia, and local laws. A senior official of the company shall sign this letter. The plan shall address the disposal of each item addressed in Sections 3.01 and 3.02 as applicable. Non-hazardous solid waste shall be broken down into individual types, i.e., asphalt, concrete, wood, brick, etc.

(2) The plan shall address each landfill to be used. A copy of all landfill permits shall be provided unless the Macon, Wolfe Creek, or Houston County landfill is to be used. The plan shall designate the employee who shall be responsible for verifying that all materials removed from the site are disposed of in accordance with the above referenced laws. The employee shall be an employee of the contractor and shall have authority to act for the contractor. Provide two copies of the Disposal Plan to the Engineer prior to the Pre-construction Conference or 14 calendar days prior to the start of disposal operations if no pre-construction conference is held.

(3) Omitted

(4) Keep on hand evidence of proper disposal of construction debris as well as providing this evidence to the Engineer. Examples of evidence include dump tickets from a licensed sanitary landfill and copies of a current landfill permits from the State of Georgia (unless Macon, Wolfe Creek, or Houston County landfill is used.), manifest, bill of sale, or other record for recycling.

(5) After contract work is completed and prior to final payment, the Contractor shall submit a letter of certification signed by a senior official of the company certifying that all materials removed from the site have been disposed of in accordance with all applicable Federal, State, and local laws.

b. Hazardous Waste: See Section 09 97 02 for requirements.

PART 2 - PRODUCTS - OMITTED.

PART 3 - EXECUTION

3.01 DISPOSAL OF WASTE/EXCESS MATERIAL:

A. Omitted.

B. Non-hazardous Solid Waste or Excess Material, except topsoil and suitable fill material, shall be removed from the site daily unless permitted otherwise by the Engineer. Dispose in a manner approved by the US Environmental Protection Agency and the Georgia Department of Natural

Resources, Environmental Protection Division (EPD). Also comply with applicable local codes and requirements. Equipment/material to be removed from the project but not turned in to the Government is the property of the contractor.

1. Disposal: Use one or more of the following methods to dispose of non-hazardous solid waste.

a. Sanitary Landfill: All solid waste may be disposed of in a sanitary landfill properly licensed by the State of Georgia. If a landfill other than the Macon, Wolfe Creek, or Houston County sanitary landfill is used, provide a copy of the landfill license. Provide proof that any Georgia municipal solid waste disposal facility to which they propose to bring waste, except Macon, Wolfe Creek, or Houston County, is operated by someone who has obtained the certification required by the Georgia Solid Waste Management Act, O.C.G.A. 12-8-24.1.

b. Inert Waste Landfill: Materials not likely to cause production of leachate of environmental concern may be disposed of in an inert waste landfill. Only earth and earth-like products, concrete, cured asphaltic concrete, rock, bricks, yard trimmings, and land clearing debris such as stumps, limbs, and leaves are acceptable for disposal in an inert waste landfill. This definition excludes industrial and demolition waste not specifically listed above. Provide a copy of the written notice of commencement of operation by the landfill as given to the Georgia EPD.

c. Construction/Demolition Disposal Site: Only wood, metal, wallboard, paper, cardboard, as well as materials that can go in an inert waste landfill may be disposed of in this facility. Provide a copy of the landfill license.

d. Recycling: Recycling of materials is strongly encouraged. Materials destined for recycling must meet the definition of non-hazardous wastes under federal/state solid waste regulations. Materials defined as “recovered materials” by GA EPD regulations are excluded from regulation as solid wastes.

e. All materials to be disposed of in other than a sanitary landfill must be kept segregated at the project site from those materials, which are allowed only in a sanitary landfill.

C. Solid Waste Disposal Outside of Georgia: Dispose of no solid waste outside the state of Georgia without prior written approval of the Engineer. If the contractor desires this, he shall provide sufficient information as determined by the Engineer to allow verification

3.02 Omitted:

3.03 PROTECTION OF LAND RESOURCES:

A. General: Do not take any action which shall adversely affect the existing Water Quality Standards classification of any streams, rivers, lakes or reservoirs within or adjacent to the project site or which would otherwise contribute to pollution of these water resources. No fuel, oils, bituminous, calcium chloride, acids, construction waste or otherwise harmful materials shall be permitted to enter these water resources. Preserve the land resources in their present condition or restore to a condition that appears natural and does not detract from the appearance of the surrounding area. If restoration is to be accomplished, the Contractor must submit his restoration plan and receive approval from the County on his proposed procedures.

B. Omitted.

C. Omitted

D. Restoration of Landscape Damage:

1. Do not allow any trees or other debris to get into the storm drainage system.

2. Surface Drainage:

a. Surface drainage from cuts and fills within the construction limits, whether or not completed, and from borrow and waste disposal areas, shall, if turbidity producing materials are present, be held in suitable sedimentation ponds or shall be graded to control erosion. Temporary erosion and sediment control measures such as berms, dikes, drains, or sedimentation basins, if required to meet the above standards, shall be provided and maintained until permanent drainage and erosion control facilities are completed and operating. The area of bare soil exposed by construction operations at any time shall be held to a minimum. Stream crossings by fording with equipment shall be limited to control turbidity. Fills and waste areas shall be constructed by select placement to eliminate pollution to adjacent streams.

b. Stabilization of permanent steep slopes shall be accomplished as soon as possible, using a 2-step procedure, if necessary, to establish vegetation. Apply mulch immediately after finished grading is completed, regardless of season, and delay permanent seeding and fertilizing, if necessary, until the season most favorable for germination.

E. Spills: Prevent the spill of chemicals, fuels, oils, grease, bituminous materials, waste washings, herbicides, cement drainage or any other hazardous materials. Immediately report all spills to the Macon-Bibb County Fire Department, emergency number 911, giving name, telephone number, location of spill, and type and amount of material spilled. Notify the Engineer of the spill immediately following initial reporting to the Fire Department. Take containment action against any hazardous spills, which threaten storm drains and other environmental areas. Ensure clean up of materials spilled as a result of contractor action, or lack thereof. The contractor is responsible for the clean up of material(s) spilled. No spill residue shall be transported off site without specific approval from the Engineer. The contractor shall provide support, as appropriate, for containment and clean up of spills. If the spill exceeds reportable quantity limits, coordinate notification to the National Response Center with the local office of the Environmental Protection Division (EPD) through the Engineer.

3.04 AIR QUALITY:

A. Open burning operations must be approved by the Macon-Bibb County Fire Department and the Georgia Forestry Commission. Note that a burn ban is in effect from 1 May to 30 September of each year.

3.05 DUST CONTROL: Maintain all excavations, embankments, stockpiles, haul roads, permanent access roads, plant sites, waste areas, borrow areas, and all other work within or without the project boundaries free from dust which could cause a hazard or nuisance to others. Approved temporary

01560 – ENVIRONMENTAL REQUIREMENTS

methods of stabilization consisting of sprinkling, chemical treatment, light bituminous treatment or similar methods are permitted to control dust. To be approved, sprinkling must be repeated at such intervals as to keep all parts of the disturbed area damp at all times. If sprinkling is used, keep sufficient equipment on the job site at all times. Perform dust control as the work proceeds and whenever a dust nuisance or hazard occurs.

3.06 USING HAZARDOUS MATERIALS IN PERFORMING THE WORK:

- A. Written Notification: Comply with all applicable federal, state, and local requirements concerning use of hazardous materials. Provide written notification to the Engineer when hazardous materials/chemicals are to be used or demolished. This must include the following information:
1. A list of each work activity/process required to use/demolish hazardous materials/chemicals.
 2. A list of hazardous materials/chemicals used.
 3. A Safety Data Sheet (SDS) for each hazardous material/chemical used.
 4. Written procedures for disposing of hazardous waste generated.
 5. Omitted.
 6. For additional hazardous material brought on site during the performance of the contract, the contractor shall provide an updated list and SDS to the Engineer.

3.07 Omitted

3.08 Omitted

3.09 THREATENED AND ENDANGERED SPECIES:

- A. The construction project is not anticipated to have any impact in this area since most plant and animal species of concern exist in wetlands. Any project activities believed to interface with threatened and endangered species shall be coordinated through the Engineer.

3.10 WETLANDS: Comply with water and land protection paragraphs of this Section to prevent construction site sediments and runoff from entering wetlands.

3.11 Omitted

Section 1560 Submittals

Para #	Description	Date Required	Inspector Check Mark
1.04 A.2.a	Solid Waste Disposal Plan	at pre-construction conf.	_____
1.04 A.2.a. (5)	Disposal Certification Ltr.	prior to final payment	_____
3.01 B.1.c	Landfill License	prior to dumping	_____
3.06	Use of Hazardous Chem	Prior to Work	_____

01590 – UTILITY RELOCATION

PART 1 – GENERAL

1.01 Cooperation with Utilities: Macon-Bibb County will notify all utility companies, all pipeline owners, all railroad companies, or other parties affected by award of the Contract, giving the name and address of the Contractor, and will assist the Contractor in arranging for all necessary adjustments of the public or private utility fixtures, pipe lines, and other appurtenances within or adjacent to the limits of construction. Water lines, gas lines, wire lines, service connections, water and gas meter boxes, water and gas valve boxes, light standards, cableways, signals, railroad facilities, and all other utility appurtenances within the limits of the proposed construction which are to be relocated or adjusted are to be moved by the owners at their expense, except as otherwise provided for elsewhere in the Contract. It is understood and agreed that the Contractor has considered in his bid all of the permanent and temporary utility appurtenances in their present location or relocated positions, and that no additional compensation will be allowed for any delays, inconvenience, or damage sustained by him due to any interference from said utility appurtenances or the operation of moving them, with the exception that delays and interruptions to the work are covered in Subsection 1.02. It shall be the Contractor's responsibility to plan with each utility owner a schedule of operations which will clearly set forth at which stage of the Contractor's operations the utility owner will be required to perform his removal and relocation work.

1.02 Contractor's Responsibility for Utility Property and Services

A. Overhead or Underground Utility Facilities

At points where the Contractor's operations are adjacent to or conflict with overhead or underground utility facilities, or are adjacent to other property, damage to which might result in considerable expense, loss, or inconvenience, work shall not be commenced until all arrangements necessary for the protection thereof have been made.

B. Utility Facility Owners

The names of known utility owners and the location of known utility facilities will be shown on the Plans or herein, and the Contractor shall give 24-hour notice to such utility owners before commencing work adjacent to said utility facilities which may result in damage thereto. Contractor shall further notify utility owners of any changes in his work schedules affecting required action by the utility owners to protect or adjust their facilities. Notice to the utility companies by Macon-Bibb of the award of contract, under Subsection 1.01, shall not be deemed to satisfy the notice required by this paragraph.

C. Cooperation with Facility Owners

The Contractor shall cooperate with the owners of any underground or overhead utility facilities in their removal and rearrangement operations in order that these operations may progress in a reasonable manner, that duplication of rearrangement work may be reduced to a minimum, and that services rendered by those parties will not be unnecessarily interrupted.

01590 – UTILITY RELOCATION

D. Interruption of Services

In the event of interruption to water or other utility services as a result of accidental breakage or as a result of being exposed or unsupported, the Contractor shall promptly notify the proper authority and shall cooperate with the said authority in the restoration of service. If utility service is interrupted, repair work shall be continuous until the service is restored. No work shall be undertaken around fire hydrants until provisions for continued service have been approved by the local fire authority.

E. Facilities Supported on Bridges

If the utility facilities are to be supported on bridges, the following provisions shall apply:

1. The Plans will show the location of the facility and the auxiliary items necessary to support the facility.
2. The Contractor who constructs the bridge shall install anchor bolts, thimbles, inserts, or other auxiliary items that are attached to the bridge as a part of the support for the utility facility. The Utility owner, at his or her expense, shall furnish these auxiliary items, unless the Contract indicates that these items are to be furnished by the Contractor as a part of the bridge.
3. The Agency constructing the utility facility shall install hanger rods, pipe rolls, and other attachments necessary for the support of the utility facility as indicated on the Plans. The Utility owner, at his expense, shall furnish these attachments unless otherwise specified. This work shall also include:
 - a. Caulking the openings around the utility where it passes through endwalls to prevent the passage of undesirable materials.
 - b. Painting the exposed portions of utility supports unless such supports are corrosion resistant. Painting shall be done in accordance with the applicable portions of the specifications.
4. The sequence of bridge construction work may be set forth in the Plans and/or the Specifications and will show at what stage of the work a utility owner will be allowed to make the utility installation. Further, all or any portion of the work under Subsection 1.02.E.3 may be included in the bridge contract by the Plans and/or the Specifications.
5. Any damage to the bridge structure caused by the utility installation shall be repaired to the satisfaction of the Engineer at the expense of the agency installing the utility facility.

F. Clearances

The Plans provide for at least minimum clearance of utilities as required by the National Electrical Safety Code, U.S. Department of Commerce, National Bureau of Standards. Any additional clearance the Contractor may desire or require in performing The work shall be arranged by the contractor with the utility owner. Macon-Bibb will pay no extra compensation for such additional clearances.

G. Delays

Delays and interruptions to the work caused by the adjustment or repair of water, gas, or other utility appurtenances and property will be considered for an extension of contract time unless such delays are due to the negligence of the Contractor.

01590 – UTILITY RELOCATION

H. Compensation

There will be no direct compensation for complying with the above. Any additional cost to the contractor for the above services, interruptions, or special procedures, shall be included in the over-all bid submitted.

1.03 KNOWN UTILITIES

The following utilities are known to have facilities on the project site. Those requiring relocation are identified below. See the plans for more detailed information on the affected areas. Known existing utilities are shown on the plans. The contractor is responsible for calling the Utilities Location Protection Center prior to digging to have all utilities in the project site located. The contractor is responsible to repair all damages to identified utilities as a result of his operations.

Utility	Contact		Relocation Required
Macon Water Authority	Algernon Wallace	478-464-5662	No
Georgia Power			Yes
Downtown	Chris Zeno	478-784-5705	
South and West	Phillip Saunders		
East of Ocmulgee	Lavelle Lewis		
North	Dennis Pritchett		
AT&T	Mel Redd	478-788-1040	TBD
Cox Cable	Mike Adams	478-256-1544	TBD
Atlanta Gas Light	Corey Alford (Engineer) Larry Adams(Retired) (Project Mgr)	404-807-4915 678-725-0421	TBD
Norfolk Southern	Jake Watson	(404) 529-1225	TBD
Public Service Telephone	Jeremy Kendrick Mitchell Harris	478-847-6524 478-951-7815 (C) 478-847-6522 478-837-3877 (C)	TBD
Southern Telecom			TBD

01590 – UTILITY RELOCATION

Georgia Public Web 888-662-6324 (24 Hour)	Greg Spell	770-661-2808	TBD
Level III (Formerly KMC Telecom and Telco)	Tony Charlton	321-312-3225 relo@level3.com	TBD
Macon-Bibb (Fiber)	Rob Ryals	478-751-0401	TBD
UnityFiber (Tower Cloud)	Lee Clark	727-471-5600	TBD
Medical Center of CG	Tim Slocomb	478-633-1036	TBD
Windstream			TBD
Jointly Owned Natural Gas Ronnie Jones	Wayne James 478-952-1605 (C)	478-654-6059	TBD
Colonial Pipeline	Kevin Railey	706-891-7584	TBD
Hargray	Jason White	843-815-1062	TBD

1.04 SUBMITTALS:

A. General: Provide the following submittals in accordance with instructions found in Section 01300, Submittals and Contractor Furnished Items.

B. Material Submittals: None required under this section.

C. Other Submittals: Provide the following submittals as required by the contract or as directed by the Contracting Officer.

Para #	Description	Date Required	Inspector Checklist
1.02 B.	Utility Notification	When Identified	_____

01590 – UTILITY RELOCATION

<<<<< END OF SECTION >>>>>

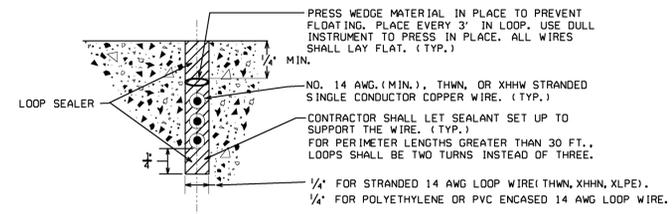
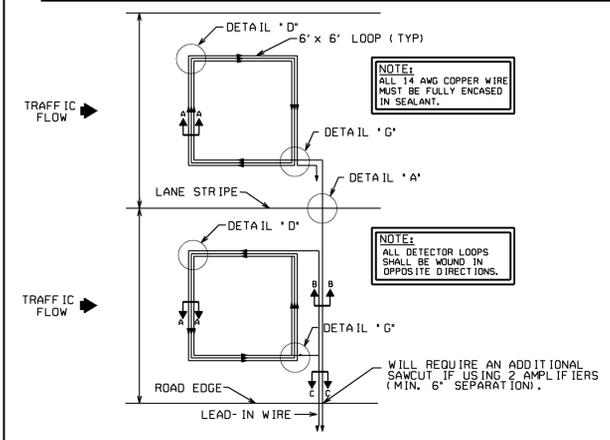
General Notes:

1. The contractor shall verify all utility locations prior to construction, by calling the Utility Protection Center.
2. The contractor will be responsible for coordinating any utility relocations before work begins on said affected roadways.
3. The contractor shall be responsible for furnishing all labor, material; equipment and incidental items needed to provide adequate construction signing, barricades, traffic control devices and other related items for the project area, during the construction period.
4. The contractor shall provide reasonable access to residential, commercial and public properties in the project area. During construction, traffic may be restricted to local traffic, only with approval of the Traffic Engineer.
5. Any surplus excavation shall become the property of the contractor, and disposal shall be the contractor's responsibility at no additional cost to the government.
6. The contractor shall backfill behind replaced curbs and adjacent to asphalt overlay areas as needed.
7. The contractor shall level all disturbed areas with topsoil and hand rake to a uniform appearance.
8. All work shall be done according to the Macon Bibb County provided specifications.
9. Contractor shall be paid at unit bid prices unless otherwise designated.
10. All patches shall be milled to a depth of 5" below grade, compacted and filled with 12.5mm Superpave asphalt.
11. Small patches shall be compacted by use of slide tamp or by hand tamping. Vibratory roller shall be used on larger patches.
12. Macon-Bibb County reserves the right to delete any street from this contract.
13. Some streets may have concrete, brick or cobble stone under the existing asphalt.
14. As time is of the essence the contractor agrees to begin work immediately and keep work in progress until the completion of said contract.
15. For patches deeper than 5", contractor shall fill in the patch with G.A.B.C. to within 5" of final grade; compact with adequate compacting device to 98% dry density and install 5" 12.5mm Superpave asphalt. Extra G.A.B.C. shall be paid by the unit bid price only.
16. The contractor is responsible for any geotechnical testing that will be required by Macon-Bibb County during the execution of this contract.
17. The contractor will provide a daily gradation sheet for any asphalt delivered to Macon-Bibb County.
18. The contractor will provide a daily compaction report for the asphalt delivered for use in Macon-Bibb County. This sample can be obtained at the asphalt plant or on the job site at the time of delivery
19. Milling asphaltic concrete pavement, measured as specified, will be paid for at the Contract Unit Price bid per ton. The price bid for this item includes the credit value of all Reclaimed Asphalt Pavement (RAP) recovered, and no adjustment in the unit price for this item or other items will be considered for variations in the amount of RAP actually recovered. Payment is full compensation for furnishing equipment, milling, hauling, stockpiling milled material, and satisfactorily performing the work.
20. The contractor shall obtain permission for all storage on private property. Materials stored on Macon-Bibb County right of way must be permitted by the appropriate authority (Macon-Bibb Engineering & Macon-Bibb Sheriff's Offices).
21. Macon-Bibb County will not incur any liability for any of the contractor's stolen or damaged property while stored on public right of way.
22. The contractor will be responsible for the replacement of any traffic loops damaged during the execution of this contract. See attached loop installment detail.

STATE	COUNTY	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA.				

INDUCTIVE LOOP VEHICLE DETECTOR DETAILS USING STRANDED COPPER WIRE

PLAN VIEW OF STANDARD LOOP SAW CUTS



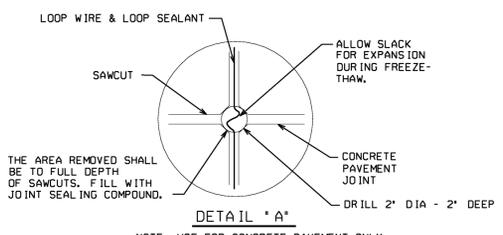
SECTION AA



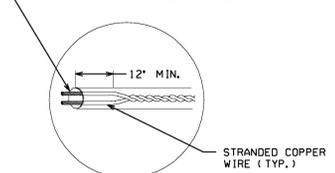
SECTION BB



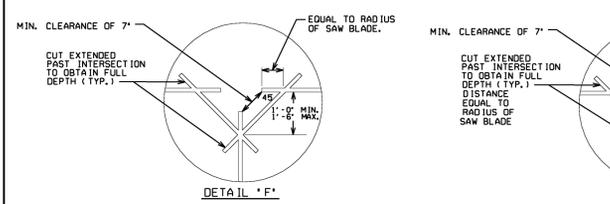
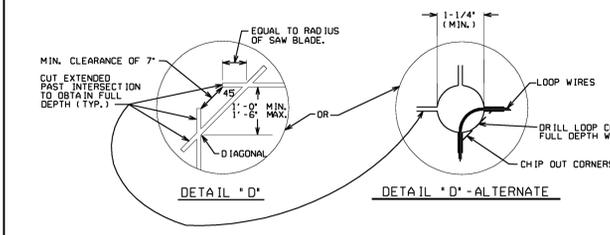
SECTION CC



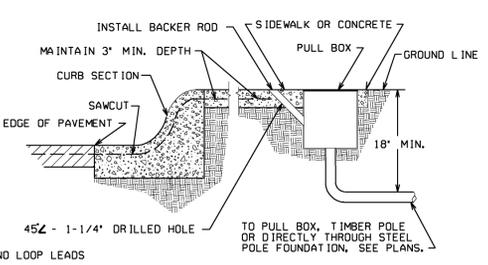
DETAIL A*



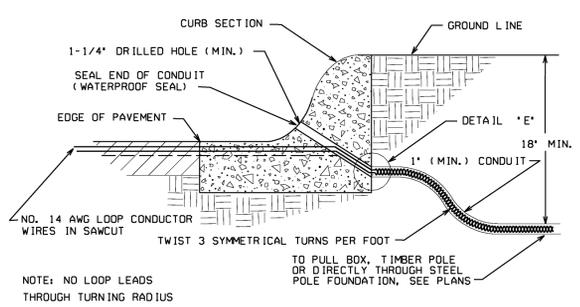
DETAIL E*



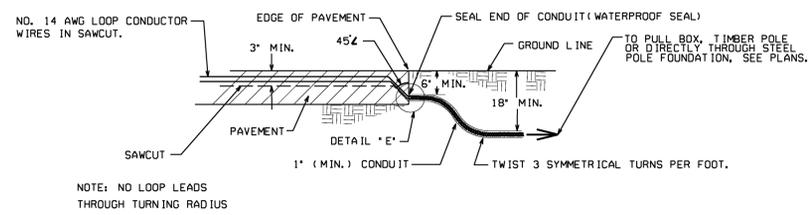
TYPICAL CURB DETAIL (WITH SIDEWALK)



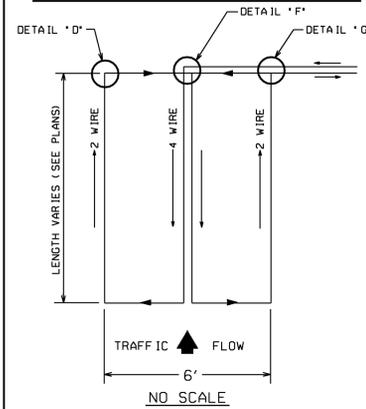
TYPICAL CURB DETAIL (WITHOUT SIDEWALK)



DETAIL WHERE NO CURB EXISTS



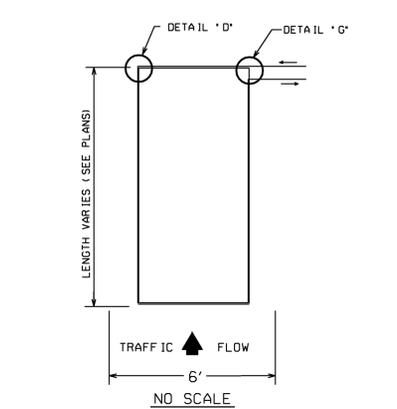
PLAN VIEW OF QUADRUPOLE



LOOP WIRE CONFIGURATION

THE DOUBLE LAYER CONFIGURATION (2-4-2) SHOWN IS A MINIMUM DESIGN FOR NORMAL INSTALLATIONS WHEN REQUIRED BY THE PLANS.

PLAN VIEW OF STANDARD LOOP



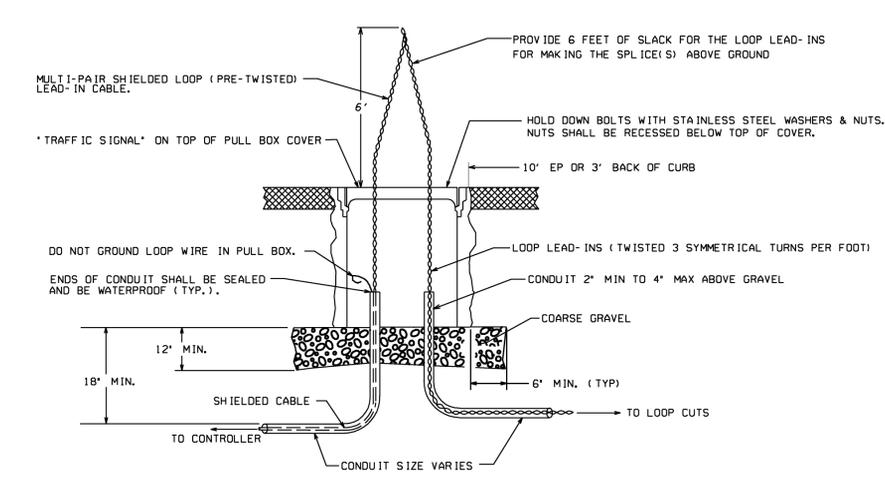
LOOP WIRE CONFIGURATION

THE DOUBLE LAYER CONFIGURATION (2-2) SHOWN IS A MINIMUM DESIGN FOR NORMAL INSTALLATIONS WHEN REQUIRED BY THE PLANS.

NOTE:
INDUCTIVE LOOPS SHALL NOT BE INSTALLED IN A BRIDGE DECK.
LOOPS MAY BE INSTALLED IN AN APPROACH SLAB.

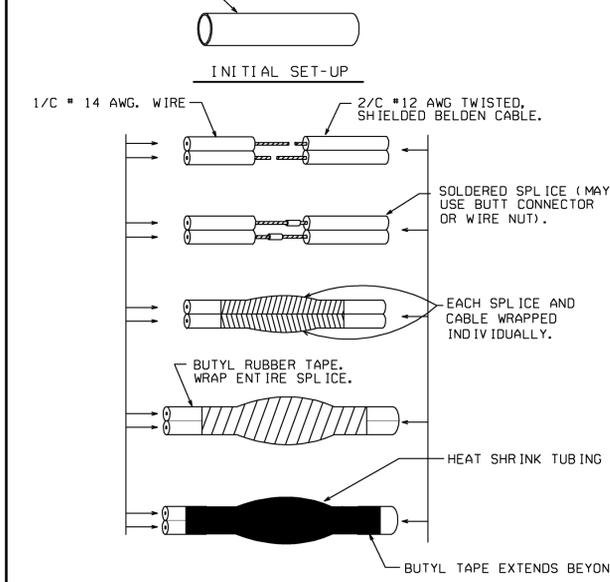
Guidelines For Usage On Metric Projects
When these details are incorporated into plans and or projects that are being prepared or constructed in metric units, exact or precise conversion to metric units is not required. The dimensions shown that are in feet and inches may be converted to corresponding metric units using the following "Rounded-Off" conversion factors: 1"=25mm, 4"=100mm, and 12" or 1'-300mm. All measurement notes that refer to linear feet and square yards shall be interpreted to mean linear meters and square meters.

PULL BOX-SPLICE DETAILS



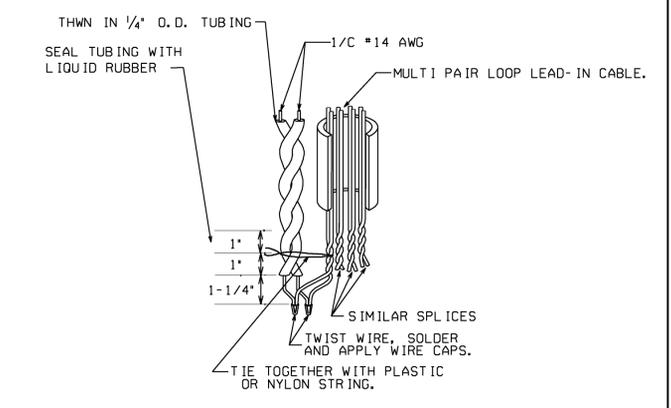
SPLICE DETAILS

ALTERNATE #1

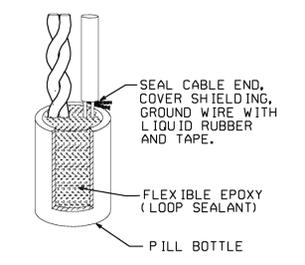


NOTE:
FINISHED SPLICE MUST BE WATERPROOF.

ALTERNATE #2



FINISHED SPLICE



DATE		DEPARTMENT OF TRANSPORTATION STATE OF GEORGIA	
		TRAFFIC SIGNAL DETAIL INDUCTIVE-LOOP DETECTOR INSTALLATION	
REV. BY:	REVISION DESCRIPTION	DETAIL NUMBER	
		APRIL 2010 <small>NOT TO SCALE - REPORT ERRORS</small>	
		TS-01	

Section 301—Soil-Cement Construction

301.1 General Description

This work includes constructing a base, subbase, or shoulder course composed of soil, or a mixture of soils, and stabilizing with Portland cement. Construct according to these Specifications and conform to the lines, grades, and typical sections shown on the Plans or established by the Engineer.

The provisions in [Section 300](#) apply to this Item.

301.1.01 Definitions: Omitted

301.1.02 Related References

A. Standard Specifications

[Section 109— Measurement and Payment](#)

[Section 205— Roadway Excavation](#)

[Section 300— General Specifications for Base and Subbase Courses](#)

[Section 412— Bituminous Prime](#)

[Section 814— Soil Base Materials](#)

[Section 821— Cutback Asphalt](#)

[Section 830— Portland Cement](#)

[Section 831— Admixtures](#)

[Section 880— Water](#)

B. Referenced Documents

[GDT 19](#)

[GDT 20](#)

[GDT 21](#)

[GDT 59](#)

[GDT 67](#)

[GDT 86](#)

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301.1.03 Submittals

Before constructing a test section, submit a Construction Work Plan to the Engineer for approval.

Section 301—Soil-Cement Construction

301.2 Materials

Ensure that materials meet the requirements of the following Specifications:

Material	Specification
Soil-Cement Material	Subsection 814.2.02
Portland cement	Subsection 830.2.01
Water	Subsection 880.2.01
Fly Ash and Slag	Subsection 831.2.03
Cutback Asphalt RC-30, RC-70, RC-250, or MC-30, MC-70, MC-250	Subsection 821.2.01
Blotter Material (Sand)	Subsection 412.3.05.G.3

When fly ash or slag is specified as an admixture in the soil-cement base, use fly ash or slag that meets the physical requirements of [Subsection 831.2.03](#). (see Appendix A)

301.2.01 Delivery, Storage, and Handling: Omitted

301.3 Construction Requirements

A. General

1. Methods

This Specification is based on the mixed-in-place and central plant mix methods. Supplement in-place or plant mixing with plow, harrow, or blade mixing when the Engineer permits.

When the Plans and Proposal indicate that the material will be paid by the ton (megagram), use the central plant mixing method. If the work will be paid by the square yard (meter), the Plans and Proposal will indicate the required thickness and the mixing method to be used.

When payment is made by the square yard (meter) and a roadway mixer is used, the Engineer will determine if the materials in the roadbed are suitable for use. If the Engineer approves, use materials in the roadbed without payment, except for the payment per cubic yard (meter) provided in [Subsection 301.5.A, "Soil -Cement Material"](#) below.

If it is necessary to add other materials to those in the roadbed to meet the desired thickness or to modify the physical properties of the existing materials, these materials will be measured and paid by the cubic yard (meter).

2. Fly Ash and Slag

Unless otherwise specified in the Contract, fly ash and slag shall be used only in central plant mix construction. Apply fly ash and slag to the mix according to the procedures for cement established in [Subsection 300.3.02.A, "Central Mix Plants"](#) (see Appendix B) and [Subsection 301.3.05.A.4, "Cement ."](#)

3. Weather Limitations

Ensure the following:

Section 301—Soil-Cement Construction

Mix and place cement-treated base or subbase only when the weather permits the course to be finished without interruption in the time specified.

Mix and place materials only when the moisture content of the soil to be used in the mixture meets the limits specified in this Subsection.

Begin mixing only when the air temperature is above 40 °F (4 °C) in the shade, and rising.

Ensure that the temperature of the soil to be used in the mixture and the subbase or subgrade is above 50 °F (10 °C).

4. Interruption of Work

If the work is interrupted for more than two hours after cement has been added, or if rain increases the cement's moisture content outside the limits specified in [Subsection 301.3.05.B.7.c, "Moisture Control,"](#) remove and replace the affected portion at no additional cost to the Department.

301.3.01 Personnel

Ensure that only experienced and capable personnel operate equipment.

301.3.02 Equipment

Use equipment that meets the requirements of [Subsection 300.3.02](#) and this subsection. The Engineer will approve equipment type and condition before construction begins.

Provide sufficient equipment in good working condition to do the following:

- Allow continuous prosecution of the Work.
- Mix, place, and compact within the required time limits.

Use any applicable equipment specified in [Subsection 412.3.02, "Equipment"](#) (see Appendix C) for bituminous prime.

301.3.03 Preparation

A. Subgrade or Subbase Preparation

Prepare the subgrade or subbase as specified in [Subsection 300.3.03.C, "Preparing the Subgrade"](#) or [Subsection 300.3.03.D, "Preparing the Subbase"](#) if the base, subbase, or shoulders will be composed entirely of new materials, whether mixed-in-place or central plant mixed. Place materials only on dry, thawed subgrade or subbase.

301.3.04 Fabrication: Omitted

301.3.05 Construction

A. In-Place Mixing

1. Soil

If additional soil is needed on the roadbed, place and spread the soil uniformly to the proper depth to obtain the specified thickness.

2. Pulverization

Section 301—Soil-Cement Construction

Pulverize the roadbed materials as follows:

- a. Loosen and pulverize roadbed materials to the width and depth to be stabilized without disturbing or damaging the underlying subgrade.
- a. Continue pulverizing until 100 percent of roadbed material passes through a 1-1/2 in (37.5 mm) sieve, and until at least 80 percent of the soil, excluding any stone or gravel, passes through a No. 4 (4.75 mm) sieve.
- b. Add water to assist pulverization if necessary.
- c. Remove all roots, sod, and rocks that exceed 3 in (75 mm) in diameter.
- d. Remove all other harmful materials.

3. Moisture Adjustments

Immediately before spreading cement, adjust the moisture content of the in-place material so it will stabilize to within 100 to 120 percent of optimum moisture (amount of moisture in the mixture at maximum dry density).

4. Cement

Spread cement as follows:

- a. Uniformly spread the required amount of Portland cement with a cyclone-type mechanical spreader or its equivalent.
- b. Apply the Portland cement at a rate that ensures the pounds spread are within ± 10 percent of the amount specified. Furnish a square-yard cloth, scales and personnel for checking the spread rate of cement placed.
- c. Apply cement on soils with a moisture content less than 120 percent of optimum.
- d. Apply cement on days when wind will not interfere with spreading.
- e. If the cement content is below the 10 percent limit in the mixing area, add additional cement to bring the affected area within the tolerance specified and recalibrate the mechanical spreader's spread rate. If the cement content is more than the 10 percent limit in the mixing area, the excess quantity will be deducted from the Contractor's pay for cement.
- f. Regulate operations to limit the application of cement to sections small enough so that all of the compacting and finishing operations specified in [Subsection 301.3.05.B.7, "Compacting and Finishing"](#) can be completed within the required time limits.
- g. Pass only spreading and mixing equipment over the spread cement. Operate this equipment so that it does not displace cement.
- h. Replace damaged cement at no additional cost the Department when damage is caused by:
 - Hydration due to rain, before or during mixing operations
 - Spreading procedures contrary to the requirements mentioned above
 - Displacement by the Contractor's equipment or other traffic

5. Mixing

Mix the material as follows:

Section 301—Soil-Cement Construction

- a. Uniformly windrow the material if the mixing plant requires it. Otherwise, shape the material to the proper line, grade, and cross-section before mixing.
 - b. Mix the material according to either roadmix method in [Subsection 301.3.05 .A.6, “ Road Methods .”](#)
 - c. Begin mixing as soon as practical after the cement is spread, and continue until a homogeneous and uniform mixture is produced. If the equipment does not produce a homogeneous and uniform mixture meeting these Specifications, make any necessary changes to meet the Engineer’s requirements.
6. Road Methods
- a. Multiple Pass Mixing
Perform multiple pass mixing as follows:
 - 1) After spreading the cement, mix it with the material to be treated.
 - 2) Ensure that the material has been adjusted for moisture as stated in [Subsection 301.3.05.B.7.c, “Moisture Control.”](#)
 - 3) Continue mixing with successive passes until a uniform mixture of cement and soil, or soil-aggregate is obtained.
 - 4) Immediately after the preliminary mixing of cement and soil or soil-aggregate, add water as needed to maintain or bring the mixture to within the moisture requirements of [Subsection 3 01.3.0 5.B .7.c, “Moisture Control.”](#)
 - 5) Uniformly mix the additional water to incorporate it into the full depth of the mixture.
 - b. Traveling Plant Mixing
Perform traveling plant mixing as follows:
 - 1) After spreading the cement, mix it with an approved traveling plant mixer.
 - 2) Ensure that the mixer picks up the full depth of material from the windrow on the roadbed onto the bottom shell or pan.
 - 3) Mix at a speed that ensures a uniform mixture of soil, cement, and water.
 - 4) Apply water through a water-metering device on the plant to uniformly distribute the proper amount of water to the loose material on the shell or pan. Distribute the water so that cement balls do not form.
 - 5) Continue to mix the cement and water so that all material to be treated is mixed at once.
 - 6) Ensure that there is enough mixture to produce, after final compaction, a course within allowable tolerances.
7. Compacting and Finishing
Compact and finish according to [Subsection 301.3.05.B.7, “Compacting and Finishing”](#).

B. Central Plant Mixing

1. Soil
Do the following:

Section 301—Soil-Cement Construction

- a. Before introducing any soil into the mixer, pulverize it until 100 percent passes a 1-1/2 in (37.5 mm) sieve.
- b. Ensure that at least 80 percent of the soil, excluding any stone or gravel, passes through a No. 4 (4.75 mm) sieve.
- c. Have enough stockpile material meeting the requirements of [Subsection 300.3.05.B, “Mining And Mixing In A Pit”](#) for at least one day of base construction before operations begin.

2. Cement

Do the following:

- a. Measure cement by weight.
Uniformly add cement into the mixture. The cement incorporated, per ton (megagram) of soil, shall be within ± 5 percent of the amount prescribed by the Engineer.
- b. Perform cement checks that compare the actual percent cement in the mixture with the required percent cement specified in the approved Mix Design for the Project on each of the first two tankers supplying cement to the plant. If these checks are within the specified tolerance, one cement check per day will be required.
- c. Perform and make available to the Engineer a minimum of four daily comparison checks between the certified scales and the plant computer to ensure the proper percentage of cement is being incorporated into the mixture between cement checks.
- d. When a cement check is out of the specified tolerance, at least two, passing one-tanker checks, are required before returning to a one cement check per day basis. When three consecutive cement checks fail to meet the specified tolerance, discontinue soil-cement plant production. Correct the problem, and recalibrate the plant as specified in [Subsection 300.3.06.A “Monitoring Quality Control”](#) before resuming the work.
- e. When the cement content exceeds the specified tolerance, the Department will deduct the excess cement from the Contractor’s pay for cement. When the cement content does not meet the specified tolerance, the Engineer will evaluate the strength of the affected area after 7 days.
- f. Correct any areas of base with deficient strength as specified in the Strength Correction Chart at no additional cost to the Department, regardless of the percent of compaction. This correction also applies to the test section described in [Subsection 301.3.05.B.7.a, “Test Section .”](#)
- g. Quantities of cement used in calibrating the plant will also be deducted from the Contractor’s pay for cement.

3. Mixing

Do the following:

- a. Measure proportions of soil, cement, and water separately and accurately before mixing.
- b. Charge all materials into the mixer together. Begin mixing immediately.
- c. Mix until a homogeneous and uniform mixture is produced. If the final blend of materials is not homogeneously mixed or does not meet the moisture range specified in [Subsection 301.3.05.B.7.c,](#)

Section 301—Soil-Cement Construction

[“Moisture Control,”](#) cease plant operations until corrections are made in the plant or to the materials.

4. Hauling

Do the following:

- a. Deliver soil-cement material to the Project.
- b. Spread soil-cement material so that compaction can begin within 45 minutes after the soil, cement, and water have been charged into the mixer.
- c. Protect the mixture in transit by using a securely fastened waterproof cover large enough to extend down over the sides and the end of the bed of each haul vehicle.

5. Spreading

Spread the soil-cement mixture as follows:

- a. Use an approved mixture spreader as specified in [Subsection 300.3.02.D, “Mixture Spreader”](#) to obtain the specified thickness. Spread the mixture the full width of the area to be covered.
- b. Ensure that trucks and other construction equipment, including motor graders, do not travel over the material until compaction equipment has made initial passes over the mixture.
- c. Ensure that less than 30 minutes elapse between the placement of cement-treated material in adjacent lanes at any location, unless longitudinal joints are specified.

6. Thickness of Course

Compact the soil-cement base to a maximum thickness of 8 in (200 mm). Place the full thickness in one course only and compact as specified in [Subsection 301.3.05.B.7, “Compacting and Finishing”](#) below.

7. Compacting and Finishing

a. Test Section

Construct a test section as follows:

- 1) Use the first section of each constructed soil-cement base course as a test section.
- 2) Use a test section between 350 ft (100 m) and 500 ft (150 m) long for the designated width.
- 3) Before constructing a test section, submit a Construction Work Plan to the Engineer for approval. The Construction Work Plan must indicate proposed equipment and compaction procedures.
- 4) If the Construction Work Plan is approved, the Engineer will evaluate the Work Plan during test section construction. The Engineer will evaluate compaction, moisture, homogeneity of mixture, thickness of course, and laminations or compaction planes (scabbing).
- 5) If the Engineer determines that the Work Plan is not satisfactory, revise the compaction procedure and augment or replace equipment, as necessary, to complete work according to the Specifications.

b. Time Limits

Observe the following time limits:

Section 301—Soil-Cement Construction

- 1) Begin compaction within 45 minutes of the time water is added to the soil-cement mixture.
 - 2) Complete compaction within 2 hours.
 - 3) Complete all operations in four hours, from adding cement to finishing the surface.
- c. Moisture Control
- Control moisture as follows:
- 1) During compaction, ensure a uniform moisture content of the mixture that is between 100 and 120 percent of the optimum moisture content.
 - 2) If the moisture content exceeds the tolerance at any time, cease operations immediately and make the adjustments necessary to bring the moisture content within tolerance.
 - 3) Do not use materials that “pump” under construction traffic, regardless of moisture content.
- d. Additional Compaction Requirements
- Perform the following additional compaction requirements:
- 1) Compact the soil-cement base, subbase, or shoulder course to at least 98 percent of the maximum dry density as determined in this Subsection.
 - 2) Do not perform vibratory compaction on materials more than 1-1/2 hours old, measured from the time the cement was added to the mixture.
 - 3) Uniformly compact the mixture and then fine-grade the surface to the line, grade, and cross-section shown on the Plans.
 - 4) Loosened material accumulated during this process is considered waste and is to be removed from the Project. Do not use additional layers of cement-treated materials in order to conform to cross-sectional or grade requirements.
 - 5) Use a pneumatic-tired roller to roll the finished surface until the surface is smooth, closely knit, free from cracks, and in conformance with the proper line, grade, and cross-section.
If the Engineer requires, lightly apply water to the finished surface to aid in sealing the completed base and preparing the surface for priming.
 - 6) At any place inaccessible to the roller, secure the required compaction with mechanical tampers approved by the Engineer. The same compaction requirements stated in the above Subsection apply.
- e. Additional Finishing Requirements
- Perform the following additional finishing requirements:
- 1) Use the automatically controlled screed equipment when required by [Subsection 300.3.03.H, “Fine Grading Machine”](#) of the Specifications. Control fine-grading for this requirement with sensing wires or a taut string line. Furnish, install, and maintain this operation as a part of this Pay Item. When automatically controlled screed equipment is not required, fine-grading with motor graders is permitted.
 - 2) Fine-grade the surface of the cement-stabilized subbase for Portland cement concrete pavement or the cement-stabilized base for asphaltic concrete pavement.
 - 3) Fine-grade immediately after placement and compaction. Roll the subbase again according to this Subsection.

Section 301—Soil-Cement Construction

8. Construction Joints

Form construction joints as follows:

- a. Form a straight transverse joint at the end of each day's construction or when the work is interrupted so that the material cannot be compacted within the time limit specified in this Subsection.
- b. Create the straight transverse joint by cutting back into the completed work to form a true vertical face free of loose or shattered material.
- c. Form the joint at least 2 ft (600 mm) from the point at which the strike-off plate of the spreader comes to rest at the end of the day's work, or at the point of interruption.
- d. Form a longitudinal joint as described above if the soil-cement mixture is placed over a large area where it is impractical to complete the full width during one day's work. Use the procedure for forming a straight transverse joint. Ensure that waste material is removed from the compacted base.

9. Prime

Apply bituminous prime to the finished surface of the base course at the end of each day or as soon as the Engineer determines it is practical. Apply prime only to an entirely moist surface.

If weather delays prime application, apply prime as soon as the surface moisture is adequate. Apply prime according to [Section 412](#).

10. Opening to Traffic

No traffic or equipment is permitted to operate on the finished base, subbase, or shoulders until the prime has hardened enough so that it does not pick up under traffic. For the first seven days after priming, traffic is restricted to lightweight vehicles such as passenger cars and pickup trucks. Vehicles with an average axle load exceeding 20,000 pounds (9 Mg) will not be allowed on the finished base or subbase at any time.

Correct any failures caused by traffic at no additional cost to the Department.

11. Protection of Course

Maintain the base, subbase, or shoulder course constructed under these Specifications until the Engineer determines that it has sufficiently cured and is ready to be covered with the next base or pavement course. Make repairs specified in Subsection [300.3.06.B](#), "[Repairing Defects](#)" whenever defects appear. This preservation action does not relieve the Contractor of his responsibility to maintain The Work until final acceptance as specified in [Section 105](#). (see [Appendix D](#))

301.3.06 Quality Acceptance

A. Compaction Tests

Test compaction as follows:

1. Determine the maximum dry density for central plant mix construction from representative samples of the material to be compacted according to [GDT19](#) (AASHTO T 134).
2. Determine the maximum dry density for mixed-in-place construction according to [GDT 19](#) or [GDT 67](#).

Section 301—Soil-Cement Construction

3. Determine the in-place density of the cement-stabilized base, subbase, or shoulders as soon as possible after compaction, but before the cement sets. Determine in-place density according to [GDT 20](#), [GDT 21](#), or [GDT 59](#).

B. Finished Surface Tests

Test the finished surface as follows:

1. Check the finished surface of the cement stabilized base, subbase, or shoulder course transversely.
2. Place a 15 ft (4.5 m) straightedge parallel to the centerline. Additionally, use one of the following tools:
 - A template, cut true to the required cross-section and set with a spirit level on non-superelevated sections
 - A system of ordinates, measured from a string line
 - A surveyor's level
3. Ensure that ordinates measured from the bottom of the template, string line, or straightedge to the surface do not exceed 1/4 in (6 mm) at any point. Rod readings shall not deviate more than 0.02 foot (6 mm) from the required readings.
4. Correct any variations from requirements immediately, as specified in [Subsection 300.3.05.D](#).

C. Tolerances

1. Thickness Measurements

- a. Thickness requirements apply to shoulder construction where the Plans specify a uniform thickness, or where the shoulders will be surfaced. Do the following:
- b. Determine the thickness of the base, subbase, or shoulder course, by making as many checks as necessary to determine the average thickness.

2. Deficient Thickness

- a. If any measurement is deficient in thickness more than 1/2 in (13 mm), make additional measurements to determine the deficient area.
- b. Correct any area deficient by more than 1/2 in (13 mm) to the design thickness by using one of the following methods according to these Specifications:
 - Apply Asphaltic Concrete 9.5 mm Superpave.
 - Remove material to the full depth of the course and reconstruct to the required thickness.

No payment will be made for any 9.5 mm Superpave asphaltic concrete applied to correct deficiencies nor will payment be made for removing and reconstructing the deficient work.

3. Average Thickness

Average thickness is measured as follows:

- a. The average thickness per linear mile (kilometer) is determined from all measurements within the mile (kilometer) increments.
- b. The average thickness shall not exceed the specified thickness by more than 1/2 in (13 mm).

Section 301—Soil-Cement Construction

- c. If the unit of payment is by the ton (megagram) or cubic yard (meter), and the average thickness for any mile (kilometer) increment exceeds the allowable 1/2 in (13 mm) tolerance, payment for the excess quantity in that increment will be deducted.
 - d. The excess quantity is calculated by multiplying the average thickness that exceeds the allowable 1/2 in (13 mm) tolerance by the surface area of the base, subbase, or shoulder, as applicable.
4. Strength Test
- Do the following:
- a. Ensure that the strength of the soil-cement base, subbase, or shoulder course is at least 300 psi (2070 kPa), as determined from testing the unconfined compressive strength of cores from the completed course in accordance with [GDT 86](#).
 - b. If a strength test falls below 300 psi (2070 kPa), do the following:
 - 1) Isolate the affected area by securing additional cores.
 - 2) Average all compressive strengths in the affected area to determine the basis for corrective work according to the table below or the Engineer's directions.

5. Compaction

The compaction requirement for soil-cement base, subbase, or shoulder course shall be a minimum of 98 percent of the specified theoretical density.

If any compaction test falls below 98 percent, core and retest the represented area for compressive strength determination after 7 days. If the strength is 300 psi (2070 kPa) or greater, no correction will be required. If the strength is less than 300 psi (2070 kPa), isolate the affected area by obtaining additional cores.

Average all compressive strengths in the affected area to determine the basis for corrective work, according to the following table.

Compressive Strength	Correction Work
300 psi (2070 kPa) or greater	None
200 psi (1380 kPa) to 299 psi (2069 kPa)	6 in & 8 in (150 mm & 200 mm) base—add 135 lbs/yd ² (75 kg/m ²) asphaltic concrete
Less than 200 psi (1380 kPa)	Reconstruct affected area

Ensure that a corrected area requiring asphaltic concrete is at least 150 ft (45 m) long.

Perform corrective work requiring asphaltic concrete or reconstruction at no additional cost to the Department.

301.3.07 Omitted

Section 301—Soil-Cement Construction

301.4 Measurement

A. Soil-Cement Material

Soil-cement material is measured by the cubic yard (meter), loose volume, as specified in Section 109, during mixed-in-place construction if it is necessary to add materials to the roadbed or to build up the base, subbase, or shoulders with new material.

B. Soil-Cement Stabilized Base, Subbase, and Shoulder Course

Soil-cement stabilized base, subbase, and shoulder course are measured as follows:

1. The surface length is measured along the centerline when payment is specified by the square yard (meter). The width is specified on the Plans.
 - a. Irregular areas, such as turnouts and intersections, are measured by the square yard (meter).
 - b. Material is measured in tons (megagrams), as mixed and accepted, when payment is specified by the ton (megagram).

The actual weight is determined by weighing each loaded vehicle on a required motor truck scale as the material is hauled to the roadway. The actual weight will be the pay weight; no deduction will be made for the weight of the cement.

C. Portland Cement

Portland cement is measured by the ton (megagram).

D. Fly Ash and Slag

No separate measurement or payment is made under this Specification.

E. Prime

Bituminous prime is not measured for separate payment. Include the cost of furnishing and applying bituminous prime according to the provisions of [Section 412](#) in the Unit Price Bid for each individual base item.

F. Unsuitable Material

Unsuitable materials that have been removed are measured and paid for according to the Earthwork Item in the Contract.

301.4.01 Limits: Omitted

301.5 Payment

A. Soil-Cement Material

Where in-place mixing is done, and when it is necessary to add other materials to those in the roadbed or to build up the base, subbase, and shoulders entirely with new materials, the added soil-cement material, in place and accepted, will be paid at the Contract Price per cubic yard (meter). Payment will be full compensation for soil-cement material; mixing in the pit; loading, hauling, and unloading; and spreading

Section 301—Soil-Cement Construction

B. Soil-Cement Stabilized Base, Subbase, and Shoulder Course

Where specified, soil-cement stabilized base, subbase, and shoulder course, in place and accepted, will be paid at the Contract Price per square yard (meter). Payment will be full compensation for roadbed preparation, mixing on the road, shaping, pulverizing, watering, compaction, defect repair, and maintenance.

C. Pre-mixed Soil-Cement Stabilized Base, Subbase, and Shoulder Course

Where specified, pre-mixed soil-cement stabilized base, subbase, and shoulder course, in place and accepted, will be paid at the Contract Price per ton (megagram) or square yard (meter).

Payment will be full compensation for roadbed preparation; all materials except Portland cement; loading, hauling, and unloading; mixing; spreading; watering; rolling and shaping; and maintenance.

D. Portland Cement

Portland cement will be paid at the Contract Price per ton (megagram). Payment is full compensation for furnishing, hauling, and applying the material. Only Portland cement incorporated in the finished course will be paid; no payment will be made for cement used to correct defects due to the Contractor's negligence, faulty equipment, or plant calibration error.

E. Fly Ash and Slag

Payment for any fly ash and slag will be included in the price of Portland cement. Payment will be full compensation for hauling and applying the materials. Only fly ash and slag incorporated into the finished course will be paid; no payment will be made for fly ash and slag used to correct defects due to the Contractor's negligence, faulty equipment, or plant calibration error.

Payment will be made under:

Item No. 301	Soil-cement stabilized base, subbase, and shoulder course ___in (mm)	per square yard (meter)
Item No. 301	Portland cement	per ton (megagram)

301.5.01 Omitted

Section 301: Appendix A

831.2.03 Fly Ash, Raw or Calcined Natural Pozzolan, Slag, and Microsilica

A. Requirements

1. Fly Ash

Fly ash is finely divided residue from the combustion of ground or powdered coal that is transported from the boiler by flue gases.

Use fly ash that meets the requirements of AASHTO M 295, Class F or C and that are listed in [QPL 30](#).

2. Raw or Calcined Natural Pozzolan

This is a siliceous or siliceous and aluminous material.

Use Pozzolan that meets the requirements of AASHTO M 295, Class N and that are listed in [QPL 30](#).

3. Granulated Iron Blast-Furnace Slag

This is a glassy granular material formed when molten blast-furnace slag is rapidly chilled and then finely ground. Use slag that meets the requirements of AASHTO M 302, Grade 100 or 120 and that are listed in [QPL 30](#).

4. Microsilica (Silica Fume)

This is an amorphous material with high silica content and purity, made as a by-product of high purity quartz that is reduced with other ingredients in an electric-arc furnace.

Use microsilica that meets the requirements of AASHTO M 307.

300.3 Construction Requirements

300.3.01 Personnel

Supply all personnel and equipment necessary for obtaining samples from base plants and delivering them to the plant laboratory.

300.3.02 Equipment

Ensure that all equipment for constructing base and subbase courses is of an approved design and in satisfactory condition before construction begins. The equipment required for each type of base or subbase will be determined according to the construction method used.

A. Central Mix Plants

The central mixing plant will not be approved for proportioning, batching, or mixing unless a field laboratory meeting the requirements of [Section 152](#) is available for the exclusive use of the Engineer or Inspector.

Design, coordinate, and operate plants so that the mixture is produced within the specified tolerances. The requirements are as follows.

1. Scales

Before any mixture is delivered to the Project, check all scales with standard weights for accuracy and for agreement with each other.

If weight proportioning is used, provide accurate scales so all ingredients of the mixture can be weighed separately. Use scales that are accurate to within 0.5 percent of the measured load. Support scales with rigid supports so that vibration from the plant does not interfere with accurate readings.

a. Weight Box and Hopper Scales

Use springless dial scales of a standard make and design for weight boxes and hopper. Inspect and seal scales when the Engineer determines it necessary to assure accuracy. Ensure that at least ten 50 lb. (25 kg) weights are available for testing the scales.

b. Motor Truck Scales

Section 300—General Specifications for Base and Subbase Courses

With each plant, include a motor truck scale with a platform large enough to accommodate the entire length of any vehicle used. Ensure that the scale is certified according to [Section 109](#) and is large enough to weigh the largest anticipated load. Do not measure weights greater than the rated capacity of the scales.

Ensure that the weights of the aggregate batches in the truck before delivery to the Project are within two percent of the sum of the weights of the batch ingredients.

Complete Forms OMR-TM-141 (Daily Truck Weights) and Form 474 (Tally Sheet) for each day's production and submit them to the Engineer.

2. Mixer

Equip each central mix plant with an approved mixer.

If Portland cement is required, begin mixing immediately after the cement is added to the coarse aggregate and soil mortar. Continue mixing until a homogeneous and uniform mixture is produced.

If the equipment does not produce a homogeneous and uniform mixture that meets these Specifications, the Engineer will require the Contractor to make the changes necessary to accomplish this result.

Any adjustments made to the charge in a batch mixer or the rate of feed to a continuous mixer must ensure a complete mix of all of the material.

Correct dead areas in the mixer where the material does not move or is not sufficiently agitated, by reducing the volume of material or by making other adjustments.

3. Mixture Proportioning

Add Portland cement, bituminous materials, aggregates, or other ingredients in such a manner that they are uniformly distributed throughout the mixture during the mixing operation.

4. Water Proportioning

In all plants, proportion water by weight. Provide a means for the Engineer to verify the amount of water per batch or the rate of flow for continuous mixing.

Use spray bars to evenly distribute moisture throughout the mixture.

5. Sampling

Use sampling equipment approved by the Engineer to obtain samples before combining them with other ingredients or introducing them into the mixer.

Use sampling equipment to provide an accurate representation of the furnished material.

6. Additional Requirements for Continuous-Mixing Plants

a. Feeder System

Continuous mixing plants shall use a feeder system that accurately proportions aggregate from each bin by weight.

Equip each feeder with a device that can change the quantity of material being fed. Use a feeder with adjustments that can be securely fastened.

Ensure that the plant has an interlocking system of feeders and conveyors that can be synchronized to supply a continuous flow of aggregate, including a positive flow of dry and liquid additives for mixing.

Provide an electronic belt-weighing device to monitor the combined aggregates. Ensure that there are meters for maintaining the aggregates and additives at varying production rates.

Use an electronic control package capable of tracking which accepts a signal from the belt-weighing device and signals to continuously vary the dry and liquid additive feeder speed and maintain the feed rate.

Proportion dry additives with a gravimetric (depleting weight) system meeting the following requirements:

Section 300—General Specifications for Base and Subbase Courses

- The dry additive gravimetric (depleting weight) system includes an isolation vessel supported by load cells independent of the fines silo.
 - Use load cells in conjunction with an electronic scale package having remote digital display and the necessary controls. Continuously weigh the material being metered with a positive displacement feeder mounted on the discharge of the isolation vessel.
- b. Control System
- Use a control package that has a plant interlock shutdown capability. Plants must be able to shut down if actual flow rates differ from desired flow rates excessively. If the flow rate deviates excessively, an alarm shall sound at any of the aggregate, dry additive, or liquid additive metering devices.
- Provide a monitoring station to control the entire operation that shows continuous quantitative data on the production and proportioning of the mix ingredients.
- a. Portable Power Units
- Equip plants that use portable electric power generators with a frequency meter (graduated and accurate to one hertz) and a voltmeter (graduated and accurate to two volts), installed in the power circuit.
- b. Mixer
- Use a mixer equipped with enough paddles or blades to produce a uniform and homogeneous mixture. Replace paddle blades that show more than 25 percent wear in the face area. Use paddles that can be adjusted to angular positions on the shafts and that can be reversed to retard the flow of the mix. Keep the mixer level.
- c. Surge Hopper
- Equip the mixer with a surge hopper. Use a surge hopper that automatically discharges the mixture when it reaches a predetermined level.
7. Additional Requirements For Batch-Mixing Plants
- a. Weigh Box or Hopper
- Use weigh boxes and hoppers that are suspended on scales, large enough to hold a full batch without spilling or needing hand raking, and equipped with a device for accurately weighing each size of aggregate.
- Provide a convenient and accurate means of obtaining samples of aggregates from each bin before the material enters the mixing chamber. Equip each bin compartment with a bin level indicator that automatically stops weighing when a bin is empty.
- b. Mixer
- Include an approved, leak-proof batch mixer in the plant. Use a mixer fast enough or equipped with enough paddles or blades to produce a properly and uniformly mixed batch. Replace paddles and blades that show more than 25 percent wear in the face area.
- a. Weighing Cement
- Weigh cement on scales separate from the aggregate batching scales. Ensure that all scales meet the requirements of [Section 109](#).
- d. Proportioning Bituminous
- Introduce bituminous material into the mixer through spray bars and weigh it on scales separate from the aggregate batching scales.
- e. Control of Mixing Time
- Use a time-locking device that automatically limits mixing time. Do not mix materials less than 30 seconds.

B. In-Place Mixers

For in-place mixing operations, use mixers that meet the following requirements:

Section 300—General Specifications for Base and Subbase Courses

1. Multiple Pass Mixers

Use approved rotary-type multiple pass mixers with sufficient tines that mix cement, soil or soil-aggregate, and water uniformly for the full depth of the course.

2. Traveling Plant Mixers

Use approved traveling mixing plants to pick up the aggregate, soil, or other materials from the windrow or roadway. Use plants equipped with a bottom shell or pan that pick up and mix the material while it is separated from the foundation material during at least 50 percent of the mixing cycle.

Use plants that mix the material for the full depth of the section. Ensure that travelling plants move forward with successive increments the length and width of the roadbed so that the roadbed is compacted and finished in one operation. Ensure that none of the materials being mixed are lost or segregated.

Use plants mounted on wheels or crawler tracks wide enough so that they will not rut or damage the mixed surface when loaded to capacity.

Use plants with a pressurized metering device that introduces water during mixing.

Ensure that devices for proportioning water and materials to be mixed accurately measures the specified amounts while the machine is in motion.

For bituminous stabilization, use plants equipped with a metering device that accurately measures the bituminous material into the mixer within the tolerances specified in [Section 302.3.05.B](#). Ensure that the meter indicator dial has a scale with divisions indicating gallons (liters).

If mixing equipment does not produce a homogeneous and uniform mixture, make the changes necessary to produce this result, as required by the Engineer.

C. Mechanical Cement Spreader

When the material is to be mixed in-place, use an approved mechanical cement spreader to uniformly and accurately spread the cement. Do not use pneumatic tubes to transfer the cement from the tanker to the material to be stabilized.

D. Mixture Spreader

Use an approved mechanical spreader that meets the following requirements to uniformly spread the mixture:

- A height-adjustable strike-off plate to obtain the specified thickness of the finished base
- A self-propelled spreader with rollers to contact the truck tires and push the truck without skewing the spreader or truck
- A hopper large enough to prevent spilling or wasting the material

E. Static Rollers

Use static rollers that meet the following requirements. Use self-propelled static rollers on cement stabilized base.

1. Trench Roller

In this context, “roller” describes a wheel made of a flat metal surface; “wheel” describes a rubber wheel of the automotive type.

When base widening is specified, use at least one trench roller. Use a trench roller that has a guiding roller or wheel that operates in tandem with the compression roller on the area to be compacted or with the auxiliary wheel or roller.

Ensure that the trench roller is equipped with an auxiliary wheel or roller, mounted on a height-adjustable axle. The contact surface of the auxiliary wheel or roller must be adjustable to at least 10 in (250 mm) above and 2 in (50 mm) below the rolling plane of the compression roller. If this adjustment is not sufficient to compact the subgrade to the Plan elevation, adjust the contact surface the necessary amount.

If the steering roller or wheel operates in tandem with the auxiliary wheel or roller, it does not need to be height-adjustable.

Section 300—General Specifications for Base and Subbase Courses

Ensure that the auxiliary wheel or roller operates on the surface of the pavement adjacent to the area to be compacted, and at a distance from the edge of the pavement that no damage occurs. Keep the height adjustment of the auxiliary wheel or roller such that the compression roller will develop a smooth, compacted surface true to crown.

Use gas-propelled trench rollers equipped with reversing, smooth operating friction clutches. Ensure that friction clutches have smooth operating brakes of ample capacity. Use either hand-powered or power-operated steering devices.

The compression per inch (25 mm) width of compression roller shall not be less than 300 lbs (545 kg) and not greater than 365 lbs (660 kg). If necessary, use a hollow compression roller and secure the minimum weight with liquid ballast. The trench roller must compact a minimum width of at least 15 in (375 mm).

Fit rollers with adjustable spring scrapers that can scrape in both directions.

2. Steel-Wheel Rollers

Use three-wheel or tandem steel-wheel rollers. Use self-propelled rollers equipped with cleaning devices to prevent material from adhering to the wheels.

For base or subbase materials, use 3-wheel rollers on base or subbase materials that have a minimum weight of 10 tons (9 Mg) and a minimum compression of 325 pounds per inch (580 kg/100 mm) of width for the rear wheels.

Use steel wheel tandem rollers with a minimum weight of 10 tons (9 Mg) and a minimum compression of 225 pounds per inch (400 kg/100 mm) of width for the rear drum.

3. Pneumatic-Tire Rollers

Use pneumatic-tire rollers with a minimum contact pressure of 50 psi (345 kPa) per wheel.

Equip rollers to uniformly distribute the load between all wheels.

Use multiple axle, multiple wheel rollers with wheels staggered on the axles and spaces between each wheel to provide uniform compaction for the full compacting width of roller.

Ensure that the air pressure of any tire does not vary more than 5 psi (35 kPa) from the established pressure.

Operate rollers between 3 mph (5 kph) and 8 mph (13 kph), unless otherwise directed by the Engineer.

4. Sheepsfoot Rollers

Use vibratory or static compaction sheepsfoot rollers of sufficient size and weight to obtain the desired compaction.

F. Vibratory Rollers

Use an approved vibratory roller designed to activate the frequency of vibration and the roller movement separately.

Ensure that the weight and amplitude of the roller can compact the surface to Specifications with a minimum number of passes.

G. Bituminous Sampling Valve

Use bituminous transfer pumps that include a valve for sampling bituminous materials.

H. Fine Grading Machine

Specifications for the Fine Grading Machine are included in either a Special Provision or a Supplemental Specification in the Proposal or in the current Supplemental Specification book.

300.3.03 Preparation

A. Alternate Methods

When alternate methods of construction are provided without restriction, the Contractor may select these alternate methods at will, provided the equipment and organization are suited to the method selected. Before starting construction, discuss the proposed method with the Engineer. The method selected must:

Section 300—General Specifications for Base and Subbase Courses

- Spread base or subbase material uniformly without damaging the subgrade, subbase, or the material being placed
- Mix the materials until they are homogeneous
- Use the specified water and cement or bitumen content
- Compact throughout the depth of the course to the density specified
- Complete the work within the specified time limits

Organize the work and equipment so that spreading, compacting, and finishing the base or subbase is a continuous operation. Do not exceed minimum or maximum time limits where the detailed Specifications require them, except in unusual cases where permitted by the Engineer.

B. Preparing the Pit Site

Remove grass, weeds, roots, and other debris from local materials pits. Adhere to the requirements of [Subsection 107.23, “Environmental Considerations”](#) when performing this work. Include the cost in the prices bid for the pertinent Pay Items. This work is not considered as clearing and grubbing.

C. Preparing the Subgrade

If the subgrade does not meet the requirements of [Section 209](#) for surface, compaction, and stability, repair all defective portions until it meets the requirements of that Section. Remove unsuitable materials and replace with acceptable material, if necessary. Compact the subgrade as specified in [Section 209](#).

Have enough prepared subgrade meeting the requirements of [Section 209](#) for at least one day of base construction before beginning work.

D. Preparing the Subbase

If a subbase is required, prepare it according to the requirements for surface and compaction. Ensure that it is stable enough to support the equipment that will place the base material without rutting or pumping. Repair all defective portions and replace any unsuitable material with acceptable material, if the subbase does not meet the requirements of the Specifications.

300.3.04 Fabrication

General Provisions 101 through 150.

300.3.05 Construction

A. Draining and Leaving Materials Pits

Keep materials pits well drained while materials are being removed from them. After removing materials, leave pits in the condition required by [Section 106](#) and [Section 160](#).

B. Mining and Mixing in a Pit

Mine all local materials pits within the pit boundaries and grid depths established by the Engineer.

Mine all materials from top to bottom. Mix materials in the pit before hauling to the roadbed or plant.

Place materials in windrows or stockpiles with a dragline or backhoe. Blend the gradation and moisture strata from each pit to a uniform mixture.

When a rim ditch is required and its depth exceeds the specified grid depth of soil-cement material, include only the material above the grid depth as base material. Use this material for the windrow or stockpile of material to be used for soil-cement base unless the Engineer determines that below-the-grid material is satisfactory.

Only use ladder pans and scrapers for stockpiling and windrowing in pits that are less than 18 in (450 mm) deep.

Section 300—General Specifications for Base and Subbase Courses

After the preliminary mixing, prevent the coarse materials from segregating from the fine materials with loading equipment that continues to blend the material.

C. Placing Materials

1. Mixture Control

The Engineer will determine the proportions of the materials to be used in compounding the base or subbase. The Engineer will determine the analysis basis of the components.

Change the mix, if required by the Engineer, to ensure that the finished base meets the requirements of these Specifications.

2. Moisture Control

Control the moisture content according to the specified requirements for each type of base or subbase.

Add water uniformly, allow it to evaporate or aerate, and roll the materials as often as necessary, to control the moisture content within the limits specified.

3. Number of Courses

Because the maximum thickness of base or subbase materials to be mixed or spread in one course varies with the equipment used, it is subject to the Engineer's approval. Ensure that the thickness meets the requirements of [Subsection 300.3 .05.C.5, "Compact ion ."](#)

4. Widening Work

Ensure that widening work conforms to [Section 150](#).

When widening in traffic areas, excavate an area that can be completed in the same day.

When widening pavement on which there is traffic on both sides, stagger operations to keep the widening trench open in one lane of traffic at a time.

5. Compaction

Compact the entire thickness of all bases and subbases to the specified maximum dry weight per cubic foot (meter), as determined by the method specified in the Section for each base or subbase.

If any base or subbase is more than 6 in (150 mm) thick, construct according to the following table for layer thickness:

Material	Layer Thickness
Topsoil, Sand-Clay, or Chert	Two equal layers, or one layer not to exceed 8 in (200 mm)
Graded Aggregate	Two equal layers, or one layer not to exceed 8 in (200 mm)
Cement Stabilized Graded Aggregate	Two equal layers, or one layer not to exceed 8 in (200 mm)
Cement Stabilized Soil Aggregate	Two equal layers, or one layer not to exceed 8 in (200 mm)
Sand Bituminous	Two equal layers, or one layer not to exceed 8 in (200 mm)
Soil-Cement	One layer not to exceed 8 in (200 mm)

D. Meeting Surface Requirements

Produce a smooth, uniform surface that complies with these Specifications.

Rebuild any areas that do not meet the requirements or remove or add material to the area until the Engineer approves of the Work.

300.3.06 Quality Acceptance

A. Monitoring Quality Control

Ensure that the mixture and the materials used meet the following quality controls:

- Before producing any mixture for the Project, calibrate the electronic sensors, devices, or settings for proportioning all mixture ingredients by scale weight. Calibrate in the presence of the Engineer, the proportioning of every ingredient for all rates of production.
- Maintain a dated, written record of the most recent calibration. Post the calibration at the base plant and make the record available for the Engineer's inspection at all times. Format records as graphs, tables, charts, or mechanically prepared data. If the material changes, the rate of production changes by more than +/- 20%, the plant is not producing base material for more than two weeks, or if a component affecting the ingredient proportions has been repaired, replaced, or adjusted, check and recalibrate the proportions.
- Verify the moisture of the mixture being produced. Perform checks on ingredient proportioning and verify truck weight as directed by the Engineer.

Provide quality control personnel and all necessary equipment to perform and document moisture tests. Perform moisture tests at a frequency of at least one test per hour of base plant production.

B. Repairing Defects

During construction: If materials that do not meet these Specifications are placed on the roadway at any time during construction, remove and replace them with acceptable materials as a part of the Pay Item for the base or subbase being constructed.

After construction: Promptly correct defects discovered in the surface finish, thickness, or compaction of the completed base or subbase before The Work is accepted.

- If the base, subbase, or shoulders are deficient in thickness and it is determined that the subgrade elevation is high, remove the materials, lower the subgrade, and reconstruct the course, according to these Specifications at no cost to the Department.
- If job conditions permit and the Engineer mandates, correct areas deficient in thickness by raising the elevation of the surface or adding material to the course.
- In other cases, the Engineer may determine that the defective portions must be entirely removed. Add, mix, spread, and compact new material according to the Specifications and at no cost to the Department.
- If a surface is less than 3 in (75 mm) deep, scarify the area to a depth of at least 3 in (75 mm), except in the case of stabilized bases or subbases. Mix and compact the new and old materials.
- Repair stabilized bases or subbases according to [Section 301](#), [Section 302](#), [Section 310](#), or [Section 316](#), whichever is applicable.

Section 301: Appendix C

412.3.02 Equipment

Provide equipment that is in good repair, including at least the following units that meet the requirements of [Subsection 424.3.02, “Equipment.”](#)

- Pressure distributor
- Power broom and blower
- Aggregate spreader (if required)

412.3.03 Preparation

See [Sub section 412.3.05.B, “Condition of Surface.”](#)

412.3.04 omitted

412.3.05 Construction

Prime the following bases and other areas:

- Cement or lime stabilized bases or subbases, regardless of pavement thickness
- Soil or aggregate bases or sub-bases on which bituminous surface treatment will be placed
- Soil or aggregate bases or sub-bases on which less than 5 in (125 mm) total thickness of hot mix asphaltic concrete will be placed

Prime is not required on driveway construction and paved shoulders.

A. Weather Limitations

Do not apply bituminous prime under any of these conditions:

- Surface is wet.
- Air temperature is below 40 °F (4 °C) in the shade.
- Rain is imminent.
- Weather conditions may prevent proper prime coat construction.

B. Condition of Surface

Ensure that the surface to which the prime is to be applied has been finished to the line, grade, and cross section specified.

Ensure that the surface is uniformly compacted and bonded. Correct surface irregularities according to the Specifications for the construction being primed.

C. Cleaning

Remove from the road loose material, dust, caked clay, and other material that may prevent bonding of the prime with the surface. Use power sweepers or blowers the full width of the prime and 2 ft (600 mm) more on each side. Where necessary, sweep by hand.

D. Moisture

Ensure that the surface is only slightly damp. If the surface is too wet, allow it to dry. If it is too dry, the Engineer may require that it be sprinkled lightly just before priming.

E. Temperature and Surface Texture

The surface texture and condition of the surface determine the bituminous material grades to be used.

The following table shows the bituminous material grades and application temperatures as they are applied to various surface textures.

Base Texture	Tight	Average	Open
Materials and grade	MC-30 RC-30	RC-70 or MC-70	RC-250 or MC-250
Application temperature °F (°C)	80–120 (27–49)	105–180 (41–82)	145–220 (63–104)

The Engineer will determine the temperature for applying bituminous prime within the limits shown above.

Heat and apply bituminous materials as specified in [Sub section 424.3.05.D, “Heating Bituminous Material”](#) and [Subsection 424.3 .05.E, “Applying Bituminous Material.”](#)

F. Amount and Extent of Prime

The Engineer will determine the exact amount of bituminous material to be used within minimum and maximum rates of

0.15 to 0.30 gal/yd² (0.7 to 1.4 liters/m²). Apply the specified amount as follows:

1. Apply the determined amount uniformly and accurately. Ensure that the amount applied to any 0.5-mile (800 m) section is within 5 percent of the amount specified.
2. Apply the prime the full width of the proposed wearing surface that will be superimposed plus 6 in (150 mm) more on each side.

G. Protection, Curing, and Maintenance

Do the following after priming the surface:

1. Close to Traffic
Do not allow traffic on the primed surface. Leave the surface undisturbed until the prime thoroughly cures and does not pick up under traffic.
2. Roll
If the surface becomes soft after it is primed, roll the surface longitudinally with a pneumatic-tired roller at no more than 6 mph (10 kph) until the surface is firmly set.
3. Blot
If necessary to prevent the prime from being picked up, spread clean, dry, sharp sand over the surface by hand or mechanically. Apply sand only to places that are tacky and use the least amount needed to prevent pick up. No extra payment for this work or material will be made.
4. Open to Traffic
After rolling and sanding (if required), open the primed surface to ordinary traffic subject to the conditions in [Subsection 412.3 .05.G.1, “Close to Traffic.”](#)
5. Maintenance
Maintain the prime coat and the primed course surface until it is covered by other construction. Remove excess bituminous material.

Section 105—Control of Work

105.01 Authority of the Engineer

The Engineer will decide all questions that may arise as to the quality and acceptability of materials furnished, work performed, and the rate of progress of The Work; the interpretation of the Plans and Specifications, and all questions as to the acceptable fulfillment of the Contract on the part of the Contractor. The Engineer will determine the quantities of the several kinds of work performed and materials furnished which are to be paid for under the Contract and his determination shall be final.

The Engineer will have the authority to suspend The Work wholly or in part due to the failure of the Contractor to correct conditions unsafe for the workmen or general public; for failure to carry out provisions of the Contract, or for failure to carry out orders; for such periods as he may deem necessary due to unsuitable weather; for conditions considered unsuitable for the prosecution of The Work; or for any other condition or reason deemed to be in the public interest.

The Contractor may request and will receive written instructions from the Engineer upon any important items.

After the Contract has been executed, and before work begins, the Engineer may designate a time and place to hold a Preconstruction Conference with the Contractor. At such time, the Contractor shall furnish the Engineer with a Progress Schedule as provided in [Subsection 108.03](#) unless this schedule has been specifically exempted by Special Provision. The Contractor will also be given a decision on any alternate Traffic Control Plan that he may have previously submitted.

Any matters pertaining to order of work, interpretation of Plans and Specifications, traffic control, utility adjustments, or others, may be discussed at the Preconstruction Conference.

105.02 Plans and Working Drawings

Plans will show details of all structures, lines, grades, typical cross sections of the roadway, location and design of all structures, and a summary of Items appearing in the Proposal.

The Plans will be supplemented by such working drawings as are necessary to adequately control the Work. Working drawings for structures shall be furnished by the Contractor and shall consist of such detailed Plans as may be required to adequately control The Work and which are not included in the Plans furnished by the Department. They shall include stress sheets, shop drawings, erection plans, false work plans, cofferdam plans, bending diagrams for reinforcing steel or any other supplementary plans, or similar data required of the Contractor. All working drawings must be approved by the Engineer and such approval shall not operate to relieve the Contractor of any responsibility under the contract for the successful completion of The Work. The Contract Bid Prices shall include the cost of furnishing all working drawings.

105.03 Conformity with Plans and Specifications

All Work performed and all materials furnished shall be in reasonably close conformity with the lines, grades, cross sections, dimensions, and material requirements, including tolerances, shown on the Plans or indicated in the Specifications.

Plan dimensions and contract Specification values are to be considered as the target values to be strived for and complied with as the design values from which any deviations are allowed. It is the intent of the Specifications that the materials and workmanship shall be uniform in character and shall conform as nearly as realistically possible to the prescribed target value or to the middle portion of the tolerance range. The purpose of the tolerance range is to accommodate occasional minor variations from the median zone that are unavoidable for practical reasons. When either a maximum and minimum value or both are specified, the production and processing of the material and the performance of the work shall be so controlled that material or work will not be preponderantly of borderline quality or dimension.

In the event the Engineer finds the materials or the finished product in which the materials are used not within reasonably close conformity with the Plans and Specifications, but that reasonably acceptable work has been produced, the Engineer shall then make a determination if the work shall be accepted and remain in place. In this event, except in cases where the appropriate price adjustments are provided for in the Specifications covering the materials and/or the finished product, a Supplemental Agreement will be executed documenting the basis of acceptance that will provide for an appropriate price

Section 105—Control of Work

adjustment in the Contract Price for such work or materials as the Engineer deems necessary to conform to his determination based on engineering judgement.

In the event the Engineer finds the materials or the finished product in which the materials are used or the work performed are not in reasonably close conformity with the Plans and Specifications, and have resulted in an inferior or unsatisfactory product, the work or materials shall be removed and replaced or otherwise corrected by and at the expense of the Contractor.

105.04 Coordination of Plans, Specifications, Supplemental Specifications, and Special Provisions

These *Standard Specifications*, the Supplemental Specifications, the Plans, Special Provisions, and all supplementary documents are essential parts of the Contract, and a requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete work.

In cases of discrepancy, the governing descending order will be as follows:

1. Special Provisions
2. Project Plans including Special Plan Details
3. Supplemental Specifications
4. Standard Plans including Standard Construction Details
5. Standard Specifications

Calculated dimensions will govern over scaled dimensions.

The Contractor shall take no advantage of any apparent error or omission in the Plans or Specifications. In the event the Contractor discovers such an error or omission, he shall immediately notify the Engineer. The Engineer will then make such corrections and interpretations as may be deemed necessary for fulfilling the intent of the Plans and Specifications.

A. Specifications of Other Organizations

When work is specified to be done or when materials are to be furnished according to the published specifications of organizations other than the Department, the latest specifications published by those organizations at the time bids are received shall apply unless otherwise specified.

AASHTO Interim Specifications and ASTM Tentative Specifications will be considered effective on date of issue.

B. Item Numbers

The first three digits of any Item Number in the itemized Proposal designates the Specification section under which the Item shall be constructed.

105.05 Cooperation by Contractor

The Contractor will be supplied with a minimum of two sets of approved Plans and Contract assemblies including Special Provisions, one set of which the Contractor shall keep available on The Work at all times.

The Contractor shall give the Work the constant attention necessary to facilitate the progress thereof, and shall cooperate with the Engineer, Inspectors, and other Contractors in every way possible.

The Contractor shall have on The Work at all times, as his agent, a competent Superintendent, capable of reading and thoroughly understanding the Plans and Specifications, and thoroughly experienced in the type of work being performed, who shall receive instructions from the Engineer or his authorized representatives. The Superintendent shall have full authority to execute orders or directions of the Engineer without delay and to promptly supply such materials, equipment, tools, labor, and incidentals as may be required. Such superintendence shall be furnished irrespective of the amount of work sublet.

Section 105—Control of Work

The Superintendent shall notify the Engineer prior to starting any Pay Item Work. The Prime Contractor shall coordinate and be responsible to the Engineer for all activities of subcontractors.

105.06 Cooperation with Utilities

The Department will notify all utility companies, all pipeline owners, all railroad companies, or other parties affected of Award of the Contract, giving the name and address of the Contractor, and will assist the Contractor in arranging for all necessary adjustments of the public or private utility fixtures, pipe lines, and other appurtenances within or adjacent to the limits of construction.

Water lines, gas lines, wire lines, service connections, water and gas meter boxes, water and gas valve boxes, light standards, cableways, signals, railroad facilities, and all other utility appurtenances within the limits of the proposed construction which are to be relocated or adjusted are to be moved by the owners at their expense, except as otherwise provided for in the Special Provisions or as noted on the Plans.

It is understood and agreed that the Contractor has considered in his bid all of the permanent and temporary utility appurtenances in their present location or relocated positions, both as shown on the Plans, and that no additional compensation will be allowed for any delays, inconvenience, or damage sustained by him due to any interference from said utility appurtenances or the operation of moving them. Delays and interruptions to the controlling Item or Items of The Work are covered in [Subsection 107.21.G](#).

It shall be each utility owner's responsibility to plan with the Contractor a schedule of operations which will clearly set forth at which stage of the Contractor's operations the utility owner will be required to perform his removal and relocation work.

105.07 Cooperation Between Contractors

The Department reserves the right at any time to Contract for and perform other or additional work on or near The Work covered by the Contract.

When separate Contracts are let within the limits of any one Project, each contractor shall conduct his work so as not to interfere with or hinder the progress or completion of The Work being performed by other Contractors. Contractors working on the same Project shall cooperate with each other.

Each Contractor involved shall assume all liability, financial or otherwise, in connection with his Contract and shall protect and save harmless the Department from any and all damages or claims that may arise because of inconvenience, delay, or loss experienced by him because of the presence and operations of other Contractors working within the limits of the same Project.

The Contractor shall arrange his work and shall place and dispose of the materials being used so as not to interfere with the operations of the other contractors within the limits of the same Project. He shall join his work with that of the others in an acceptable manner and shall perform it in proper sequence to that of the others. At the request of the Structure Contractor, the Engineer will designate an area within the right-of-way, adjacent to each structure, to be reserved for use by the Structure Contractor for Storage of Equipment and Materials necessary to construct the particular structure. So long as he occupies this area, the Structure Contractor shall be responsible for its maintenance. The Structure Contractor must relinquish this area, however, as it becomes practical to utilize completed portions of the structure.

105.08 Construction Stakes, Lines and Grades

(Subsection 105.08 Omitted)

105.09 Authority and Duties of the Resident Engineer

The Resident Engineer, regardless of his administrative title, is the Engineer designated by the Department to be the direct representative of the Chief Engineer. The Resident Engineer has immediate charge of the engineering details of each construction Project, and is responsible for the administration and construction of the Project. Such administration includes

Section 105—Control of Work

the designation of subordinates to represent him and make routine decisions. The Resident Engineer has the authority to reject defective material and to suspend any work that is being improperly performed.

105.10 Duties of the Inspector

Inspectors employed by the Department are authorized to inspect all work done and materials furnished. Such inspection may extend to all or any part of The Work and to the preparation, fabrication, or manufacture of the materials to be used. The Inspector will not be authorized to alter or waive the provisions of the Contract. The Inspector will not be authorized to issue instructions contrary to the Plans and Specifications or to act as foreman for the Contractor.

105.11 Inspection of the Work

All materials and each part of the detail of The Work shall be subject to inspection by the Engineer.

The Engineer shall be allowed access to all parts of The Work and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed Inspection.

Upon the Engineer's request, the Contractor, at any time before acceptance of The Work, shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of The Work to the standard required by the Specifications. Should The Work thus exposed or examined prove acceptable, the uncovering or removing and the replacing of the covering or making good of the parts removed will be paid for as Extra Work; but should the work so exposed or examined prove unacceptable, the uncovering, or removing and the replacing of the covering or making good of the parts removed will be at the Contractor's expense.

Any work done or materials used without supervision or inspection by an authorized Department representative may be ordered removed and replaced at the Contractor's expense, unless the Department representative failed to inspect after having been given reasonable notice in writing that The Work was to be performed.

When any unit of government or political subdivision or any railroad corporation is to pay a portion of the cost of The Work covered by the Contract, its respective representatives shall have the right to inspect The Work. Such inspection shall in no sense make any unit of government or political subdivision or any railroad corporation a party to the Contract and shall in no way interfere with the rights of either party hereunder.

105.12 Removal of Unacceptable and Unauthorized Work

All work that does not conform to the requirements of the Contract will be considered unacceptable unless otherwise determined acceptable under the provisions in [Subsection 105.03](#).

Unacceptable work, whether the result of poor workmanship, use of defective materials, damage through carelessness, or any other cause found to exist prior to the Final Acceptance of The Work, shall be removed immediately and replaced in an acceptable manner.

Except as elsewhere noted, no work shall be done without lines and grades having been given by the Engineer. Work done contrary to the instructions of the Engineer, work done beyond the lines shown on the Plans or as given, except as herein specified, or any Extra Work done without authority will be considered as unauthorized and will not be paid for under the provisions of the Contract. Work so done may be ordered removed or replaced at the Contractor's expense.

Upon failure on the part of the Contractor to comply forthwith with any order of the Engineer made under the provisions of this section, the Engineer will have authority to cause unacceptable work to be remedied or removed and replaced and to cause unauthorized work to be removed, and to deduct the costs from any monies due or to become due the Contractor.

105.13 Claims for Adjustments and Disputes

Whenever the Contractor believes that it is or will be entitled to additional compensation, whether due to delay, extra work, breach of contract, or other causes, the Contractor shall follow the procedures set forth in this Sub-Section.

Section 105—Control of Work

A. Claims For Acceleration

The Department shall have no liability for any constructive acceleration. If the Department gives express written direction for the Contractor to accelerate its effort, then both parties shall execute a Supplemental Agreement as provided in [Subsection 104.03](#).

B. Claims For Delay and All Other Claims Except Acceleration

1. The Department shall have no liability for damages beyond those items which are specifically payable under this Sub-Section.
2. The Department will be liable only for those delay damages caused by or arising from acts or omissions on the part of the Department which violate legal or contractual duties owed to the Contractor by the Department. The Contractor assumes the risk of damages from all other causes of delay.
3. The parties recognize that delays caused by or arising from right of way problems, defects in plans or design, redesign, changes in the Work by the Department, the actions of suppliers or other Contractors, the shop-drawing approval process, injunctions, court orders and other such events, forces or factors are commonly experienced in highway construction work. Such delays shall not constitute breaches of the Contract. However, such delays may constitute a basis for a claim for delay damages, if found to be in accordance with [Subsection 105.13.B.2](#) above and other provisions of the Contract, and/or a request for a time extension.
4. The term "delay" shall be deemed to mean any event, action, force or factor which extends the Contractor's time of performance. This Subsection is intended to cover all such events, actions, forces or factors, whether they be styled "delay," "disruption," "interference," "impedance," "hindrance", "impact" or otherwise.
5. Compliance with the provisions of this Subsection will be an essential condition precedent to any recovery of damages by the Contractor.
6. The following items, and only the following items, may be recoverable by the Contractor as "damages":
 - a. Additional direct hourly rates paid to employees for job site labor, including payroll taxes, welfare, insurance, benefits and all other labor burdens.
 - b. Documented additional costs for materials.
 - c. Additional equipment costs, as determined in accordance with this Sub-Section.
 - d. Documented costs of extended job-site overhead. (Not applicable for claims other than delay claims.)
 - e. An additional 15 percent of the total of [Subsections 105.13.B.6](#), a, b, c and d, which sum includes home office overhead and profit.
 - f. Bond costs.
 - g. Subcontractor costs, as determined by, and limited to, those items identified as payable under [Subsection 105.13.B.6](#), a, b, c, d, e, and f.
7. For purposes of computing additional equipment costs, rates used shall be based on the Contractor's actual experienced cost for each piece of equipment. These rates shall be supported by equipment cost records furnished by the Contractor. In no case will equipment rates be allowed in excess of those determined utilizing the "Rental Rate Blue Book," with the appropriate adjustments noted in [Subsection 109.05](#).
8. The parties agree that, in any claim for damages, the Department will have no liability for the following items of damages or expense:

Section 105—Control of Work

- a. Profit, in excess of that provided herein.
 - b. Loss of profit.
 - c. Labor inefficiencies, except as allowed under [Subsection 105.13.B.6.a.](#)
 - d. Home office overhead in excess of that provided herein.
 - e. Consequential damages, including but not limited to loss of bonding capacity, loss of bidding opportunities and insolvency.
 - f. Indirect costs or expenses of any nature.
 - g. Attorneys fees, claims preparation expenses, or costs of litigation.
 - h. Interest of any nature.
9. NOTICE OF POTENTIAL CLAIM: In any case in which the Contractor believes that it will be entitled to additional compensation, the Contractor shall notify the Engineer in writing of its intent to claim such additional compensation. Such notice shall be given in order that the Department can assess the situation, make an initial determination as to who is responsible, and institute appropriate changes or procedures to resolve the matter.
- a. Claims for Delay - The Department shall have no liability for any delay which occurred more than one week prior to the filing of such written notice. Failure of the Contractor to give such written notice in a timely fashion will be grounds for denial of the claim.
 - b. All Other Claims Except Acceleration and Delay - If the Contractor does not file such written notice before beginning the work out of which such claim arises, then the Contractor hereby agrees that it shall have waived any additional compensation for that work and the Contractor shall have no claim thereto.
10. RECORDS: After filing a "Notice of Potential Claim", the Contractor shall keep daily records of all labor, material, and equipment costs incurred for operations affected. These daily records shall identify each operation affected and the specific locations where work is affected. The Department will also keep records of all labor, material, and equipment used on operations affected. At the time and place, as designated by the Engineer, on Monday, or the first work day, of each week following the date of filing a "Notice of Potential Claim", the Contractor shall meet with the Department's representative and present the daily records for the preceding week. If the Contractor's records indicate costs greater than those kept by the Department, the Department will present its records to the Contractor. The Contractor shall notify the Engineer in writing within three (3) work days of any inaccuracies noted in, or disagreements with, the Department's records. Refusal or repeated failure by the Contractor to attend these weekly meetings and present its records will constitute a waiver by the Contractor of any objections as to the accuracy of the Department's records. When the Contractor makes an objection as to the accuracy of the Department's records, the Engineer shall review the matter, and correct any inaccuracies he finds in the Department's records. For purposes of computing damages, the Department's records will control.
- In the event the Contractor wishes to contest the accuracy of the Department's records, it may file a petition pursuant to Rule 672-1-.05 of the Official Rules and Regulations of the Department of Transportation. The decision of the Engineer, or, if contested, the decision of the Agency, will be final and binding upon the parties as to any objections to the accuracy of the Department's records, subject to the Contractor's right to judicial review under O.C.G.A. Section 50-13-19.
11. On a weekly basis after filing a "Notice of Potential Claim" for delay damages, the Contractor shall prepare and submit to the Engineer written reports providing the following information:

Section 105—Control of Work

- a. Potential effect to the schedule caused by the delay.
- b. Identification of all operations that have been delayed, or are to be delayed.
- c. Explanation of how the Department's act or omission delayed each operation, and estimation of how much time is required to complete the project.
- d. Itemization of all extra costs being incurred, including:
 - 1) An explanation as to how those extra costs relate to the delay and how they are being calculated and measured.
 - 2) Identification of all project employees for whom costs are being compiled.
 - 3) Identification of all manufacturer's numbers of all items of equipment for which costs are being compiled.

C. Required Contents of Claims

All claims shall be submitted in writing, and shall be sufficient in detail to enable the Engineer to ascertain the basis and the amount of each claim. The claim submission shall include six (6) copies. All information submitted to the Department under this Subsection will be used exclusively for analyzing the claim, resolving the claim or any litigation which might arise from the claim. At a minimum, the following information shall be provided:

1. A description of the operations that were delayed, the reasons for the delay, how they were delayed, including the report of all scheduling experts or other consultants, if any. (Not applicable for claims other than delay claims)
2. An as-built chart, CPM scheme or other diagram depicting in graphic form how the operations were adversely affected. (Not applicable for claims other than delay claims except where an extension of time is sought)
3. A detailed factual statement of the claim providing all necessary dates, locations and items of work affected by the claim.
4. The date on which actions resulting in the claim occurred or conditions resulting in the claim became evident.
5. A copy of the "Notice of Potential Claim" filed for the specific claim by the Contractor.
6. The name, function, and activity of each Department official, or employee, involved in, or knowledgeable about facts that gave rise to such claim.
7. The name, function, and activity of each Contractor or Subcontractor official, or employee, involved in, or knowledgeable about facts that gave rise to such claim.
8. The identification of any pertinent documents, and the substance of any material oral communication relating to such claim.
9. A statement as to whether the additional compensation or extension of time sought is based on the provisions of the Contract or an alleged breach of Contract.
10. The specific provisions of the Contract which support the claim, and a statement of the reasons why such provisions support the claim.
11. The amount of additional compensation sought and a break-down of that amount into the categories specified as payable under [Subsection 105.13.B.6](#), above.
12. If an extension of time is also sought, the specific days for which it is sought and the basis for such request.

D. Required Certification of Claims

When submitting the claim, the Contractor shall certify in writing, under oath in accordance with the formalities required by Georgia law, as to the following:

1. That the claim is made in good faith.
2. That supportive data are accurate and complete to the Contractor's best knowledge and belief that the amount of the claim accurately reflects what the Contractor in good faith believes to be the Department's liability.

The Contractor shall use the CERTIFICATE OF CLAIM form, which can be obtained from the Department, in complying with these requirements.

E. Auditing of Claims

All claims filed against the Department shall be subject to audit at any time following the filing of such claim, whether or not such claim is part of a suit pending in the courts of this State. The audit may be performed by employees of the Department or by an independent auditor on behalf of the Department. The audit may begin on ten days notice to the Contractor, Subcontractor, or Supplier. The Contractor, Subcontractor, or Supplier shall make a good faith effort to cooperate with the auditors. Failure to cooperate with the auditor shall constitute a waiver by the Contractor of the claim in its entirety. Failure of the Contractor, Subcontractor, or Supplier to maintain and retain sufficient records to allow the Department's auditor to verify the claim shall constitute a waiver of that portion of such claim that cannot be verified and shall bar recovery thereunder. If the claim is part of a suit pending in a court of this state or if the claim becomes a part of a suit in a court of this state, the questions of whether the Contractor has cooperated with the auditor or failed to maintain and retain sufficient records to allow the auditor to verify the claim shall be questions for determination by the judge without the assistance of a jury.

Without limiting the generality of the foregoing, and as a minimum, the auditors shall have available to them the following documents:

1. Daily time sheets and foreman's daily reports.
2. Project payroll register.
3. Profit and loss statements for the Project.
4. Payroll tax returns.
5. Material invoices, purchase orders, and all material and supply acquisition contracts for the Project.
6. Material cost distribution worksheet for the Project.
7. Equipment records (list of company equipment, rates, etc.)
8. Vendor rental agreements, and subcontractor invoices.
9. Subcontractor payment certificates.
10. Canceled checks (payroll and vendors) for the Project.
11. Job cost report for the Project.
12. Job payroll ledger for the Project.
13. General ledger, general journal, (if used) and all subsidiary ledgers and journals together with all supporting documentation pertinent to entries made in these ledgers and journals.

Section 105—Control of Work

14. Cash Disbursements journal for the Project.
15. Certified financial statements for all years reflecting the operations on this project.
16. Depreciation records on all company equipment whether such records are maintained by the company involved, its accountant, or others.
17. If a source other than depreciation records is used to develop costs for the Contractor's internal purposes in establishing the actual cost of owning and operating equipment, all such other source documents.
18. All documents which relate to each and every claim together with all documents which support the amount of damages as to each claim.
19. Worksheets used to prepare the claim establishing the cost components for items of the claim including, but not limited to, labor, benefits and insurance, materials, equipment, subcontractors, and all documents which establish the time periods, individuals involved, the hours and the rates for the individuals.

F. Mediation

After compliance by the Contractor with parts B., C., D. and E. of [Subsection 105.13](#) and if the Contractor's claim has been disallowed in whole or in part, then the Contractor may, within 30 calendar days from receipt of the ruling of the Engineer, make a written request to the Engineer that the claim or claims be referred to mediation.

If requested in accordance with this specification, mediation shall be granted by the Department. In which case, within 30 days of receipt by the Department of the Contractor's request for mediation, the Contractor and the Department will meet to select a mediator. The mediator will then schedule the mediation at a place, time, and earliest date agreeable to the Contractor and the Department.

The Contractor and the Department mutually agree that mediation shall be a condition precedent to the filing of any lawsuit concerning claims or alleged breaches of the Contract. The costs and expenses of the mediator, selected by mutual agreement of the parties, will be divided equally between the Department and the Contractor. Each party to the mediation shall bear its own costs of preparing for and participating in the mediation.

G. Remedies Exclusive

In the event any legal action is instituted against the Department by the Contractor on account of any claim for additional compensation, whether on account of delay, acceleration, breach of contract, claimed extra work, or otherwise, the Contractor agrees that the Department's liability will be limited to those items which are specifically identified as payable in this Sub-Section.

105.14 Maintenance During Construction

The Contractor shall maintain the project during construction and until the Project is accepted. This maintenance shall constitute the continuous and effective work prosecuted day by day, with adequate equipment and forces to the end that all areas of the project are kept in satisfactory condition at all times.

The Contractor's area of responsibility for maintenance is confined to the physical construction limits plus any areas affected by the Contractor's activities. Once maintenance acceptance or final acceptance has been made, the Contractor is no longer responsible for damage to The Work other than that attributable to the Contractor's actions or inadequate construction.

In case of separate contracts, each Contractor shall be responsible for any damage to the completed work of others caused by his actions or negligence. Where the work of one Contractor has been accepted by the Department, the Contractor performing subsequent work in the area shall be responsible for the maintenance and protection of all work previously completed.

If separate bridge contracts are let within the limits of a Roadway Project and the Bridge Contractor completes his Contract before the Roadway Contractor, the Bridge Contract may be accepted and the Roadway Contractor will be responsible for maintenance of the new bridge until it is opened to traffic. If the Roadway Contractor hauls materials across the bridge the

Section 105—Control of Work

Roadway Contractor shall protect the endposts, deck surface, deck edges, joints, and all other vulnerable features of the bridge by use of adequate timber or earth cushions as directed by the Engineer. The Roadway Contractor shall repair all damage caused by such use, including resealing of joints and rerubbing of finish at his own expense.

All cost of maintenance work during construction and before the Project is accepted shall be included in the Unit Prices Bid on the various Pay Items and the Contractor will not be paid an additional amount for such work except as provided in [Subsection 104.05.B](#).

The Contractor shall not allow vegetative growth at any time to obstruct signs, delineation, traffic movements, or sight distance. The Contractor shall at intervals not to exceed six months, clean up and remove litter and debris; remove weeds from around guardrail, barrier, poles, standards, utility facilities, and other structures; and cut or trim trees, bushes or tall grass. These requirements shall apply to all areas within the project termini and lateral limits.

105.15 Failure to Maintain Roadway or Structures

If at any time, the Contractor fails to comply with the provisions of [Subsection 105.14](#), the Engineer will immediately notify the Contractor of such noncompliance. If the Contractor fails to remedy the unsatisfactory maintenance within 48 hours after receipt of such notice, the Engineer may immediately proceed to maintain The Work, and the entire cost of this maintenance will be deducted from monies due or to become due the Contractor under the Contract. As an alternative to the Engineer's maintaining the Work, all the Items and quantities of work done, but not properly maintained, may be deducted from the current progress estimate, even if such Items have been paid for in a previous estimate.

105.16 Final Inspection and Acceptance

Upon due written notice from the Contractor of substantial completion of the entire Project, the Engineer will determine if the Project is ready for a Final Inspection. The Engineer will have the final decision on when the Project is substantially complete and thereby ready for a Final Inspection. If the Engineer finds the Project substantially complete the Engineer will schedule the Final Inspection. If all construction provided for and contemplated by the Contract is found completed to the Engineer's satisfaction and all documents required in connection with the Project have been submitted by the Contractor, the Engineer will make the Final Acceptance and notify the Contractor in writing of this acceptance.

If, however, the Final Inspection discloses any work, in whole or part, as being unsatisfactory, the Engineer will provide the Contractor with a written punch-list that includes the necessary instructions for correction of same. The punch-list will also include any remaining work to be completed and any final reports and other documentation required to be submitted by the Contractor. The Contractor shall immediately comply with and execute such instructions. When all construction provided for and contemplated by the Contract is found completed to the Engineer's satisfaction, including submission of any required documentation, the Engineer will make the Final Acceptance and notify the Contractor in writing of this acceptance.

When the Contractor has finished a major portion of the Contract, the Contractor may request that a semi-final inspection be made. At the discretion of the Engineer, who shall be sole judge as to making the inspection, if the work is satisfactory, as described in the first paragraph of this Section, that portion of the Contract may be accepted, opened to traffic, if not already carrying traffic, and the Contractor relieved of the maintenance obligations as described elsewhere in these Specifications.

Such partial acceptance shall in no way relieve the Contractor of responsibility for satisfactory completion of the Contract, or for failure of any portion of the accepted work prior to Final Acceptance of the Project.

Section 400—Hot Mix Asphaltic Concrete Construction

400.1 General Description

This work includes constructing one or more courses of bituminous plant mixture on the prepared foundation or existing roadway surface. The mixture shall conform with lines, grades, thicknesses, and typical cross sections shown on the Plans or established by the Engineer.

This section includes the requirements for all bituminous plant mixtures regardless of the gradation of the aggregates, type and amount of bituminous material, or pavement use.

Work will be accepted on a lot-to-lot basis according to the requirements of this Section and [Section 106](#).

400.1.01 Definitions

Segregated Mixture: Mixture which lacks homogeneity in HMA constituents of such a magnitude that there is a reasonable expectation of accelerated pavement distress or performance problems. May be quantified by measurable changes in temperature, gradation, asphalt content, air voids, or surface texture.

New Construction: A roadway section more than 0.5 mile (800 m) long that is not longitudinally adjacent to the existing roadway. If more than one lane is added, and any of the lanes are longitudinally adjacent to the existing lane, each lane shall be tested under the criteria for a resurfacing project.

Trench Widening: Widening no more than 4 ft. (1.2 m) in width.

Comparison sample: Opposite quarter of material sampled by the Contractor.

Quality assurance sample: Independent sample taken by the Department.

Referee sample: A sample of the material remaining after quartering which is used for evaluation if a comparison of Contractor and Departmental test results is outside allowable tolerances.

400.1.02 Related References

A. Standard Specifications

[Section 106—Control of Materials](#)

[Section 109—Measurement and Payment](#)

[Section 152—Field Laboratory Building](#)

[Section 413—Bituminous Tack Coat](#)

[Section 424—Bituminous Surface Treatment](#)

[Section 802—Coarse Aggregate for Asphaltic Concrete](#)

[Section 828—Hot Mix Asphaltic Concrete Mixtures](#)

B. Referenced Documents

AASHTO T 209

AASHTO T 202

AASHTO T 49

Section 400—Hot Mix Asphaltic Concrete Construction

Laboratory Standard Operating Procedure (SOP) 27, “Quality Assurance for Hot Mix Asphaltic Concrete Plants in Georgia”

Department of Transportation Standard Operating Procedure (SOP) 15

[GDT 38](#)

[GDT 73](#)

[GDT 78](#)

[GDT 83](#)

[GDT 93](#)

[GDT 119](#)

[GDT 125](#)

[GSP 15](#)

[GSP 21](#)

[QPL 1](#)

[QPL 2](#)

[QPL 7](#)

[QPL 26](#)

[QPL 30](#)

[QPL 39](#)

[QPL 41](#)

[QPL 45](#)

[QPL 65](#)

[QPL 67](#)

[QPL 70](#)

[QPL 77](#)

400.1.03 Submittals

A. Invoices

When the Department requests, furnish formal written invoices from a supplier for all materials used in production of HMA. Show the following on the Bill of Lading:

- Date shipped
- Quantity in tons (megagrams)
- Included with or without additives (for asphalt cement)

Purchase asphaltic cement from a supplier who will provide copies of Bill of Lading upon the Department’s request.

Section 400—Hot Mix Asphaltic Concrete Construction

B. Paving Plan

Before starting asphaltic concrete construction, submit a written paving plan to the Engineer for approval. Include the following on the paving plan:

- Proposed starting date
- Location of plant(s)
- Rate of production
- Average haul distance(s)
- Number of haul trucks
- Paver speed feet (meter)/minute for each placement operation
- Mat width for each placement operation
- Number and type of rollers for each placement operation
- Sketch of the typical section showing the paving sequence for each placement operation
- Electronic controls used for each placement operation
- Temporary pavement marking plan

If staged construction is designated in the Plans or contract, provide a paving plan for each construction stage.

If segregation is detected, submit a written plan of measures and actions to prevent segregation. Work will not continue until the plan is submitted to and approved by the Department.

C. Job Mix Formula

After the Contract has been awarded, submit to the Engineer a written job mix formula proposed for each mixture type to be used based on an approved mix design. Furnish the following information for each mix:

- Specific project for which the mixture will be used
- Source and description of the materials to be used
- Mixture I.D. Number
- Proportions of the raw materials to be combined in the paving mixture
- Single percentage of the combined mineral aggregates passing each specified sieve
- Single percentage of asphalt by weight of the total mix to be incorporated in the completed mixture
- Single temperature at which to discharge the mixture from the plant
- Theoretical specific gravity of the mixture at the designated asphalt content
- Name of the person or agency responsible for quality control of the mixture during production

Do the following to have the formulas approved and to ensure their quality:

Section 400—Hot Mix Asphaltic Concrete Construction

1. Submit proposed job mix formulas for review at least two weeks before beginning the mixing operations.
2. Do not start hot mix asphaltic concrete work until the Engineer has approved a job mix formula for the mixture to be used. No mixture will be accepted until the Engineer has given approval.
3. Provide mix designs for all Superpave and 4.75 mm mixes to be used. The Department will provide mix design results for other mixes to be used.
4. After a job mix formula has been approved, assume responsibility for the quality control of the mixtures supplied to the Department according to [Subsection 106.01. –Source of Supply and Quantity of Materials.I](#) :

The materials used in The Work shall meet all quality requirements of the Contract. Materials will not be considered as finally accepted until all tests, including any to be taken from the finished Work have been completed and evaluated. To expedite the inspection and testing of materials, the Contractor shall notify the Engineer in writing of his proposed sources of materials at least 2 weeks before delivery, or earlier if blend determinations or mix designs are required. When required, representative preliminary samples of the character and quality prescribed shall be submitted for examination and testing. The approval of preliminary samples does not obligate the Engineer to accept materials from the same source delivered later. If, after trial, it is found that sources of supply for previously approved materials do not produce uniform and satisfactory products, or if the product from any source proves unacceptable at any time, the Contractor shall furnish materials from other sources. The Engineer shall have the right to reject the entire Output of any source from which he finds it is impractical to secure a continuous flow of uniformly satisfactory material.

Upon request by the Department, the Contractor shall furnish formal written invoices from the materials suppliers. The invoice shall show the date shipped, the quantities, and the unit prices.

The Contractor shall purchase materials from suppliers who are willing for the Contractor to furnish the Department copies of invoices as noted herein upon request by the Department.

Materials used and operations performed under [Section 400- Hot Mix Asphaltic Concrete Construction](#), shall be controlled and tested by the Contractor. This shall be done in such a manner as to produce a uniform product that meets Specification requirements. In the event the Contractor's quality control procedures do not achieve the desired objective, operations shall be suspended until satisfactory results are obtained.

The Contractor's quality control personnel shall be properly instructed and trained to perform all tests and make calculations, and shall be competent to control all processes so that the requirements are met.

D. Quality Control Program

Submit a Quality Control Plan to the Office of Materials and Research for approval. The Quality Control Program will be included as part of the certification in the semiannual plant inspection report.

400.2 Materials

Ensure that materials comply with the specifications listed in Table 1.

Section 400—Hot Mix Asphaltic Concrete Construction

Table 1—Materials Specifications

Material	Subsection
Asphalt Cement, Grade Specified	820.2
Coarse Aggregates for Asphaltic Concrete	802.2.02
Fine Aggregates for Asphaltic Concrete	802.2.01
Mineral Filler	883.1
Heat Stable Anti-Stripping Additive	831.2.04
Hydrated Lime	882.2.03
Silicone Fluid	831.2.05
Bituminous Tack Coat: PG 58-22, PG 64-22, PG 67-22	820.2
Hot Mix Asphaltic Concrete Mixtures	828
Fiber Stabilizing Additives	819

When required, provide Uintaite material, hereafter referred to by the common trade name Gilsonite, as a reinforcing agent for bituminous mixtures. Supply a manufacturer's certification that the Gilsonite is a granular solid which meets the following requirements:

Softening Point (AASHTO: T-53)	300-350 °F (150-175 °C)
Specific Gravity, 77 °F (25 °C) (AASHTO: T-228)	1.04 ± 0.02
Flash Point, COC (AASHTO: T-48)	550 °F (290 °C) Min.
Ash Content (AASHTO: T-111)	1.0% Max.
Penetration, 77 °F (25 °C), 100 gm., 5 sec. (AASHTO: T-49)	0

400.2.01 Delivery, Storage, and Handling

Storage of material is allowed in a properly sealed and insulated system for up to 24 hours except that Stone Matrix Asphalt (SMA), Open-Graded Friction Course (OGFC), or Porous European Mix (PEM) mixtures shall not be stored more than 12 hours. Mixtures other than SMA, OGFC, or PEM may be stored up to 72 hours in a sealed and insulated system, equipped with an auxiliary inert gas system, with the Engineer's approval. Segregation, lumpiness, or stiffness of stored mixture is cause for rejection of the mixture. The Engineer will not approve using a storage or surge bin if the mixture segregates, loses excessive heat, or oxidizes during storage.

The Engineer may obtain mixture samples or recover asphalt cement according to [GDT 119](#). AASHTO T 202 and T 49 will be used to perform viscosity and penetration tests to determine how much asphalt hardening has occurred.

A. Vehicles for Transporting and Delivering Mixtures

Ensure that trucks used for hauling bituminous mixtures have tight, clean, smooth beds.

Follow these guidelines when preparing vehicles to transport bituminous mixtures:

Section 400—Hot Mix Asphaltic Concrete Construction

1. Use an approved releasing agent from [QPL 39](#) in the transporting vehicle beds, if necessary, to prevent the mixture from sticking to the bed. Ensure that the releasing agent is not detrimental to the mixture. When applying the agent, drain the excess agent from the bed before loading.
2. Protect the mixture with a waterproof cover large enough to extend over the sides and ends of the bed. Securely fasten the waterproof cover before the vehicle begins moving.
3. Insulate the front end and sides of each bed with an insulating material with the following specifications:
 - Consists of builders insulating board or equivalent
 - Has a minimum “R” value of 4.0
 - Can withstand approximately 400 °F (200 °C) temperatures

Install the insulating material so it is protected from loss and contamination.

4. Mark each transporting vehicle with a clearly visible identification number.
5. Create a hole in each side of the bed so that the temperature of the loaded mixture can be checked. Ensure that the mixture is delivered to the roadway at a temperature within ± 20 °F (± 11 °C) of the temperature on the job mix formula.

If the Engineer determines that a truck may be hazardous to the Project or adversely affect the quality of the work, remove the truck from the project.

B. Containers for Transporting, Conveying, and Storing Bituminous Material

To transport, convey, and store bituminous material, use containers free of foreign material and equipped with sample valves. Bituminous material will not be accepted from conveying vehicles if material has leaked or spilled from the containers.

400.3 Construction Requirements

400.3.01 omitted.

400.3.02 Equipment

Hot mix asphaltic concrete plants that produce mix for Department use are governed by Quality Assurance for Hot Mix Asphaltic Concrete Plants in Georgia, Laboratory Standard Operating Procedure No. 27.

The Engineer will approve the equipment used to transport and construct hot mix asphaltic concrete. Ensure that the equipment is in satisfactory mechanical condition and can function properly during production and placement operations. Place the following equipment at the plant or project site:

A. Omitted.

B. Plant Equipment

1. Scales

Provide scales as follows:

- a. Furnish (at the Contractor’s expense) scales to weigh bituminous plant mixtures, regardless of the measurement method for payment.
- b. Ensure that the weight measuring devices that provide documentation comply with

Section 400—Hot Mix Asphaltic Concrete Construction

Subsection 109.01. —Measurement and Quantities.I :

The method of measurement and computations to be used in determination of quantities of material furnished and of work performed under the Contract will be those methods generally recognized as conforming to good engineering practice.

Unless otherwise specified, longitudinal measurements for area computations will be made along the surface, and no deductions will be made for individual fixtures having an area of 9 ft² (1 m²) or less. Unless otherwise specified, transverse measurements for area computations will be the neat dimensions shown on the Plans or ordered in writing by the Engineer.

Where payment is to be made by the square yard (square meter) for a specified thickness, the length will be measured on the surface along the centerline and the pay width shall be that width specified on the plans for the Final surface of the completed section. Intermediate courses shall be placed at a width sufficient to support successive courses with no detriment to the stability of the successive courses. The width of material required beyond the pay width will not be eligible for payment and shall be considered incidental to the work.

Structures will be measured according to neat lines shown on the Plans or as altered to fit field conditions.

All items which are measured by the linear foot (linear meter), such as pipe culverts, guard rail, underdrains, etc., will be measured parallel to the base or foundation upon which such structures are placed, unless otherwise shown on the Plans.

In computing volumes of excavation, the average end area method or other acceptable methods will be used.

The term “gage,” when used in connection with the measurement of steel plates, will mean the U.S. Standard Gage.

When the term “gage” refers to the measurement of electrical wire it will mean the wire gage specified in the National Electrical Code.

The term “ton” will mean the short ton consisting of 2,000 pounds avoirdupois. The term “megagram” will mean one metric ton, equivalent to 1,000 kg. Any commodity paid for by weight shall be weighed on scales that have been approved as specified below and which are furnished at the expense of the Contractor or Supplier.

Weighing and measuring systems including remote controls shall be subject to type-approval by the Department of Transportation. The manufacture, installation, performance, and operation of such devices located in Georgia shall conform to, and be governed by, the Official Code of Georgia, Annotated, Section 10-2-5 of the Georgia Weights and Measures Act, the Georgia Weights and Measures Regulations, as amended and adopted, the current edition of the National Bureau of Standards Handbook 44, and these Specifications. Weighing and measuring systems located outside Georgia which are utilized for weighing materials to be used in Department work shall be manufactured, installed, approved, and operated in accordance with applicable laws and regulations for the state in which the scales are located.

All weighing, measuring, and metering devices used to measure quantities for payment shall be suitable for the purpose intended and will be considered to be “commercial devices.” Commodity scales located in Georgia

shall be certified before use for accuracy, condition, etc., by the Weights and Measures Division of the Georgia Department of Agriculture, its authorized representative, or the Georgia Department of Transportation Office

Section 400—Hot Mix Asphaltic Concrete Construction

of Materials and Research. Scales located outside Georgia shall be certified in accordance with applicable laws and regulations for the state in which the scales are located. The Georgia Department of Transportation Office of Materials and Research may certify the scales. This certification shall have been made within a period of not more than one year prior to date of use for weighing commodity.

All equipment and all mechanisms and devices attached thereto or used in connection therewith shall be constructed, assembled, and installed for use so that they do not facilitate the perpetration of fraud. Any scale component or mechanism, which if manipulated would alter true scale values (including manual zero setting mechanisms) shall not be accessible to the scale operator. Such components and mechanisms that would otherwise be accessible to the scale operator shall be enclosed. Provisions shall be made for security seals where appropriate on equipment and accessories. A security seal shall be affixed to any adjustment mechanism designed to be sealed. Scale or accessory devices shall not be used if security seals have been broken or removed.

Any certified scale or scale component which has been repaired, dismantled, or moved to another location shall again be tested and certified before it is eligible for weighing.

Whenever materials that are paid for based on weight are from a source within the State, the scales shall be operated by and the weights attested to by signature and seal of a duly authorized Certified Public Weigher in accordance with Standard Operating Procedure 15 and the Official Code of Georgia, Annotated, Section 10-2-5 of the Georgia Weights and Measures Act as amended and adopted. When such materials originate from another state that has a certified or licensed weigher program, the scales shall be operated by a weigher who is certified by that state in accordance with applicable laws, and weight ticket recordation shall be in accordance with Standard Operating Procedure 15.

When materials are paid for based on weight and originate from another state which has no program for certifying or licensing weighers, the materials shall be weighed on scales located in the State of Georgia by a Certified Public Weigher in accordance with Standard Operating Procedure 15 and the Official Code of Georgia, Annotated, Section 10-2-5 of the Georgia Weights and Measures Act as amended and adopted.

No scale shall be used to measure weights greater than the scale manufacturer's rated capacity. A digital recorder shall be installed as part of any commodity scale. The recorder shall produce a printed digital record on a ticket with the gross, tare, and net weights of the delivery trucks, along with the date and time printed for each ticket. Provisions shall be made so that the scales or recorders may not be manually manipulated during the printing process. The system shall be so interlocked as to allow printing only when the scale has come to rest. Either the gross or net weight shall be a direct scale reading. Printing and recording systems that are capable of accepting keyboard entries shall clearly and automatically differentiate a direct scale weight value from any other weight values printed on the load ticket.

All scales used to determine pay quantities shall be provided to attain a zero balance indication with no load on the load receiving element by the use of semi-automatic zero (push-button zero) or automatic zero maintenance.

Vehicle scales shall have a platform of sufficient size to accommodate the entire length of any vehicle weighed and shall have sufficient capacity to weigh the largest load. Adequate drainage shall be provided to

Section 400—Hot Mix Asphaltic Concrete Construction

prevent saturation of the ground under the scale foundation.

The Engineer, at his discretion, may require the platform scales to be checked for accuracy. For this purpose the Contractor shall load a truck with material of his choosing, weigh the loaded truck on his scales, and then weigh it on another set of certified vehicle scales. When the difference exceeds 0.4 percent of load, the scales shall be corrected and certified by a registered scale serviceman registered in the appropriate class as outlined in the Georgia Weights and Measures Regulations or in accordance with applicable requirements of the state in which the scales are located. A test report shall be submitted to the appropriate representative of the Department of Agriculture.

Materials to be measured by volume in the hauling vehicle shall be hauled in approved vehicles and measured therein at the point of delivery. Vehicles for this purpose may be of any size or type acceptable to the Engineer, provided that the body is of such shape that the actual contents may be readily and accurately determined. All vehicles shall be loaded to their water level capacity as determined by the Engineer, provided that the body is of such shape that the actual contents may be readily and accurately determined.

Cement and lime will be measured by the ton (megagram). Whenever cement or lime is delivered to the Project in tank trucks, a certified weight shall be made at the shipping point by an authorized Certified Public Weigher who is not an employee of the Department. Whenever cement and lime are from a source within the State, the scales shall be operated by the weights attested to by signature and seal of a duly authorized Certified Public Weigher in accordance with Standard Operating Procedure 15 and the Official Code of Georgia, Annotated, Section 10-2-5 of the Georgia Weights and Measures Act as amended and adopted. When such materials originate from another state that has a certified or licensed weigher program, the scales shall be operated by a weigher who is certified by that state in accordance with applicable laws, and the weight ticket recordation shall be in accordance with Standard Operating Procedure 15. When cement and lime originate from another state that has no program for certifying or licensing weighers, the materials shall be weighed on scales located

in the State of Georgia by a Certified Public Weigher in accordance with Standard Operating Procedure 15 and the Official

Code of Georgia, Annotated, Section 10-2-5 of the Georgia Weights and Measures Act as amended and adopted.

The shipping invoice shall contain the certified weights and the signature and seal of the Certified Public Weigher. A security seal shall also be affixed to the discharge pipe cap on the tank truck before leaving the shipping point. The number on the security seal shall also be recorded on the shipping invoice. The shipping invoice for quicklime shall also contain a certified lime purity percentage. Unsealed tank trucks will require reweighing by a Certified Public Weigher.

Timber will be measured by the thousand feet board measure (MFBM) (cubic meter) actually incorporated in the structure. Measurements will be based on nominal widths and thickness and the actual length in place. No additional measurement will be made for splices except as noted for overlaps as shown on the Plans.

The term "Lump Sum" when used as an item of payment will mean complete payment for the Work described in the Contract.

When a complete structure or structural unit (in effect, "Lump Sum" work) is specified as the unit of the measurement, the unit will be construed to include all necessary fittings and accessories. Rental of equipment will be measured as defined in [Subsection 109.05.B.4.:](#)

Section 400—Hot Mix Asphaltic Concrete Construction

Equipment: For any machinery or special equipment (other than small tools) including fuel and lubricant, plus transportation costs, the use of which has been authorized by the Engineer, the Contractor shall receive the rental rates indicated below for the actual time that such equipment is in operation on The Work or the time, as indicated below, the equipment is directed to stand by.

Equipment rates shall be based on the latest edition of the *Rental Rate Blue Book for Construction Equipment* or *Rental Rate Blue Book for Older Construction Equipment*, whichever applies, as published by Equipment Watch using all instructions and adjustments contained therein and as modified below.

Allowable Equipment Rates shall be established as defined below:

- Allowable Hourly Equipment Rate = Monthly Rate/176 x Adjustment Factors x 70%.
- Allowable Hourly Operating Cost = Hourly Operating Cost x 70%.
- Allowable Rate Per Hour = Allowable Hourly Equipment Rate + Allowable Hourly Operating Cost.
- Standby Rate = Allowable Hourly Equipment Rate x 35%

NOTE: The monthly rate is the basic machine plus any attachments.

Standby rates shall apply when equipment is not in operation and is directed by the Engineer to standby for later use. In general, Standby rates shall apply when equipment is not in use, but will be needed again to complete The Work and the cost of moving the equipment will exceed the accumulated standby cost. Payment for standby time will not be made on any day the equipment operates for 8 or more hours. For equipment accumulating less than 8 hours operating time on any normal workday, standby payment will be limited to only that number of hours which, when added to the operating time for that day equals 8 hours. Standby payment will not be made on days that are not normally considered workdays.

The Department will not approve any rates in excess of the rates as outlined above unless such excess rates are supported by an acceptable breakdown of cost.

Payable time periods will not include:

- Time elapsed while equipment is broken down
- Time spent in repairing equipment, or
- Time elapsed after the Engineer has advised the Contractor the equipment is no longer needed

If a piece of equipment is needed which is not included in the above *Blue Book* rental rates, reasonable rates shall be agreed upon in writing before the equipment is used. All equipment charges by persons or firms other than the contractor shall be supported by invoices.

Transportation charges for each piece of equipment to and from the site of the Work will be paid provided:

Section 400—Hot Mix Asphaltic Concrete Construction

- The equipment is obtained from the nearest approved source
- The return charges do not exceed the delivery charges
- Haul rates do not exceed the established rates of licensed haulers, and such charges are restricted to those units of equipment not already available and not on or near the project

No additional compensation will be made for equipment repair.

When standard manufactured items are specified as fence, wire, plates, rolled shapes, pipe conduits, etc., and these items are identified by gage, unit weight, section dimensions, etc., such identification will be considered to be nominal weights or dimensions. Unless more stringently controlled by tolerance in cited Specifications, manufacturing tolerances established by the industries involved will be accepted.

- c. When not using platform scales, provide weight devices that record the mixture net weights delivered to the truck. A net weight system will include, but is not limited to:
 - Hopper or batcher-type weight systems that deliver asphaltic mixture directly to the truck
 - Fully automatic batching equipment with a digital recording device
- d. Use a net weight printing system only with automatic batching and mixing systems approved by the Engineer.
- e. Ensure that the net weight scale mechanism or device manufacturer, installation, performance, and operation meets the requirements in [Subsection 109.01, —Measurement and Quantities I](#)
- f. Provide information on the Project tickets according to Department of Transportation SOP-15.

2. Time-Locking Devices

Furnish batch type asphalt plants with automatic time-locking devices that control the mixing time automatically. Construct these devices so that the operator cannot shorten or eliminate any portion of the mixing cycle.

3. Surge- and Storage-Systems

Provide surge and storage bins as follows:

- a. Ensure that bins for mixture storage are insulated and have a working seal, top and bottom, to prevent outside air infiltration and to maintain an inert atmosphere during storage.

Bins not intended as storage bins may be used as surge bins to hold hot mixtures for part of the working day. However, empty these surge bins completely at the end of the working day.
- b. Ensure that surge and storage bins can retain a predetermined minimum level of mixture in the bin when the trucks are loaded.
- c. Ensure that surge and storage systems do not contribute to mix segregation, lumpiness, or stiffness.

4. Controls for Dust Collector Fines:

Control dust collection as follows:

- a. When collecting airborne aggregate particles and returning them to the mixture, have the return system meter all or part of the collected dust uniformly into the aggregate mixture and waste the excess. The collected dust percentage returned to the mixture is subject to the Engineer's approval.
- b. When the collected dust is returned directly to the hot aggregate flow, interlock the dust feeder with the hot aggregate flow and meter the flow to maintain a flow that is constant, proportioned, and uniform.

Section 400—Hot Mix Asphaltic Concrete Construction

5. Mineral Filler Supply System

When mineral filler is required as a mixture ingredient:

- a. Use a separate bin and feed system to store and proportion the required quantity into the mixture with uniform distribution.
- b. Control the feeder system with a proportioning device that meets these specifications:
 - Is accurate to within ± 10 percent of the filler required
 - Has a convenient and accurate means of calibration
 - Interlocks with the aggregate feed or weigh system to maintain the correct proportions for all rates of production and batch sizes
- c. Provide flow indicators or sensing devices for the mineral filler system and interlock them with the plant controls to interrupt the mixture production if mineral filler introduction fails.
- d. Add mineral filler to the mixture as follows, according to the plant type:
 - Batch Type Asphalt Plant. Add mineral filler to the mixture in the weigh hopper.
 - Continuous Plant Using Pugmill Mixers. Feed the mineral filler into the hot aggregate before it is introduced into the mixer so that dry mixing is accomplished before the bituminous material is added.
 - Continuous Plants Using the Drier-Drum Mixers. Add the mineral filler so that dry mixing is accomplished before the bituminous material is added and ensure that the filler does not become entrained into the air stream of the drier.

6. Hydrated Lime Treatment System

When hydrated lime is required as a mixture ingredient:

- a. Use a separate bin and feed system to store and proportion the required quantity into the mixture.
- b. Ensure that the aggregate is uniformly coated with hydrated lime aggregate before adding the bituminous material to the mixture. Add the hydrated lime so that it will not become entrained in the exhaust system of the drier or plant.
- c. Control the feeder system with a proportioning device that meets these specifications:
 - Is accurate to within ± 10 percent of the amount required
 - Has a convenient and accurate means of calibration
 - Interlocks with the aggregate feed or weigh system to maintain the correct proportions for all rates of production and batch sizes and to ensure that mixture produced is properly treated with lime
- d. Provide flow indicators or sensing devices for the hydrated lime system and interlock them with the plant controls to interrupt mixture production if hydrated lime introduction fails.

7. Net Weight Weighing Mechanisms

Certify the accuracy of the net weight weighing mechanisms by an approved registered scale serviceperson at least once every 6 months. Check the accuracy of net weight weighing mechanisms at the beginning of Project production and thereafter as directed by the Engineer. Check mechanism accuracy as follows:

Section 400—Hot Mix Asphaltic Concrete Construction

- a. Weigh a load on a set of certified commercial truck scales. Ensure that the difference between the printed total net weight and that obtained from the commercial scales is no greater than 4 lbs/1,000 lbs (4 kg/Mg) of load.

Check the accuracy of the bitumen scales as follows:

- Use standard test weights.
- If the checks indicate that printed weights are out of tolerance, have a registered scale service person check the batch scales and certify the accuracy of the printer.
- While the printer system is out of tolerance and before its adjustment, continue production only if using a set of certified truck scales to determine the truck weights.

- b. Have plants that use batch scales maintain ten 50 lb (25 kg) standard test weights at the plant site to check batching scale accuracy.

Ensure that plant scales that are used only to proportion mixture ingredients, not to determine pay quantities, are within two percent throughout the range.

8. Fiber Supply System

When stabilizing fiber is required as a mixture ingredient:

- a. Use a separate feed system to store and proportion by weight the required quantity into the mixture with uniform distribution.
- b. Control the feeder system with a proportioning device that meets these Specifications:
 - Is accurate to within ± 10 percent of the amount required. Automatically adjusts the feed rate to maintain the material within this tolerance at all times
 - Has a convenient and accurate means of calibration
 - Provide in-process monitoring, consisting of either a digital display of output or a printout of feed rate, in pounds (kg) per minute, to verify feed rate
 - Interlocks with the aggregate feed or weigh system to maintain the correct proportions for all rates of production and batch sizes
- c. Provide flow indicators or sensing devices for the fiber system and interlock them with the plant controls to interrupt the mixture production if fiber introduction fails or if the output rate is not within the tolerances given above.
- d. Introduce the fiber as follows:
 - When a batch type plant is used, add the fiber to the aggregate in the weigh hopper. Increase the batch dry mixing time by 8 to 12 seconds from the time the aggregate is completely emptied into the mixer to ensure the fibers are uniformly distributed prior to the injection of asphalt cement into the mixer.
 - When a continuous or drier-drum type plant is used, add the fiber to the aggregate and uniformly disperse prior to the injection of asphalt cement. Ensure the fibers will not become entrained in the exhaust system of the drier or plant.

C. Equipment at Project Site:

Section 400—Hot Mix Asphaltic Concrete Construction

1. Cleaning Equipment:

Provide sufficient hand tools and power equipment to clean the roadway surface before placing the bituminous tack coat. Use power equipment that complies with [Subsection 424.3.02.F, –Power Broom and Power Blower.I :](#)

Provide at least one power broom and one power blower, or a combination power broom and blower that can remove dust or loose materials from the road surface.

2. Pressure Distributor

To apply the bituminous tack coat, use a pressure distributor that complies with [Subsection 424.3.02.B, –Pressure Distributor.I :](#)

The Department will inspect annually the pressure distributor before it is used in the work. If the distributor is approved, the Department will attach an equipment certification sticker to the distributor. The pressure distributor should be equipped as follows:

1. Mount the pressure distributor on pneumatic tires wide enough to prevent damage to the road surface.
2. Design, equip, maintain, and operate the distributor so that the bituminous material will be heated and applied evenly throughout the length of the spray bars. Ensure that it maintains a constant, uniform pressure on the nozzles.
3. Install screens between the tank and the nozzles and clean them frequently to prevent clogging.
4. Use an adjustable distributor that can deliver controlled amounts of bituminous material from 0.04 to 1.0 gal/yd², ± 0.02 gal/yd² (0.18 to 4.53 L/m², ± 0.10 L/m²) up to 24 ft (7.2 m) wide without atomization, streaking, or pulsation in the flow.
5. Use a distributor equipped with the following:
 - A tachometer and thermometers to indicate the application rate and the temperature of the tank contents
 - Measuring devices to accurately indicate the amount of bituminous material, in gallons (liters), in the distributor before and after each application
 - Full circulating spray bars that can be adjusted laterally to conform to a stringline and capable of vertical and horizontal adjustment.
 - A positive shut-off control to prevent dripping bituminous material on the roadway
 - A distributor tank equipped with a sample valve in a safe and convenient location to obtain bituminous material samples

3. Bituminous Pavers

To place hot mix asphaltic concrete, use bituminous pavers that can spread and finish courses that are:

- As wide and deep as indicated on the Plans
- True to line, grade, and cross section
- Smooth
- Uniform in density and texture

Section 400—Hot Mix Asphaltic Concrete Construction

- a. Continuous Line and Grade Reference Control. Furnish, place, and maintain the supports, wires, devices, and materials required to provide continuous line and grade reference control to the automatic paver control system.
- b. Automatic Screed Control System. Equip the bituminous pavers with an automatic screed control system actuated from sensor-directed mechanisms or devices that will maintain the paver screed at a pre-determined transverse slope and elevation to obtain the required surface.
- c. Transverse Slope Controller. Use a transverse slope controller capable of maintaining the screed at the desired slope within ± 0.1 percent. Do not use continuous paving set-ups that result in unbalanced screed widths or off-center breaks in the main screed cross section unless approved by the Engineer.
- d. Screed Control. Equip the paver to permit the following four modes of screed control. The method used shall be approved by the Engineer.
 - Automatic grade sensing and slope control
 - Automatic dual grade sensing
 - Combination automatic and manual control
 - Total manual control

Ensure that the controls are referenced with a taut string or wire set to grade, or with a ski-type device or mobile reference at least 30 ft (9 m) long when using a conventional ski. A non-contacting laser or sonar-type ski with at least four referencing mobile stations may be used with a reference at least 24 ft. (7.3 m) long. Under limited conditions, a short ski or shoe may be substituted for a long ski on the second paver operating in tandem, or when the reference plane is a newly placed adjacent lane.

Automatic screed control is required on all Projects; however, when the Engineer determines that Project conditions prohibit the use of such controls, the Engineer may waive the grade control, or slope control requirements, or both.

- e. Paver Screed Extension. When the laydown width requires a paver screed extension, use bolt-on screed extensions to extend the screeds, or use an approved mechanical screed extension device. When the screed is extended, add auger extensions according to the paver manufacturer's recommendations.

<p>Note: Do not use extendible strike-off devices instead of approved screed extensions. Only use a strike-off device in areas that would normally be luted in by hand labor.</p>

4. Compaction Equipment

Ensure that the compaction equipment is in good mechanical condition and can compact the mixture to the required density. The compaction equipment number, type, size, operation, and condition is subject to the Engineer's approval

5. Materials Transfer Vehicle (MTV)

- a. Use a Materials Transfer Vehicle (MTV) when placing asphaltic concrete mixtures on Projects on the

Section 400—Hot Mix Asphaltic Concrete Construction

state route system with the following conditions:

- 1) When to use:
 - The ADT is equal to or greater than 6000,
 - The project length is equal to or greater than 3000 linear feet (915 linear meters),
 - The total tonnage (megagrams) of all asphaltic concrete mixtures is greater than 2000 tons (1815 Mg).
 - 2) Where to use:
 - Mainline of the traveled way
 - Collector/distributor (C/D) lanes on Interstates and limited access roadways
 - Leveling courses at the Engineer's discretion
- b. Ensure the MTV and conventional paving equipment meet the following requirements:
- 1) MTV
 - Has a truck unloading system which receives mixture from the hauling equipment and independently deliver mixtures from the hauling equipment to the paving equipment.
 - Has mixture remixing capability by either a storage bin in the MTV with a minimum capacity of 14 tons (13 megagrams) of mixture and a remixing system in the bottom of MTV storage bin, or a dual pugmill system located in the paver hopper insert with two full length transversely mounted paddle mixers to continuously blend the mixture as it discharges to a conveyor system.
 - Provides to the paver a homogeneous, non-segregated mixture of uniform temperature with no more than 20 °F(18 °C) difference between the highest and lowest temperatures when measured transversely across the width of the mat in a straight line at a distance of one foot to three feet from the screed while the paver is operating.
 - 2) Conventional Paving Equipment has a paver hopper insert with a minimum capacity of 14 tons (13 Mg) installed in the hopper of conventional paving equipment when an MTV is used.
- c. If the MTV malfunctions during spreading operations, discontinue placement of hot mix asphaltic concrete after there is sufficient hot mix placed to maintain traffic in a safe manner. However, placement of hot mix asphaltic concrete in a lift not exceeding 2 in. (50 mm) may continue until any additional hot mix in transit at the time of the malfunction has been placed. Cease spreading operations thereafter until the MTV is operational.
- d. Ensure the MTV is empty when crossing a bridge and is moved across without any other Contractor vehicles or equipment on the bridge. Move the MTV across a bridge in a travel lane and not on the shoulder. Ensure the speed of the MTV is no greater than 5 mph (8 kph) without any acceleration or deceleration while crossing a bridge.

400.3.03 Preparation

A. Prepare Existing Surface

Section 400—Hot Mix Asphaltic Concrete Construction

Prepare the existing surface as follows:

1. Clean the Existing Surface. Before applying hot mix asphaltic concrete pavement, clean the existing surface to the Engineer's satisfaction.

2. Patch and Repair Minor Defects

Before placing leveling course:

a. Correct potholes and broken areas that require patching in the existing surface and base as directed by the Engineer.

b. Cut out, trim to vertical sides, and remove loose material from the areas to be patched.

c. Prime or tack coat the area after it has been cleaned. Compact patches to the Engineer's satisfaction. Material for patches does not require a job mix formula, but shall meet the gradation range shown in [Section 828](#). The Engineer must approve the asphalt content to be used.

3. Apply Bituminous Tack Coat

Apply the tack coat according to [Section 413](#).

Construction

A. Seasonal and Weather Limitation

Do not apply tack coat if the existing surface is wet or frozen. Do not place emulsified asphalt if the air temperature in the shade is less than 40 °F (4 °C).

B. Application

Coat the entire areas to be paved with the tack coat unless directed otherwise by the Engineer. Apply tack coat with distributor spray bars instead of hand hoses, except in small areas that are inaccessible to spray bars.

C. Temperature of Material

Apply bituminous materials within the temperature ranges specified below.

Bituminous Materials	Temperature of Application °F (°C)
Asphalt	350 - 400 (175 - 205)
CRS-2h	140 - 180 (60 - 80)
CRS-3	140 - 180 (60 - 80)

D. Cleaning

Immediately before applying the tack coat, clean the entire area free of loose dirt, clay, and other foreign materials.

E. Application Rate

The Engineer will determine the application rate of the bituminous tack coat.

F. Limitations and Areas Coated

Apply only enough tack coat to the prepared road surface that can be covered with the new pavement course the same working day the tack coat is applied.

G. Maintenance and Protection

After applying the tack coat material, allow it to break until it is tacky enough to receive the surface course. Do not allow traffic on the tack.

The Engineer will determine the application rate, which must be within the limitations Table 2.

Table 2—Application Rates for Bituminous Tack, gal/yd² (L/m²)

	Minimum	Maximum
Under OGFC and PEM Mixes	0.06 (0.270)	0.08 (0.360)
All Other Mixes	0.04 (0.180)	0.06(0.270)
*On thin leveling courses and freshly placed asphaltic concrete mixes, reduce the application rate to 0.02 to 0.04 gal/yd ² (0.09 to 0.18 L/m ²).		

B. Place Patching and Leveling Course

1. When the existing surface is irregular, bring it to the proper cross section and grade with a leveling course of hot mix asphaltic concrete materials.
2. Use leveling at the same Superpave Mix Design Level specified for the surface course except when leveling is no greater than 0.75 inch (19 mm).
3. Place leveling at the locations and in the amounts directed by the Engineer.
4. Use leveling course mixtures that meet the requirements of the job mix formulas defined in:

- [Subsection 400.3 .05.A. -Observe Composition of Mixtures](#)
- [Section 828- Hot mix Asphaltic Concrete Mixtures:](#)

This specification includes the requirements for hot mix asphaltic concrete mixtures, including:

- Open-graded surface mixtures
- Stone Matrix Asphalt mixtures
- Superpave asphaltic concrete mixtures
- Fine-graded mixtures

828.1.01 Definitions

Nominal Maximum Sieve Size: One standard sieve size larger than the first sieve to retain more than ten percent.

828.1.02 Related References

A. Standard Specifications

[Section 800– Coarse Aggregate](#)

[Section 802–Aggregates for Asphaltic Concrete](#)

[Section 820–Asphalt Cement](#)

[Section 831–Admixtures](#)

B. Referenced Documents

AASHTO TP 4

AASHTO PP 2

AASHTO TP 8-94

AASHTO T 112

AASHTO T 209

AASHTO T 305

Standard Operating Procedure (SOP) 2 SP–Control of Superpave Bituminous Mixture Designs

[GDT 4](#)

[GDT 56](#)

Section 400—Hot Mix Asphaltic Concrete Construction

[GDT 66](#)

[GDT 115](#)

[GDT 125](#)

[QPL 26](#)

[QPL 41](#)

828.2 Materials

A. Requirements

All mixtures are designated based on the Nominal Maximum Sieve Size. Determine the amount finer than No. 200 (75 μm) by washing (See [GDT 4](#)) or by the correlation procedure described in [GDT 125](#). Use

hot mix asphaltic concrete mixtures that meet the following requirements:

1. Ensure the materials used to prepare the mixtures are approved by the Engineer before incorporating into the Work.
2. Use aggregate groups and blends that meet the following pay item designations, as indicated in the Proposal and Plans:

Section 828—Hot Mix Asphaltic Concrete Mixtures

Pay Item Designation	Allowable Aggregate Groups
Group I or II	100% of Group I, Group II, or Blend I.
Group II only	Only 100% Group II.
Blend I	Either 100% Group II material or a blend of Group I and Group II. Do not use Group I material for more than 60% by weight of the total aggregates, nor more than 50% by weight of the coarse aggregate portion.

3. Use Group I, Group II, or a blend of both aggregate groups, for patching or leveling. Mixes are listed in [Subsection 828.2.03](#) and [Subsection 828.2.04](#).
4. Design mixes using the Superpave System for Volumetric Design (AASHTO TP 4 and AASHTO PP 2) unless stated otherwise. Designs shall be performed by qualified and approved laboratories and technicians as specified in SOP-2 SP - Control of Superpave Bituminous Mixture Designs.
5. Ensure individual test results meet Mixture Control Tolerances
6. Include hydrated lime in all paving courses except where noted. For a list of hydrated lime sources, see [QPL 41](#).
 - a. Add lime to virgin aggregate mixtures at a minimum rate of 1 percent of the total dry aggregate weight.
 - b. Add lime to recycled mixtures at a minimum rate of 1 percent of the virgin aggregate portion, plus a minimum of 0.5 percent of the aggregate in the reclaimed asphalt pavement (RAP) portion.
 - c. Add more lime and an approved heat-stable, anti-stripping additive that meets the requirements of [Subsection 831.2.04](#), “Heat Stable Anti-Stripping Additive,” if necessary, to meet requirements for mixture properties. However, the Department will not pay for the additional required materials. For a list of Heat Stable Anti- Stripping Additive sources, please see [QPL 26](#).
 - d. On PR, LARP, airport, bridge replacement, and parking lot projects designated at Mix Design Level A, asphalt cement may include an approved, heat-stable, anti-stripping additive that meets the requirements of [Subsection 831.2.04](#), “Heat Stable Anti-Stripping Additive” instead of hydrated lime, unless specified in the Pay Item.
 - 1) Add at a minimum rate of 0.5 percent of the AC portion.
 - 2) Ensure the additive treated mix meets the minimum tensile splitting ratio:

Tensile Splitting Ratio	Type of Asphaltic Concrete
0.4	4.75 mm mix
0.6	All other mixes

7. Use performance grade PG 67-22 asphalt cement in all mixtures except as follows:
 - a. b. For RAP mixtures, the Engineer will determine the performance grade to be used.
 - c. On PR, LARP, airport, bridge replacement, and parking lot projects, PG 64-22 may be substituted for PG 67-22. Use only performance grade PG 76-22 for all mixtures that specify polymer-modified asphalt in the pay item designation.
8. Use of local sand is restricted as follows:
 - a. No more than 20 percent, based on total aggregate weight, may be used in mixtures for shoulder construction and on projects designed at Mix Design Level A.
 - b. For mixtures placed on the mainline traveled way of projects designed at Mix Design Level B, C, or D (except interstate projects), local sand may be used only in the 25 mm Superpave and shall not exceed 20 percent based on total aggregate weight.
 - c. Do not use local sand in any mixture placed on the traveled way of Interstate mainline or ramps. No more than 20 percent local sand, based on total aggregate weight, may be used in mixtures for shoulder construction.
 - d. Do not use local sand that contains more than 7 percent clay.
 - e. Do not use local sand that contains any clay lumps as determined by AASHTO T 112.

B. Fabrication

General Provisions 101 through 150.

Section 828—Hot Mix Asphaltic Concrete Mixtures

C. Acceptance

Ensure the mix design has been reviewed and approved by the Department prior to beginning production.

1. Rutting Susceptibility Testing

- a. Fabricate three beams or six cylindrical specimens from each asphalt mix for the test using [GDT 115](#).
- b. Design mixtures which meet the following criteria for rutting where tested using [GDT 115](#):
- c. Mix Design Level A – 0.3 in (7 mm) maximum

Mix Design Level B – 0.25 in (6 mm) maximum

Mix Design Level C & D – 0.2 in. (5 mm) maximum

Mixtures designed prior to July 1, 2001 which do not exceed 0.2 in (5 mm) rutting when tested at 120 °F (49 °C) using [GDT 115](#) may be acceptable.

Tests will not be required for mixtures designed exclusively for trench widening nor for the 4.75 mm mix, nor for open-graded surface mixtures.

2. Fatigue Testing

The Department may perform the test according to AASHTO TP 8-94 or other Department approved procedure.

D. Materials Warranty

General Provisions 101 through 150.

828.2.01 Open-Graded Surface Mixture

A. Requirements

1. Use the information in the following table for job mix formulas and design limits:

Mixture Control Tolerance	Asphaltic Concrete	9.5 mm OGFC	12.5 mm OGFC	12.5 mm PEM
	Grading Requirements	Percent Passing		
±0.0	3/4 in (19 mm) sieve		100	100
±6.1	1/2 in (12.5 mm) sieve	100*	85-100	80-100
±5.6	3/8 in (9.5 mm) sieve	85-100	55-75	35-60
±5.7	No. 4 (4.75 mm) sieve	20-40	15-25	10-25
±4.6	No. 8 (2.36 mm) sieve	5-10	5-10	5-10
±2.0	No. 200 (75 µm) sieve	2-4	2-4	1-4
	Design Requirements			
±0.4	Range for % AC	6.0-7.25	5.75-7.25	5.5-7.0
	Class of stone (Section 800)	"A" only	"A" only	"A" only
	Coating retention (GDT-56)	95	95	95
	Drain-down, AASHTO T 305 (%)	<0.3	<0.3	<0.3

* Mixture control tolerance not applicable to this sieve for this mix.

2. Use only PG 76-22 (specified in [Section 820](#)) in the 12.5 mm OGFC and 12.5 mm PEM mixtures.

3. Use a stabilizing fiber, which meets the requirements of [Section 819](#) in 12.5 mm OGFC and 12.5 mm PEM mixtures. The dosage rate will be as recommended by the Engineer and shall be sufficient to prevent excessive drain-down.

B. Fabrication

General Provisions 101 through 150.

Section 828—Hot Mix Asphaltic Concrete Mixtures

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

General Provisions 101 through 150.

828.2.02 Stone Matrix Asphalt Mixtures

A. Requirements

Use the information in the following table for the job mix formula and design limits.

Mixture Control Tolerance	Asphaltic Concrete	9.5 mm SMA	12.5 mm SMA	19 mm SMA
	Grading Requirements	Percent Passing		
0.0 ±	1- in (25 mm) sieve			100
7.0 ±	3/4 in (19 mm) sieve		100*	90-100
6.1 ±	1/2 in (12.5 mm) sieve	100*	85-100	44-70
5.6 ±	3/8 in (9.5 mm) sieve	70-100	50-75	25-60
5.7 ±	No. 4 (4.75 mm) sieve	28-50	20-28	20-28
4.6 ±	No. 8 (2.36 mm) sieve	15-30	16-24	15-22
3.8 ±	No. 50 (300 µm) sieve	10-17	10-20	10-20
2.0 ±	No. 200 (75 µm) sieve	8-13	8-12	8-12
	Design Requirements			
0.4 ±	Range for % AC	6.0-7.5	5.8-7.5	5.5-7.5
	Design optimum air voids (%)	3.5 0.5 ±	3.5 0.5 ±	3.5 0.5 ±
	% aggregate voids filled with AC (VFA)	70-90	70-90	70-90
	Tensile splitting ratio after freeze-thaw cycle GDT-66	80%	80%	80%
	Drain-down AASHTO T 305 (%)	<0.3	<0.3	<0.3

* Mixture control tolerance not applicable to this sieve for this mix.

1. Compact SMA mixtures at 50 gyrations with the Superpave Gyratory compactor or 50 blows with the Marshall compactor.
2. A Tensile splitting ratio of no less than 70% may be acceptable so long as all individual test values exceed 100 psi (690 kPa).
3. Stone Matrix Asphalt mixtures shall contain asphalt cement, mineral filler, and fiber stabilizing additives which meet the following requirements:
 - a. Use asphalt cement that meets requirements of PG 76-22 of [Section 820](#).
 - b. Use mineral filler that meets requirements of [Section 883](#) and has been approved by the Engineer. Local sand shall not be used in lieu of mineral filler.
 - c. Treat these mixes with a fiber-stabilizing additive, which meets the requirements of [Section 819](#). The dosage rate will be as recommended by the Engineer and shall be sufficient to prevent excessive drain-down.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

See [Subsection 828.2.C](#).

Section 828—Hot Mix Asphaltic Concrete Mixtures

D. Materials Warranty

General Provisions 101 through 150.

828.2.03 Superpave Asphaltic Concrete Mixtures

A. Requirements

Use the information in the following table for job mix formula and design limits:

Mixture Control Tolerance	Asphaltic Concrete	9.5 mm Superpave Level A	9.5 mm Superpave Level B,C,D	12.5 mm Superpave	19 mm Superpave	25 mm Superpave
	Grading Requirements	Percent Passing				
	1-1/2 in (37.5 mm) sieve					100
8.0 ±	1- in (25.0 mm) sieve				100*	90-100
8.0 ±	3/4 in (19.0 mm) sieve			100*	90-100	55-89
6.0**±	1/2 in (12.5 mm) sieve	100*	100*	90-100	60-89	50-70
5.6 ±	3/8 in (9.5 mm) sieve	90-100	90-100	70-85	55-75	
5.6 ±	No. 4 (4.75 mm) sieve	65-85	55-75			
4.6 ±	No. 8 (2.36 mm) sieve	53-58	42-47	34-39	29-34	25-30
2.0 ±	No. 200 (75 µm) sieve	4.0-7.0	4.0-7.0	3.5-7.0	3.5-6.0	3.0-6.0

* Mixture control tolerance not applicable to this sieve for this mix.

**Mixture control tolerance shall be ± 8.0% for this sieve for 19 mm Superpave.

Superpave mixtures shall also meet the following requirements:

- The Mixture Control Tolerance for asphalt cement shall be ± 0.4%.
- Volumetric Criteria

Design Parameter	Design Criteria
a. Percent of Maximum Specific Gravity (%G _{mm}) at the design number of gyrations, (N _d) (See Note 1)	96%
b. % G _{mm} at the initial number of gyrations, (N _i)	Level A <91.5% Level B <90.5% Level C & D <89%
c. Percent voids in mineral aggregate (VMA) at N _d	See Table 828.2.03.A.3
d. Percent voids filled with asphalt (VFA) at N _d	See Table 828.2.03.A.4
e. Fines to effective asphalt binder ratio (F/P _{be})	
1) Asphaltic concrete 9.5 mm Superpave (Level A)	0.6-1.2
2) All Superpave mixtures excluded in Item 1	0.8-1.6
f. Tensile strength (GDT 66)	
1) Ratio (See Note 2)	80% min.
2) Stress	60 psi (414 kPa) min.
g. Retention of Coating (GDT 56)	95% min.

Note 1: Maximum specific gravity (G_{mm}) determined in accordance with AASHTO T 209.

Section 828—Hot Mix Asphaltic Concrete Mixtures

Note 2: A tensile splitting ratio of no less than 70% may be acceptable so long as all individual test values exceed 100 psi (690 kPa).

3. VMA Criteria

Nominal Maximum Sieve Size	Minimum % VMA*
1 in (25 mm)	12
3/4 in (19 mm)	13
1/2 in (12.5 mm)	14
3/8 in (9.5)	15

* VMA is to be determined based on effective specific gravity of the aggregate (G_{se}).

4. VFA Criteria

MIX DESIGN LEVEL	RANGE % VFA	
	Minimum	Maximum
A	67	80
B	65	78
C	65	76
D	65	75

5. Superpave Gyrotory Compaction Criteria

MIX DESIGN LEVEL	NUMBER OF GYRATIONS	
	N_i	N_d
A	6	50
B	7	75
C	8	100
D	9	125

Use mix Design Level A for all Superpave mixes used as shoulder surface mixture, trench widening, temporary detour, or sub-base mixture under Portland cement concrete pavement unless specified otherwise in the plans.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

See [Subsection 828.2.C](#).

D. Materials Warranty

General Provisions 101 through 150.

828.2.04 Fine Graded Mixtures

A. Requirements

Use the following table for the job mix formula and design limits:

ASPHALTIC CONCRETE - 4.75 mm Mix		
MIXTURE CONTROL	GRADING	

Section 400—Hot Mix Asphaltic Concrete

TOLERANCE	REQUIREMENTS	% Passing
0.0 ±	1/2 in (12.5 mm) sieve	100*
5.6 ±	3/8 in (9.5 mm) sieve	90-100
5.7 ±	No. 4 (4.75 mm) sieve	75-95
4.6 ±	No. 8 (2.36 mm) sieve	60-65
3.8 ±	No. 50 (300 μ) sieve	20-50
2.0 ±	No. 200 (75 μ) sieve	4-12
	DESIGN REQUIREMENTS	
0.4 ±	Range for % AC	6.00-7.50
	Design optimum air voids (%)	4-7
	% Aggregate voids filled with AC	50-80
	Tensile splitting ratio after freeze-thaw cycle (GDT 66)	80% minimum

* Mixture control tolerance not applicable to this sieve for this mix.

Design this mixture at Superpave Mix Design Level A.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

General Provisions 101 through 150.

- Leveling acceptance schedules in [Subsection 400.3.06.A, -Acceptance Plans for Gradation and Asphalt Cement Content](#)

- If the leveling and patching mix type is undesignated, determine the mix type by the thickness or spread rate according to Table 3, but do not use 4.75 mm mix on interstate projects.

Table 3—Leveling and Patching Mix Types

Thickness	Rate of Spread	Type of Mix
Up to 0.75 in (19 mm)	Up to 85 lbs/yd ² (45 kg/m ²)	4.75 mm Mix or 9.5 mm Superpave (Level A)
0.75 to 1.5 in (19 to 38 mm)	85 to 165 lbs/yd ² (45 to 90 kg/m ²)	9.5 mm Superpave (Level B)
1.5 to 2 in (38 to 50 mm)	165 to 220 lbs/yd ² (90 to 120 kg/m ²)	12.5 mm Superpave *
2 to 3 in (50 to 75 mm)	220 to 330 lbs/yd ² (120 to 180 kg/m ²)	19 mm Superpave *
Over 3 in (75 mm)	Over 330 lbs/yd ² (180 kg/m ²)	25 mm Superpave

* These mixtures may be used for isolated patches no more than 6 in. (150 mm) deep and no more than 4 ft. (1.2 m) in diameter or length.

400.3.04 Fabrication

Section 400—Hot Mix Asphaltic Concrete

General Provisions 101 through 150.

400.3.05 Construction

Provide the Engineer at least one day's notice prior to beginning construction, or prior to resuming production if operations have been temporarily suspended.

A. Observe Composition of Mixtures

1. Calibration of plant equipment

If the material changes, or if a component affecting the ingredient proportions has been repaired, replaced, or adjusted, check and recalibrate the proportions.

Calibrate as follows:

- a. Before producing mixture for the Project, calibrate by scale weight the electronic sensors or settings for proportioning mixture ingredients.
- b. Calibrate ingredient proportioning for all rates of production.

2. Mixture control

Compose hot mix asphaltic concrete from a uniform mixture of aggregates, bituminous material, and if required, hydrated lime, mineral filler, or other approved additive.

Make the constituents proportional to produce mixtures that meet the requirements in [Section 828](#). The general composition limits prescribed are extreme ranges within which the job mix formula must be established. Base mixtures on a design analysis that meets the requirements of [Section 828](#).

If control test results show that the characteristic tested does not conform to the job mix formula control tolerances given in [Section 828](#), take immediate action to ensure that the quality control methods are effective.

Control the materials to ensure that extreme variations do not occur. Maintain the gradation within the composition limits in [Section 828](#).

B. Prepare Bituminous Material

Uniformly heat the bituminous material to the temperature specified in the job mix formula with a tolerance of ± 20 °F (± 10 °C).

C. Prepare the Aggregate

Prepare the aggregate as follows:

1. Heat the aggregate for the mixture, and ensure a mix temperature within the limits of the job mix formula.
2. Do not contaminate the aggregate with fuel during heating.
3. Reduce the absorbed moisture in the aggregate until the asphalt does not separate from the aggregate in the prepared mixture. If this problem occurs, the Engineer will establish a maximum limit for moisture content in the aggregates. When this limit is established, maintain the moisture content below this limit.

Section 400—Hot Mix Asphaltic Concrete

D. Prepare the Mixture

Proportion the mixture ingredients as necessary to meet the required job mix formula. Mix until a homogenous mixture is produced.

1. Add Mineral Filler

When mineral filler is used, introduce it in the proper proportions and as specified in [Subsection 400.3 .02.B.5. —Mineral Filler Supply System.l](#)

2. Add Hydrated Lime

When hydrated lime is included in the mixture, add it at a rate specified in [Section 828](#) and the job mix formula. Use methods and equipment for adding hydrated lime according to [Subsection 400.3 .02.B.6. —Hydr ated Lime Treat ment System.l](#)

Add hydrated lime to the aggregate by using Method A or B as follows:

Method A—Dry Form—Add hydrated lime in its dry form to the mixture as follows, according to the type of plant:

- a. Batch Type Asphalt Plant: Add hydrated lime to the mixture in the weigh hopper or as approved and directed by the Engineer.
- b. Continuous Plant Using Pugmill Mixer: Feed hydrated lime into the hot aggregate before it is introduced into the mixer so that dry mixing is complete before the bituminous material is added.
- c. Continuous Plant Using Drier-Drum Mixer: Add hydrated lime so that the lime will not become entrained into the air stream of the drier and so that thorough dry mixing will be complete before the bituminous material is added.

Method B—Lime/Water Slurry—Add the required quantity of hydrated lime (based on dry weight) in lime/water slurry form to the aggregate. This solution consists of lime and water in concentrations as directed by the Engineer.

Equip the plant to blend and maintain the hydrated lime in suspension and to mix it with the aggregates uniformly in the proportions specified.

3. Add Stabilizing Fiber

When stabilizing fiber is included in the mixture, add it at a rate specified in [Section 819](#): The selected fiber shall meet the properties described below. Dosage rates given are typical ranges but the Office of Materials and Research shall approve the actual dosage rate used.

A. Cellulose Fibers

Add cellulose fibers at a dosage rate between 0.2% and 0.4% by weight of the total mix as approved by the Engineer. Fiber properties shall be as follows:

Fiber length: 0.25 inch (6.35 mm) maximum

Sieve Analysis

Alpine Sieve Method

Passing No. 100 (150 µm) sieve: 60-80%

Ro-Tap Sieve Method

Passing No. 20 (850 µm) sieve: 80-95%

Passing No. 40 (425 µm) sieve: 45-85%

Section 400—Hot Mix Asphaltic Concrete

Passing No. 100 (150 μ m) sieve: 5-40%

Ash Content: 18% non-volatiles (\pm 5%)

pH: 7.5 (\pm 1.0)

Oil Absorption: 5.0 (\pm 1.0) (times fiber weight)

Moisture Content: 5.0 % (maximum)

B. Cellulose Pellets

Use cellulose pellets that are a blend of cellulose fiber and asphalt cement. Add them at a dosage rate between 0.4% and 0.8% by weight of the total mix. The cellulose used shall comply with requirements of [Subsection 819.2.A](#).

- Pellet size: 1/4 cubic inch (4.093 cubic centimeters) maximum
- Asphalt: 25–80 pen.

Section 400—Hot Mix Asphaltic Concrete

Section 819—Fiber Stabilizing Additives

C. Mineral Fibers

Use mineral fibers that are made from virgin basalt, diabase, or slag that is treated with a cationic sizing agent to enhance disbursement of the fiber and to increase adhesion of the fiber surface to the bitumen. Add the fiber at a dosage rate between 0.2% to 0.5% by weight of the total mix as approved by the Engineer.

1. Size Analysis:

- Average Fiber length: 0.25 inches (6.35 mm) maximum
- Average Fiber thickness: 0.0002 inches (0.005 mm) maximum

Shot content (ASTM C612)

- Passing No. 60 (250 µm) sieve: 90 - 100%
- Passing No. 230 (67 µm) sieve: 65 - 100%
- Degradation ([GDT 124/McNett Fractionation](#)): 30% (maximum)

and the Job Mix

Formula. Introduce it as specified in [Subsection 400.3.02.B.8. —Fiber Supply System. II](#)

4. Add Gilsonite Modifier

When required, add the Gilsonite modifier to the mixture at a rate such that eight percent by weight of the asphalt cement is replaced by Gilsonite. Use either PG 64-22 or PG 67-22 asphalt cement as specified in [Subsection 820.2.01](#). Provide suitable means to calibrate and check the rate of Gilsonite being added. Introduce Gilsonite modifier by either of the following methods.

- a. For batch type plants, incorporate Gilsonite into the pugmill at the beginning of the dry mixing cycle. Increase the dry mix cycle by a minimum of 10 seconds after the Gilsonite is added and prior to introduction of the asphalt cement. For this method, supply Gilsonite in plastic bags to protect the material during shipment and handling and store the modifier in a waterproof environment. The bags shall be capable of being completely melted and uniformly blended into the combined mixture.

Section 400—Hot Mix Asphaltic Concrete

Gilsonite may also be added through a mineral filler supply system as described in [Subsection 400.3.02. B.5. —Mineral Filler Supply System.](#) The system shall be capable of injecting the modifier into the weigh hopper near the center of the aggregate batching cycle so the material can be accurately weighed.

- b. For drum drier plants, add Gilsonite through the recycle ring or through an acceptable means which will introduce the Gilsonite prior to the asphalt cement injection point. The modifier shall be proportionately fed into the drum mixer at the required rate by a proportioning device which shall be accurate within ± 10 percent of the amount required. The entry point shall be away from flames and ensure the Gilsonite will not be caught up in the air stream and exhaust system.

5. Avoid Materials from Different Sources

Do not use mixtures prepared from aggregates from different sources intermittently. This will cause the color of the finished pavement to vary.

E. Observe Weather Limitations

Do not mix and place asphaltic concrete if the existing surface is wet or frozen. Do not lay asphaltic concrete OGFC mix or PEM at air temperatures below 55 °F (13 °C). For other courses, follow the temperature guidelines in the following table:

Table 4—Lift Thickness Table

Lift Thickness	Minimum Temperature
1 in (25 mm) or less	55 °F (13 °C)
1.1 to 2 in (26 mm to 50 mm)	45 °F (8 °C)
2.1 to 3 in (51 mm to 75 mm)	35 °F (2 °C)
3.1 to 4 in (76 mm to 100 mm)	30 °F (0 °C)
4.1 to 8 in (101 mm to 200 mm)	Contractor's discretion

F. Perform Spreading and Finishing

Spread and finish the course as follows:

1. Determine the course's maximum compacted layer thickness by the type mix being used according to Table 5.

Table 5—Maximum Layer Thickness

Mix Type	Minimum Layer Thickness	Maximum Layer Thickness	Maximum Total Thickness
25 mm Superpave	3 in (75 mm)	5 in (125 mm) *	—
19 mm Superpave	1 3/4 in (44 mm)	3 in (75 mm) *	—
12.5 mm Superpave	1 3/8 in (35 mm)	2 1/2 in (62 mm)*	8 in (200 mm)
9.5 mm Superpave Levels	1 1/8 in.(28 mm)	2 in (50 mm)	4 in (100 mm)

Section 400—Hot Mix Asphaltic Concrete

Mix Type	Minimum Layer Thickness	Maximum Layer Thickness	Maximum Total Thickness
B, C, or D)			
9.5 mm Superpave Level A)	3/4 in (19 mm)	1 3/8 in (35 mm)	4 in (100 mm)
4.75 mm Mix	7/8 in (22) mm)	1 1/8 in (30 mm)	2 in (50 mm)
9.5 mm OGFC	55 lbs/yd ² (30 kg/m ²)	65 lbs/yd ² (36 kg/m ²)	—
12.5 mm OGFC	85 lbs/yd ² (47 kg/m ²)	95 lbs/yd ² (53 kg/m ²)	—
12.5 mm PEM	110 lbs/yd ² (80 kg/m ²)	165 lbs/yd ² (90 kg/m ²)	—
9.5 mm SMA	1 1/8 in (28 mm)	1 1/2 in (40 mm)	4 in (100 mm)
12.5 mm SMA	1 1/4 in (32 mm)	3 in (75 mm)	6 in (150 mm)
19 mm SMA	1 3/4 in (44 mm)	3 in (75 mm)	—
* Allow up to 6 in (150 mm) per lift on trench widening. Place 9.5 mm Superpave and 12.5 mm Superpave up to 4 in (100 mm) thick for driveway and side road transition.			

2. Unload the mixture into the paver hopper or into a device designed to receive the mixture from delivery vehicles.
3. Except for leveling courses, spread the mixture to the loose depth for the compacted thickness or the spread rate. Use a mechanical spreader true to the line, grade, and cross section specified.
4. For leveling courses, use a motor grader equipped with a spreader box and smooth tires to spread the material or use a mechanical spreader meeting the requirements in [Subsection 400.3.02.C, —Equipment at Project Site.](#)
5. Obtain the Engineer’s approval for the sequence of paving operations, including paving the adjoining lanes. Minimize tracking tack onto surrounding surfaces.
6. Ensure that the outside edges of the pavement being laid are aligned and parallel to the roadway center line.
7. For Contracts that contain multiple lifts or courses, arrange the width of the individual lifts so that the longitudinal joints of each successive lift are offset from the previous lift at least 1 ft (300 mm). This requirement does not apply to the lift immediately over thin lift leveling courses.
Ensure that the longitudinal joint(s) in the surface course and the mix immediately underneath asphaltic concrete OGFC are at the lane line(s).

NOTE: Perform night work with artificial light provided by the Contractor and approved by the Engineer.

8. Where mechanical equipment cannot be used, spread and rake the mixture by hand. Obtain the Engineer’s approval of the operation sequence, including compactive methods, in these areas.
9. Keep small hand raking tools clean and free from asphalt build up. Do not use fuel oil or other harmful solvents to clean tools during the work.
10. Do not use mixture with any of these characteristics:

Section 400—Hot Mix Asphaltic Concrete

- Segregated
 - Nonconforming temperature
 - Deficient or excessive asphalt cement content
 - Otherwise unsuitable to place on the roadway in the work
11. Remove and replace mixture placed on the roadway that the Engineer determines has unacceptable blemish levels from segregation, streaking, pulling and tearing, or other characteristics. Replace with acceptable mixture at the Contractor's expense. Do not continually place mixtures with deficiencies. Do not place subsequent course lifts over another lift or courses placed on the same day while the temperature of the previously placed mix is 140 °F (60 °C) or greater.
 12. Obtain the Engineer's approval of the material compaction equipment. Perform the rolling as follows:
 - a. Begin the rolling as close behind the spreader as possible without causing excessive distortion of the asphaltic concrete surface.
 - b. Continue rolling until roller marks are no longer visible.
 - c. Use pneumatic-tired rollers with breakdown rollers on all surface and subsurface courses except asphaltic concrete OGFC, PEM and SMA or other mixes designated by the Engineer.
 13. If applicable, taper or "feather" asphaltic concrete from full depth to a depth no greater than 0.5 in (13 mm) along curbs, gutters, raised pavement edges, and areas where drainage characteristics of the road must be retained. The Engineer will determine the location and extent of tapering.

G. Maintain Continuity of Operations

Coordinate plant production, transportation, and paving operations to maintain a continuous operation. If the spreading operations are interrupted, construct a transverse joint if the mixture immediately behind the paver screed cools to less than 250 °F (120 °C).

H. Construct the Joints

1. Construct Transverse Joints
 - a. Construct transverse joints to facilitate full depth exposure of the course before resuming placement of the affected course.
 - b. Properly clean and tack the vertical face of the transverse joint before placing additional material.

NOTE: Never burn or heat the joint by applying fuel oil or other volatile materials.

- c. Straightedge transverse joints immediately after forming the joint.
 - d. Immediately correct any irregularity that exceeds 3/16 in. in 10 ft (5 mm in 3 m).
 2. Construct Longitudinal Joints

Clean and tack the vertical face of the longitudinal joint before placing adjoining material. Construct longitudinal joints so that the joint is smooth, well sealed, and bonded.
 3. Construction Joint Detail for OGFC and PEM Mixtures

In addition to meeting joint requirements described above, construct joints and transition areas for 12.5 mm OGFC and 12.5 mm PEM mixtures as follows:

Section 400—Hot Mix Asphaltic Concrete

- a. For projects which do not have milling included as a pay item:
 - 1) Place OGFC mixture meeting gradation requirements of 9.5 mm OGFC as specified in [Section 828](#) on entrance and exit ramp gore areas and end of project construction joints.
 - Taper mixture from 3/8 in (10 mm) at end of project to full plan depth within maximum distance of spread for one load of mixture
 - Taper mixture placed on gore areas from thickness of the edge of the mainline to 3/8 in (10 mm) at the point of the ramp transverse joint.
 - 2) Construct the ramp transverse joint at the point specified in the plans or as directed by the Engineer.
 - 3) Mixture placed in the transition and gore areas will be paid for at the contract unit price for 12.5 mm OGFC or 12.5 mm PEM as applicable.
- b. For projects which have milling included as a pay item:
 - 1) Taper milling for a distance of no less than 50 ft (15 m) to a depth of 2 1/4 in (59 mm) at the point of the transverse joint
 - 2) Taper thickness, if needed, of the dense-graded surface mix within the 50 ft (15 m) distance to 1 1/2 in (40 mm) at the point of the transverse joint
 - 3) Taper thickness of the 12.5 mm OGFC or 12.5 mm PEM to 3/4 in (19 mm) so that it ties in at grade level with the existing surface at the point of the transverse joint

I. Protect the Pavement

Protect sections of the newly finished pavement from traffic until the traffic will not mar the surface or alter the surface texture. If directed by the Engineer, use artificial methods to cool the newly finished pavement to open the pavement to traffic more quickly.

J. Modify the Job Mix Formula

If the Engineer determines that undesirable mixture or mat characteristics are being obtained, the job mix formula may require immediate adjustment.

400.3.06 Quality Acceptance

A. Acceptance Plans for Gradation and Asphalt Cement Content

The Contractor will randomly sample and test mixtures for acceptance on a lot basis. The Department will monitor the Contractor testing program and perform comparison and quality assurance testing.

1. Determine Lot Amount

A lot consists of the tons (megagrams) of asphaltic concrete produced and placed each production day. If this production is less than 500 tons (500 Mg), or its square yard (meter) equivalent, production may be incorporated into the next working day. The Engineer may terminate a lot when a pay adjustment is imminent if a plant or materials adjustment resulting in a probable correction has been made. Terminate all open lots at the end of the month, except for materials produced and placed during the adjustment period. The lot will be terminated as described in [Subsection 400.5.01, "Adjustments"](#).

Section 400—Hot Mix Asphaltic Concrete

If the final day's production does not constitute a lot, the production may be included in the lot for the previous day's run; or, the Engineer may treat the production as a separate lot with a corresponding lower number of tests.

1. Determine Lot Acceptance

Determine lot acceptance as found in [Sub section 400.5.01, -Adjustments.](#)

The Department will perform the following task:

Determine the pay factor by using the mean of the deviations from the job mix formula of the tests in each lot and apply it to Table 9—Mixture Acceptance Schedule for Surface Mixes or Table 10—Mixture Acceptance Schedule for Subsurface Mixes, whichever is appropriate. This mean will be determined by averaging the actual numeric value of the individual deviations from the job mix formula, disregarding whether the deviations are positive or negative amounts. Do not calculate lot acceptance using test results for materials not used in the Work. Determine the pay factor for each lot by multiplying the contract unit price by the appropriate pay factor from the Mixture Acceptance Schedule - Table 9 or Table 10. When two or more pay factors for a specific lot are less than 1.0, determine the adjusted payment by multiplying the contract unit price by the lowest pay factor.

If the mean of the deviations from the job mix formula of the lot acceptance tests for a control sieve or for asphalt cement content exceeds the tolerances established in the appropriate Mixture Acceptance Schedule, and if the Engineer determines that the material need not be removed and replaced, the lot may be accepted at an adjusted unit price as determined by the Engineer. If the Engineer determines that the material is not acceptable to leave in place, the materials shall be removed and replaced at the Contractor's expense.

3. Provide Quality Control Program

Provide a Quality Control Program as established in SOP 27 which includes:

- Assignment of quality control responsibilities to specifically named individuals who have been certified by the Office of Materials and Research
- Provisions for prompt implementation of control and corrective measures
- Provisions for communication with Project Manager, Bituminous Technical Services Engineer, and Testing Management Operations Supervisor at all times
- Provisions for reporting all test results daily through the Office of Materials and Research computer Bulletin Board Service; other checks, calibrations and records will be reported on a form developed by the Contractor and will be included as part of the project records
- Notification in writing of any change in quality control personnel

a. Certification Requirements:

- Use laboratory and testing equipment certified by the Department. (Laboratories which participate in and maintain AASHTO accreditation for testing asphaltic concrete mixtures will be acceptable in lieu of Departmental certification.)
- Provide certified quality control personnel to perform the sampling and testing. A Quality Control Technician (QCT) may be certified at three levels:

Section 400—Hot Mix Asphaltic Concrete

- 1) Temporary Certification – must be a technician trainee who shall be given direct oversight by a certified Level 1 or Level 2 QCT while performing acceptance testing duties during the first 5 days of training. The trainee must complete qualification requirements within 30 production days after being granted temporary certification. A trainee who does not become qualified within 30 production days will not be re-eligible for temporary certification. A certified Level 1 or Level 2 QCT shall be at the plant at all times during production and shipment of mixture to monitor work of the temporarily certified technician.
 - 2) Level 1 – must demonstrate they are competent in performing the process control and acceptance tests and procedures related to hot mix asphalt production and successfully pass a written exam.
 - 3) Level 2 – must meet Level 1 requirements and must be capable of and responsible for making process control adjustments, and successfully pass a written exam.
 - Technician certification is valid for 3 years from the date on the technician’s certificate unless revoked or suspended. Eligible technicians may become certified through special training and testing approved by the Office of Materials and Research. Technicians who lose their certification due to falsification of test data will not be eligible for recertification in the future unless approved by the State Materials and Research Engineer.
- b. Quality Control Management
- 1) Designate at least one Level 2 QCT as manager of the quality control operation. The Quality Control Manager shall meet the following requirements:
 - Be accountable for actions of other QCT personnel
 - Ensure that all applicable sampling requirements and frequencies, test procedures, and Standard Operating Procedures are adhered to
 - Ensure that all reports, charts, and other documentation is completed as required
 - 2) Provide QCT personnel at the plant as follows:
 - If daily production for all mix types is to be greater than 250 tons (megagrams), have a QCT person at the plant at all times during production and shipment of mixture until all required acceptance tests have been completed
 - If daily production for all mix types will not be greater than 250 tons (megagrams) a QCT may be responsible for conducting tests at up to two plants, subject to random number sample selection
 - Have available at the plant or within immediate contact by phone or radio a Level 2 QCT responsible for making prompt process control adjustments as necessary to correct the mix
 - 3) Sampling, Testing, and Inspection Requirements.

Provide all sample containers, extractants, forms, diaries, and other supplies subject to approval of the Engineer.

Section 400—Hot Mix Asphaltic Concrete

Perform daily sampling, testing, and inspection of mixture production that meets the following requirements:

- (a) Randomly sample mixtures according to [GSP 15](#), and [GDT 73 \(Method C\)](#) and test on a lot basis. In the event less than the specified number of samples are taken, obtain representative 6 in (150 mm) cores from the roadway at a location where the load not sampled was placed. Take enough cores to ensure minimum sample size requirements are met for each sample needed.
- (b) Maintain a printed copy of the computer generated random sampling data as a part of the project records.
- (c) Perform sampling, testing, and inspection duties of [GSP 21](#).
- (d) Perform extraction or ignition test ([GDT 83](#) or [GDT 125](#)) and extraction analysis ([GDT 38](#)). If the ignition oven is used, a printout of sample data including weights shall become a part of the project records. For asphalt cement content only, digital printouts of liquid asphalt cement weights may be substituted in lieu of an extraction test for plants with digital recorders. Calculate the asphalt content from the ticket representing the mixture tested for gradation.
- (e) Save extracted aggregate, opposite quarters, and remaining material (for possible referee testing) of each sample as follows:
 - Store in properly labeled, suitable containers
 - Secure in a protected environment
 - Store for three working days. If not obtained by the Department, within three days they may be discarded.
- (f) Maintain a process control flow chart daily for each sieve specified on the job mix formula and including the percent asphalt cement. The flow chart shall include:
 - Allowable ranges based on the Mixture Control Tolerance in [Section 828](#)
 - A graph plot of the deviations from the job mix formula for each test per mix type
- (g) Add the following information on load tickets from which a sample or temperature check is taken:
 - Mixture temperature
 - Signature of the QCT person performing the testing

Note: Determine mixture temperature at least once per hour of production for OGFC and PEM mixes.

- (h) Calibrate the lime system when hydrated lime is included in the mixture:
 - Perform a minimum of twice weekly during production
 - Post results at the plant for review

Section 400—Hot Mix Asphaltic Concrete

- Provide records of materials invoices upon request (including asphalt cement, aggregate, hydrated lime, etc.)
 - (i) Take action if acceptance test results are outside Mixture Control Tolerances of [Section 828](#).
 - One sample out of tolerance
 - (1) Contact Level 2 - QCT to determine if a plant adjustment is needed
 - (2) Immediately run a process control sample. Make immediate plant adjustments if this sample is also out of tolerance
 - (3) Test additional process control samples as needed to ensure corrective action taken appropriately controls the mixture
 - Two consecutive acceptance samples of the same mix type out of tolerance regardless of Lot or mix design level, or three consecutive acceptance samples out of tolerance regardless of mix type
 - (1) Stop plant production immediately
 - (2) Reject any mixture already in storage that:
 - Deviates more than 10 percent in gradation from the job mix formula based on the acceptance sample
 - Deviates more than 0.7 percent in asphalt content from the job mix formula based on the acceptance sample
 - (3) Make a plant correction to any mix type out of tolerance prior to resuming production
 - Do not send any mixture to the project before test results of a process control sample meets Mixture Control Tolerances
 - Reject any mixture produced at initial restarting that does not meet Mixture Control Tolerances
- 4) Comparison Testing and Quality Assurance Program

Periodic comparison testing by the Department will be required of each QCT to monitor consistency of equipment and test procedures. The Department will take independent samples to monitor the Contractor's quality control program.

a) Comparison Sampling and Testing

Retain samples for comparison testing and referee testing if needed as described in [Subsection 400.3.06.A.3.b.3](#). Discard these samples only if the Contractor's acceptance test results meet a 1.00 pay factor and the Department does not procure the samples within three working days.

The Department will test comparison samples on a random basis. Results will be compared to the respective contractor acceptance tests and the maximum difference shall be as follows:

Table 6—Allowable Percent Difference Between Department and Contractor Acceptance Tests

<u>SIEVE SIZE</u>	<u>SURFACE</u>	<u>SUB-SURFACE</u>
1/2 in. (12.5 mm)		4.0%
3/8 in. (9.5 mm)	3.5%	4.0%
No. 4 (4.75 mm)	3.5%	3.5%
No. 8 (2.36 mm)	2.5%	3.0%
No. 200 (75 μm)	2.0%	2.0%
A.C.	0.4%	0.5%

NOTE: Pavement courses to be overlaid with OGFC or PEM mixes are considered surface mixes.

(1) If test comparisons are within these tolerances:

- Continue production
- Use the Contractor's tests for acceptance of the lot

(2) If test comparisons are not within these tolerances:

- Another Departmental technician will test the corresponding referee sample
- Results of the referee sample will be compared to the respective contractor and Departmental tests using the tolerance for comparison samples given above.
 - (a) If referee test results are within the above tolerances when compared to the Contractor acceptance test, use the Contractor's test for acceptance of the effected lot.
 - (b) If referee test results are not within the above tolerances when compared to the Contractor acceptance test, the Department will review the Contractor's quality control methods and determine if a thorough investigation is needed.

b) Quality Assurance Sampling and Testing

- (1) Randomly take a minimum of two quality assurance samples from the lesser of five days or five lots of production regardless of mix type or number of projects.
- (2) Compare test deviation from job mix formula to Mixture Control Tolerances in [Section 828](#). If results are outside these tolerances, another sample from the respective mix may be taken.

NOTE: For leveling courses less than 110 lb/yd² (60 kg/m²) that have quality assurance test results outside the Mixture Control Tolerances of [Section 828](#), use the Department's test results only and applicable pay factors will apply.

If test results of the additional sample are not within Mixture Control Tolerances, the Department will take the following action:

- Take random samples from throughout the lot as in [Subsection 400.3.06.A.3.b.3](#) and use these test results for acceptance and in calculations for the monthly plant rating. Applicable pay factors will apply and the contractor QCT test results will not be included in pay factor calculations nor in the monthly plant rating.
- Determine if the Contractor's quality control program is satisfactory and require prompt corrective action by the Contractor if specification requirements are not being met.
- Determine if the QCT has not followed Departmental procedures or has provided erroneous information.
- Take samples of any in-place mixture represented by unacceptable QCT tests and use the additional sample results for acceptance and in calculations for the monthly plant rating and apply applicable pay factors. The Contractor QCT tests will not be included in the pay factor calculations nor in the monthly plant rating.

B. Compaction

Determine the mixture compaction using either [GDT 39](#) or [GDT 59](#). The compaction is accepted in lots defined in [Subsection 400.3.06. A -Acceptance Plans for Gradation and Asphalt Cement Content](#) and is within the same lot boundaries as the mixture acceptance.

1. Calculate Pavement Mean Air Voids

The Department will calculate the pavement air voids placed within each lot as follows:

- a. Average the results of 5 tests run on randomly selected sites in that lot.
- b. Select the random sites using [GDT 73](#).

Density tests are not required for asphaltic concrete placed at 90 lbs/yd² (50 kg/m²) or less, 4.75 mm mix, and asphaltic concrete OGFC and PEM. Compact these courses to the Engineer's satisfaction.

The maximum Pavement Mean Air Voids for all Superpave and Stone Matrix Asphalt mixtures shall be 7.8 percent. The adjustment period for density shall be three lots or three production days, whichever is less, in order for the contractor to ensure maximum compactive effort has been achieved which will yield no more than 7.8 percent Mean Air Voids. If the contractor needs to adjust the mixture to improve density results, a change in the job mix formula may be requested for approval during the adjustment period so long as the following values are not exceeded:

- Coarse pay sieve $\pm 4\%$
- No. 8 (2.36 mm) sieve $\pm 2\%$
- No. 200 (75 μ m) sieve $\pm 1\%$
- Asphalt Content $\pm 0.2\%$

Section 400—Hot Mix Asphaltic Concrete

- All value changes must still be within specification limits

If the Office of Materials and Research is satisfied that the contractor has exerted the maximum compactive effort and is not able to maintain Pavement Mean Air Voids at no more than 7.8%, the Engineer may establish a maximum target for Pavement Mean Air Voids.

Mixture placed during the adjustment period for density shall meet the requirements for a 0.90 pay factor in Table 12 of [Subsection 400.5.01.C, —Calculate Mean Pavement Air Voids .I](#) Mixture which does not meet these density requirements shall be paid for using the applicable pay factor.

If the mean air voids of the pavement placed within a lot exceeds 7.8% (or 100% of the maximum target air voids, if established) and the Engineer determines that the material need not be removed and replaced, the lot may be accepted at an adjusted unit price as determined by the Engineer.

2. Obtain Uniform Compaction

For a lot to receive a pay factor of 1.00 for compaction acceptance, the air void range cannot exceed 4 percent for new construction or 5 percent for resurfacing projects. The range is the difference between the highest and lowest acceptance test results within the affected lot. If the air void range exceeds these tolerances, apply a Pay Factor of 95%.

The 5% reduced pay factor for the compaction range does not apply in these instances:

- The mixture is placed during the adjustment period as defined in [Subsection 400.5 .01.A, —Materials Produced and Placed During the Adjustment Period. II](#)
- All air void results within a given lot are less than 7.8%.

C. Surface Tolerance

In this Specification, pavement courses to be overlaid with a friction course are considered surface courses. Other asphalt paving is subject to straightedge and visual inspection and irregularity correction as shown below:

1. Visual and Straightedge Inspection

Paving is subject to visual and straightedge inspection during and after construction operations until Final Acceptance. Locate surface irregularities as follows:

- a. Keep a 10 ft (3 m) straightedge near the paving operation to measure surface irregularities on courses. Provide the straightedge and the labor for its use.
- b. Inspect the base, intermediate, and surface course surfaces with the straightedge to detect irregularities.
- c. Correct irregularities that exceed 3/16 in. in 10 ft (5 mm in 3 m) for base and intermediate courses, and 1/8 in. in 10 ft (3 mm in 3 m) for surface courses.

Mixture or operating techniques will be stopped if irregularities such as rippling, tearing, or pulling occur and the Engineer suspects a continuing equipment problem. Stop the paving operation and correct the problem. Correct surface course evaluations on individual Laser Road Profiler test sections, normally 1 mile (1 km) long.

2. Target Surface Smoothness

Section 400—Hot Mix Asphaltic Concrete

The Department will use the Laser Road Profiler method to conduct acceptance testing for surface course tolerance according to [GDT 126](#). This testing will be performed only on:

- Surface courses
- Mainline traveled way
- Ramps more than 0.5 mile (800 m) long

Achieve the smoothest possible ride during construction. Do not exceed the target Laser Road Profiler smoothness index as shown below:

Table 7—Pavement Smoothness Requirements—New Construction

Construction Description	Smoothness Index
Asphaltic concrete OGFC and PEM on interstates and asphaltic concrete OGFC and PEM on new construction	750
Other resurfacing on interstates, asphaltic concrete OGFC and PEM resurfacing on state routes, and new construction	825
All other resurfacing on state routes (excluding LARP, PR, airports, etc.)	900

If the target values are not achieved, immediately adjust the operations to meet the target values.

Corrective work is required if the surface smoothness exceeds the Laser Road Profiler smoothness index shown below:

Table 8—Pavement Smoothness Requirements—Corrective Work

Construction Description	Smoothness Index
Asphaltic concrete OGFC and PEM on interstates and asphaltic concrete OGFC and PEM on new construction	825
Other resurfacing on interstates, asphaltic concrete OGFC and PEM resurfacing on state routes, and new construction	900
All other resurfacing on state routes (excluding LARP, PR, airports, etc.)	1025

If surface tolerance deficiencies need correction, obtain the Engineer's approval of the methods and type mix used.

3. Bridge Approach Ride Quality

The following are subject to a ride quality test by the Department for 100 ft. (30 m) of roadway approaching each end of a bridge using the Rainhart Profilograph:

- A state road with 4 lanes or more
- A 2-lane state road with a current traffic count of 2,000 vpd or more
- Locations designated on the Plans

All other bridge approaches shall meet the 1/8 in. in 10 ft (3 mm in 3 m) straightedge requirement. Test ride quality as follows:

Section 400—Hot Mix Asphaltic Concrete

- a. The Department will determine a profile index value according to test method [GDT 78](#).
- b. The Department will average the profile index value from the right and left wheel path for each 100 ft (30 m) section for each lane. Keep the profile index value under 30.
- c. Meet the profile index value for the 100 ft (30 m) section of roadway up to the joint with the approach slab.
- d. Schedule the profilograph testing 5 days before needed. Clean and clear obstructions from the test area.
- e. Correct the sections that do not meet the ride quality criteria of this Specification. After correction, these sections are subject to retesting with the Rainhart Profilograph. The Engineer shall direct the type of correction method, which may include:
 - Milling
 - Grinding
 - Removing and replacing the roadway

No additional compensation will be made.

The Department will perform Profilograph testing up to two times on the bridge approaches at no cost to the Contractor. Additional profilograph testing will cost the Contractor \$500 per test.

D. Reevaluation of Lots

When lots are reevaluated as shown in [Subsection 106.03. —Samples, Tests, Cited Specifications.I](#) :

All materials will be inspected, tested, and approved by the Engineer before incorporation into The Work. Samples will be taken by a qualified representative of the Department. Unless otherwise designated, tests will be made by and at the expense of the Department and in accordance with methods of AASHTO, ASTM, or the published Specifications of any other designated organization that are current on the date of advertisements for bids. Copies of all tests will be furnished to the Contractor's representative at his request. Sampling and testing by the Department will be performed in accordance with the *Sampling, Testing and Inspection Manual*.

For Work performed under [Section 400—Hot Mix Asphaltic Concrete Construction](#) all materials shall be inspected and tested by the Contractor before incorporation into the Work. The Contractor's Quality Control Technician shall sample and test all quality control samples. The Contractor's quality control tests may be used as acceptance tests at the discretion of the Engineer. Sampling and testing by the Contractor shall be performed according to the Sampling, Testing, and Inspection Manual. Copies of all tests performed by the Contractor shall be furnished to the Engineer and will become a part of the project records. The Department will be responsible only for determining the acceptability of the construction and materials

Section 400—Hot Mix Asphaltic Concrete

incorporated therein. The Contractor shall be responsible for the quality of the construction and materials incorporated

therein. The Department will monitor the Contractor's Quality Assurance Acceptance Program to verify test accuracy.

A. Testing and Acceptance Plans

1. **A Lot:** Work will be accepted on a Lot-to-Lot basis in accordance with the requirements specified in the Acceptance Plans specified in [Section 400- Hot Mix Asphaltic Concrete Construction](#). Lot sizes will normally be specified. In the event, however, that operational conditions cause work to be interrupted, or only partially completed before the Lot size specified has been achieved, the Lot may be redefined by the Engineer as being either the amount of work accomplished within the day, or he may combine that work with the next Lot of work. A Lot is set forth in these Specifications as a defined quantity of a specified material from a single source or a measured amount of specified construction assumed to be produced by the same process.

2. **Acceptance Plans:** The Acceptance Plan for a material, product, or an Item of construction, or completed work will be as specified hereinafter in [Section 400](#) and [Section 430](#) of these Specifications. However, in addition to the following conditions, the Department reserves the right to test any additional material for Work that appears defective and to require correction if necessary prior to acceptance.

3. **Resampling of Lots:** It is the intent of these Specifications that Lots of materials, products, Items of construction, or completed construction will meet Specification requirements at the time of submission. Resampling of deficient Lots as a basis for check tests may be done by the Engineer at his option.

Non-conforming Lots, which can be corrected by reworking, will not be re-sampled before such corrective action is taken. Sampling and testing of reworked areas shall be at the expense of the Contractor.

4. **Acceptance or Rejection:** Nonconforming Lots, materials, products, or Items of construction that are not adaptable to correction by reworking shall be removed and replaced, accepted without payment, or accepted at an adjusted price as stated in the Specifications, or if not stated, as directed by the Engineer.

Following the application of the Acceptance Plan, the decision of the Engineer shall be final as to the acceptance, rejection, or acceptance at an adjusted price of the Lots unless the Contractor elects to remove and replace any deficient materials or Work at his expense.

5. Adjusted Payment:

a. **Single Deficiency:** A single deficiency is defined as a deficiency involving one characteristic of a material within a Lot. In the case of single-characteristic deficiency, it shall be used directly to determine an adjusted Contract Price.

b. **Multiple Deficiency:** A multiple deficiency is defined as deficiencies involving more than one characteristic of construction within a Lot. In the case of multiple deficiencies, the related adjusted percentage of Contract Price for each characteristic shall be determined and the greatest reduction in price shall be used to determine the Contract Unit Price to be paid. Should the total adjustment for any individual Lot be 50 percent or more, the Engineer will determine whether the deficient Lot should be removed and replaced or allowed to remain in place. No payment will be

Section 400—Hot Mix Asphaltic Concrete

made for the original Lot or for its removal. Replacement of the Lot will be paid for in accordance with the provisions for the Item. Sampling and testing will be in accordance with [GDT 73](#). Request shall be made for reevaluation immediately upon notification of the lot results. The following procedures apply:

1. Mixture Acceptance

The Department will take the same number of new tests on cores taken at a location where the load sampled was placed and will use only those core results for acceptance.

The Department will use the mean of the deviations from the job mix formula for these tests to determine acceptance based on the appropriate column in the Asphalt Cement Content and Aggregate Gradation of Asphalt Concrete [Mixture Acceptance Schedule—Table 9 or 10](#).

2. Compaction Acceptance

The Department will reevaluate the lot through additional testing by cutting 5 cores and averaging these results with the results of the original 5 compaction tests. The Department will use the average to determine acceptance according to the Compaction Acceptance Schedule in [Subsection 400.5.01.C. —Calculate Pavement Mean Air Voids](#).

Table 9—Mixture Acceptance Schedule—Surface Mixes

Mixture Characteristics	Pay Factor	Mean of the Deviations from the Job Mix Formula							
		1 Test	2 Tests	3 Tests	4 Tests	5 Tests	6 Tests	7 Tests	8 Tests
Asphalt Cement Content (Extraction, Ignition)	1.00	0.00 - 0.70	0.00 - 0.54	0.00 - 0.46	0.00 - 0.41	0.00 - 0.38	0.00 - 0.35	0.00 - 0.32	0.00 - 0.30
	0.95	0.71 - 0.80	0.55 - 0.61	0.47 - 0.52	0.42 - 0.46	0.39 - 0.43	0.36 - 0.39	0.33 - 0.36	0.31 - 0.34
	0.90	0.81 - 0.90	0.62 - 0.68	0.53 - 0.58	0.47 - 0.51	0.44 - 0.47	0.40 - 0.45	0.37 - 0.40	0.35 - 0.37
	0.80	0.91 - 1.00	0.69 - 0.75	0.59 - 0.64	0.52 - 0.56	0.48 - 0.52	0.44 - 0.47	0.41 - 0.44	0.38 - 0.41
	0.70	1.01 - 1.19	0.76 - 0.82	0.65 - 0.69	0.57 - 0.61	0.53 - 0.56	0.48 - 0.51	0.45 - 0.47	0.42 - 0.44
	0.50	1.20 - 1.40	0.83 - 0.85	0.70 - 0.72	0.62 - 0.64	0.57 - 0.59	0.52 - 0.55	0.48 - 0.51	0.45 - 0.48
3/8 in. (9.5 mm) Sieve (12.5 mm OGFC, 12.5 mm PEM, 12.5 mm Superpave)	1.00	0.00 - 0.9	0.00 - 6.6	0.00 - 5.6	0.00 - 5.0	0.00 - 4.6	0.00 - 4.2	0.00 - 3.9	0.00 - 3.6
	0.98	9.1 - 10.0	6.7 - 7.5	5.7 - 6.3	5.1 - 5.6	4.7 - 5.2	4.3 - 4.7	4.0 - 4.4	3.7 - 4.1
	0.95	10.1 - 11.9	7.6 - 8.4	6.4 - 7.0	5.7 - 6.3	5.3 - 5.8	4.8 - 5.3	4.5 - 5.0	4.2 - 4.6
	0.90	12.0 - 13.0	8.5 - 9.3	7.1 - 7.7	6.4 - 6.9	5.9 - 6.3	5.4 - 5.8	5.1 - 5.4	4.7 - 5.0
	0.85	13.1 - 14.0	9.4 - 10.2	7.8 - 8.6	7.0 - 7.6	6.4 - 6.9	5.9 - 6.3	5.5 - 5.9	5.1 - 5.5
	0.80	14.1 - 14.5	10.3 - 10.5	8.7 - 8.9	7.7 - 8.0	7.0 - 7.5	6.4 - 6.8	6.0 - 6.4	5.6 - 6.0
3/8 in. (9.5 mm) Sieve (12.5 mm SMA)	1.00	0.0 - 6.8	0.00 - 5.0	0.00 - 4.2	0.00 - 3.8	0.00 - 3.4	0.00 - 3.2	0.00 - 2.9	0.00 - 2.7
	0.98	6.9 - 7.5	5.1 - 5.6	4.6 - 4.7	3.9 - 4.2	3.5 - 3.9	3.3 - 3.5	3.0 - 3.3	2.8 - 3.1
	0.95	7.6 - 8.9	5.7 - 6.3	4.8 - 5.2	4.3 - 4.7	4.0 - 4.4	3.6 - 4.0	3.4 - 3.8	3.2 - 3.4
	0.90	9.0 - 9.8	6.4 - 7.0	5.3 - 5.8	4.8 - 5.2	4.5 - 4.8	4.1 - 4.4	3.9 - 4.1	3.5 - 3.8
	0.85	9.9 - 10.5	7.1 - 7.6	5.9 - 6.4	5.3 - 5.7	4.9 - 5.2	4.5 - 4.7	4.2 - 4.4	3.9 - 4.1
	0.80	10.6 - 10.9	7.7 - 7.9	6.5 - 6.7	5.8 - 6.0	5.3 - 5.6	4.8 - 5.1	4.5 - 4.8	4.2 - 4.5
No. 4 (4.75 mm) Sieve (9.5 mm OGFC, 9.5 mm Superpave)	1.00	0.00 - 9.0	0.00 - 6.7	0.00 - 5.7	0.00 - 5.2	0.00 - 4.8	0.00 - 4.4	0.00 - 4.1	0.00 - 3.8
	0.98	9.1 - 10.0	6.8 - 7.6	5.8 - 6.3	5.3 - 5.8	4.9 - 5.4	4.5 - 4.9	4.2 - 4.6	3.9 - 4.3
	0.95	10.1 - 11.9	7.7 - 8.5	6.4 - 6.9	5.9 - 6.4	5.5 - 5.9	5.0 - 5.4	4.7 - 5.0	4.4 - 4.7

Section 400—Hot Mix Asphaltic Concrete Construction

Mixture Characteristics	Pay Factor	Mean of the Deviations from the Job Mix Formula							
		1 Test	2 Tests	3 Tests	4 Tests	5 Tests	6 Tests	7 Tests	8 Tests
	0.90	12.0 - 13.0	8.6 - 9.4	7.0 - 7.5	6.5 - 7.0	6.0 - 6.5	5.5 - 5.9	5.1 - 5.5	4.8 - 5.1
	0.85	13.1 - 14.0	9.5 - 10.2	7.6 - 8.0	7.1 - 7.6	6.6 - 7.0	6.0 - 6.4	5.6 - 5.9	5.2 - 5.5
	0.80	14.1 - 14.5	10.3 - 10.5	8.1 - 8.3	7.7 - 8.0	7.1 - 7.5	6.5 - 6.9	6.0 - 6.4	5.6 - 5.9
No. 4 (4.75 mm) Sieve (9.5 mm SMA)	1.00	0.00 - 6.8	0.00 - 5.0	0.00 - 4.3	0.00 - 3.9	0.00 - 3.6	0.00 - 3.3	0.00 - 3.1	0.00 - 2.8
	0.98	6.9 - 7.5	5.1 - 5.7	4.4 - 4.7	4.0 - 4.4	3.7 - 4.0	3.4 - 3.7	3.2 - 3.4	2.9 - 3.2
	0.95	7.6 - 8.9	5.8 - 6.4	4.8 - 5.2	4.5 - 4.8	4.1 - 4.4	3.8 - 4.0	3.5 - 3.8	3.3 - 3.5
	0.90	9.0 - 9.8	6.5 - 7.0	5.3 - 5.6	4.9 - 5.2	4.5 - 4.9	4.1 - 4.4	3.9 - 4.1	3.6 - 3.8
	0.85	9.9 - 10.5	7.1 - 7.7	5.7 - 6.0	5.3 - 5.7	5.0 - 5.2	4.3 - 4.8	4.2 - 4.4	3.9 - 4.1
	0.80	10.6 - 10.9	7.8 - 7.9	6.1 - 6.2	5.8 - 6.0	5.3 - 5.6	4.9 - 5.2	4.5 - 4.8	4.2 - 4.4
No. 8 (2.36 mm) Sieve (Superpave and 4.75 mm mixes)	1.00	0.00 - 7.0	0.00 - 5.6	0.00 - 4.8	0.00 - 4.3	0.00 - 4.0	0.00 - 3.6	0.00 - 3.4	0.00 - 3.2
	0.98	7.1 - 8.0	5.7 - 6.3	4.9 - 5.4	4.4 - 4.8	4.1 - 4.5	3.7 - 4.1	3.5 - 3.8	3.3 - 3.6
	0.95	8.1 - 9.0	6.4 - 7.0	5.5 - 6.0	4.9 - 5.3	4.6 - 4.9	4.2 - 4.5	3.9 - 4.2	3.7 - 3.9
	0.90	9.1 - 10.9	7.1 - 7.7	6.1 - 6.6	5.4 - 5.8	5.0 - 5.4	4.6 - 4.9	4.3 - 4.6	4.0 - 4.3
	0.85	11.0 - 12.0	7.8 - 8.5	6.7 - 7.2	5.9 - 6.4	5.5 - 5.8	5.0 - 5.3	4.7 - 5.0	4.4 - 4.6
	0.75	12.1 - 12.5	8.6 - 8.8	7.3 - 7.5	6.5 - 6.8	5.9 - 6.3	5.4 - 5.7	5.1 - 5.3	4.7 - 4.9
No. 8 (2.36 mm) Sieve (12.5 mm SMA, 9.5 mm SMA)	1.00	0.00 - 5.3	0.00 - 4.2	0.00 - 3.6	0.00 - 3.2	0.00 - 3.0	0.00 - 2.7	0.00 - 2.6	0.00 - 2.4
	0.98	5.4 - 6.0	4.3 - 4.7	3.7 - 4.0	3.3 - 3.6	3.1 - 3.4	2.8 - 3.1	2.7 - 2.9	2.5 - 2.7
	0.95	6.1 - 6.8	4.8 - 5.3	4.1 - 4.5	3.7 - 4.0	3.5 - 3.7	3.2 - 3.4	3.0 - 3.2	2.8 - 2.9
	0.90	6.9 - 8.2	5.4 - 5.8	5.6 - 5.0	4.1 - 4.5	3.8 - 4.0	3.5 - 3.7	3.3 - 3.5	3.0 - 3.2
	0.85	8.3 - 9.0	5.9 - 6.4	5.1 - 5.4	4.6 - 4.8	4.1 - 4.4	3.8 - 4.0	3.6 - 3.8	3.3 - 3.4

Section 400—Hot Mix Asphaltic Concrete Construction

Mixture Characteristics	Pay Factor	Mean of the Deviations from the Job Mix Formula							
		1 Test	2 Tests	3 Tests	4 Tests	5 Tests	6 Tests	7 Tests	8 Tests
	0.75	9.1 - 9.4	6.5 - 6.6	5.5 - 5.0	4.9 - 5.1	4.5 - 4.7	4.1 - 4.3	3.9 - 4.0	3.5 - 3.7
No. 8 (2.36 mm) Sieve for OGFC and PEM mixes: When the mean of the deviations from the Job Mix Formula for a particular lot exceeds the tolerance for a 1.00 pay factor in the appropriate column, the lot will be paid for at 0.50 of the Contract Price.									

Table 10—Mixture Acceptance Schedule—Subsurface Mixes

Mixture Characteristics	Pay Factor	Mean of the Deviations from the Job Mix Formula							
		1 Test	2 Tests	3 Tests	4 Tests	5 Tests	6 Tests	7 Tests	8 Tests
Asphalt Cement Content (Extraction, Ignition)	1.00	0.00 - 0.80	0.00 - 0.61	0.00 - 0.52	0.00 - 0.46	0.00 - 0.43	0.00 - 0.39	0.00 - 0.36	0.00 - 0.34
	0.95	0.81 - 0.90	0.62 - 0.68	0.53 - 0.58	0.47 - 0.51	0.44 - 0.47	0.40 - 0.43	0.37 - 0.40	0.35 - 0.37
	0.90	0.91 - 1.00	0.69 - 0.75	0.59 - 0.64	0.52 - 0.56	0.48 - 0.52	0.44 - 0.47	0.41 - 0.44	0.38 - 0.41
	0.80	1.01 - 1.19	0.76 - 0.82	0.65 - 0.69	0.57 - 0.61	0.53 - 0.56	0.48 - 0.51	0.45 - 0.47	0.42 - 0.44
	0.70	1.20 - 1.40	0.83 - 0.85	0.70 - 0.72	0.62 - 0.64	0.57 - 0.59	0.52 - 0.55	0.48 - 0.51	0.45 - 0.48
	0.50	1.41 - 1.60	0.86 - 0.88	0.73 - 0.75	0.65 - 0.67	0.60 - 0.63	0.56 - 0.60	0.52 - 0.56	0.49 - 0.52
1/2 in. (12.5 mm) Sieve (25 mm Superpave)	1.00	0.00 - 12.9	0.00 - 8.1	0.00 - 6.9	0.00 - 6.1	0.00 - 5.5	0.00 - 5.0	0.00 - 4.7	0.00 - 4.4
	0.98	13.0 - 14.0	8.2 - 9.1	7.0 - 7.7	6.2 - 6.8	5.6 - 6.1	5.1 - 5.6	4.8 - 5.2	4.5 - 4.9
	0.95	14.1 - 15.0	9.2 - 10.1	7.8 - 8.5	6.9 - 7.5	6.2 - 6.7	5.7 - 6.1	5.3 - 5.7	5.0 - 5.4
	0.90	15.1 - 16.0	10.2 - 11.1	8.6 - 9.3	7.6 - 8.2	6.8 - 7.4	6.2 - 6.7	5.8 - 6.3	5.5 - 5.9
	0.85	16.1 - 17.0	11.2 - 11.5	9.4 - 9.6	8.3 - 8.6	7.5 - 7.8	6.8 - 7.0	6.4 - 6.5	6.0 - 6.1
	0.80	17.1 - 18.0	11.6 - 11.9	9.7 - 9.9	8.7 - 9.0	7.9 - 8.1	7.1 - 7.3	6.6 - 6.8	6.2 - 6.4
1/2 in. (12.5 mm) Sieve (19 mm SMA)	1.00	0.00 - 9.7	0.00 - 6.0	0.00 - 5.2	0.00 - 4.6	0.00 - 4.1	0.00 - 3.8	0.00 - 3.5	0.00 - 3.3
	0.98	9.8 - 10.5	6.2 - 6.8	5.3 - 5.8	4.7 - 5.1	4.2 - 4.6	3.9 - 4.2	3.6 - 3.9	3.4 - 3.7
	0.95	10.6 - 11.2	6.9 - 7.8	5.9 - 6.4	5.2 - 5.6	4.7 - 5.0	4.3 - 4.6	4.0 - 4.3	3.8 - 4.0
	0.90	11.3 - 12.0	7.9 - 8.3	6.5 - 7.0	5.7 - 6.1	5.1 - 5.6	4.7 - 5.0	4.4 - 4.7	4.1 - 4.4
	0.85	12.1 - 12.8	8.4 - 8.6	7.1 - 7.2	6.2 - 6.5	5.7 - 5.9	5.1 - 5.3	4.8 - 4.9	4.5 - 5.6
	0.80	12.9 - 13.5	8.7 - 8.9	7.3 - 7.4	6.6 - 6.8	6.0 - 6.1	5.4 - 5.5	5.0 - 5.1	4.7 - 4.8
3/8 in. (9.5 mm)	1.00	0.00 - 10.0	0.00 - 7.5	0.00 - 6.3	0.00 - 5.6	0.00 - 5.2	0.00 - 4.7	0.00 - 4.4	0.00 - 4.1

Section 400—Hot Mix Asphaltic Concrete Construction

Mixture Characteristics	Pay Factor	Mean of the Deviations from the Job Mix Formula							
		1 Test	2 Tests	3 Tests	4 Tests	5 Tests	6 Tests	7 Tests	8 Tests
Sieve (19 mm Superpave, 12.5 mm Superpave)	0.98	10.1 - 11.9	7.6 - 8.4	6.4 - 7.0	5.7 - 6.3	5.3 - 5.8	4.8 - 5.3	4.5 - 5.0	4.2 - 4.6
	0.95	12.0 - 13.0	8.5 - 9.3	7.1 - 7.7	6.4 - 6.9	5.9 - 6.3	5.4 - 5.8	5.1 - 5.4	4.7 - 5.0
	0.90	13.1 - 14.0	9.4 - 10.2	7.8 - 8.6	7.0 - 7.6	6.4 - 6.9	5.9 - 6.3	5.5 - 5.9	5.1 - 5.5
	0.85	14.1 - 14.5	10.3 - 10.5	8.7 - 8.9	7.7 - 8.0	7.0 - 7.5	6.4 - 6.8	6.0 - 6.4	5.6 - 6.0
	0.80	14.6 - 15.0	10.6 - 10.8	9.0 - 9.2	8.1 - 8.4	7.6 - 7.8	6.9 - 7.3	6.5 - 6.8	6.1 - 6.5
No. 4 (4.75 mm) Sieve (9.5 mm Superpave)	1.00	0.00 - 10.0	0.00 - 7.6	0.00 - 6.3	0.00 - 5.8	0.00 - 5.4	0.00 - 4.9	0.00 - 4.6	0.00 - 4.3
	0.98	10.1 - 11.9	7.7 - 8.5	6.4 - 6.9	5.9 - 6.4	5.5 - 5.9	5.0 - 5.4	4.7 - 5.0	4.4 - 4.7
	0.95	12.0 - 13.0	8.6 - 9.4	7.0 - 7.5	6.5 - 7.0	6.0 - 6.5	5.5 - 5.9	5.1 - 5.5	4.8 - 5.1
	0.90	13.1 - 14.0	9.5 - 10.2	7.6 - 8.0	7.1 - 7.6	6.6 - 7.0	6.0 - 6.4	5.6 - 5.9	5.2 - 5.5
	0.85	14.1 - 14.5	10.3 - 10.5	8.1 - 8.3	7.7 - 8.0	7.1 - 7.5	6.5 - 6.9	6.0 - 6.4	5.6 - 5.9
	0.80	14.6 - 15.0	10.6 - 10.8	8.4 - 8.6	8.1 - 8.4	7.6 - 8.0	7.0 - 7.4	6.5 - 6.8	6.0 - 6.3
No. 8 (2.36 mm) Sieve (All mixes except SMA)	1.00	0.00 - 8.0	0.00 - 6.3	0.00 - 5.4	0.00 - 4.8	0.00 - 4.5	0.00 - 4.1	0.00 - 3.8	0.00 - 3.6
	0.98	8.1 - 9.0	6.4 - 7.0	5.5 - 6.0	4.9 - 5.3	4.6 - 4.9	4.2 - 4.5	3.9 - 4.2	3.7 - 3.9
	0.95	9.1 - 10.0	7.1 - 7.7	6.1 - 6.6	5.4 - 5.8	5.0 - 5.4	4.6 - 4.9	4.3 - 4.6	4.0 - 4.3
	0.90	10.1 - 11.9	7.8 - 8.5	6.7 - 7.2	5.9 - 6.4	5.5 - 5.8	5.0 - 5.3	4.7 - 5.0	4.4 - 4.6
	0.85	12.0 - 13.0	8.6 - 8.8	7.3 - 7.5	6.5 - 6.8	5.9 - 6.3	5.4 - 5.7	5.1 - 5.3	4.7 - 4.9
	0.75	13.1 - 14.0	8.9 - 9.1	7.6 - 7.8	6.9 - 7.2	6.4 - 6.6	5.8 - 6.1	5.4 - 5.7	5.0 - 5.3
No. 8 (2.36 mm) Sieve (19 mm SMA)	1.00	0.00 - 6.0	0.00 - 4.7	0.00 - 4.1	0.00 - 3.6	0.00 - 3.4	0.00 - 3.1	0.00 - 2.9	0.00 - 2.4
	0.98	6.1 - 6.8	4.8 - 5.2	4.2 - 4.5	3.7 - 4.0	3.5 - 3.7	3.2 - 3.4	3.0 - 3.2	2.8 - 2.9
	0.95	6.9 - 7.5	5.3 - 5.8	4.6 - 5.0	4.1 - 4.4	3.8 - 4.0	3.5 - 3.7	3.3 - 3.5	3.0 - 3.2

Section 400—Hot Mix Asphaltic Concrete Construction

Mixture Characteristics	Pay Factor	Mean of the Deviations from the Job Mix Formula							
		1 Test	2 Tests	3 Tests	4 Tests	5 Tests	6 Tests	7 Tests	8 Tests
	0.90	7.6 - 8.9	5.9 - 6.4	5.1 - 5.4	4.5 - 4.8	4.1 - 4.4	3.8 - 4.0	3.6 - 3.8	3.3 - 3.5
	0.85	9.0 - 9.8	6.5 - 6.6	5.5 - 5.6	4.9 - 5.1	4.5 - 4.7	4.1 - 4.3	3.9 - 4.0	3.6 - 3.7
	0.75	9.9 - 10.5	6.7 - 6.8	5.7 - 5.9	5.2 - 5.4	4.8 - 5.0	4.4 - 4.6	4.1 - 4.3	3.8 - 4.0

E. Segregated Mixture

Prevent mixture placement that yields a segregated mat by following production, storage, loading, placing, and handling procedures. Also, make needed plant modifications and provide necessary auxiliary equipment. (See [Subsection 400.1.01, -Definition s.l\)](#)

If the mixture is segregated in the finished mat, the Department will take actions based on the degree of segregation. The actions are described below.

1. Unquestionably Unacceptable Segregation

When the Engineer determines that the segregation in the finished mat is unquestionably unacceptable, follow these measures:

- a. Suspend Work and require the Contractor to take positive corrective action. The Department will evaluate the segregated areas to determine the extent of the corrective work to the in-place mat as follows:
 - Perform extraction and gradation analysis by taking 6 in (150 mm) cores from typical, visually unacceptable segregated areas.
 - Determine the corrective work according to [Subsection 400.3.06.E.3.](#)
- b. Require the Contractor to submit a written plan of measures and actions to prevent further segregation. Work will not continue until the plan is submitted to and approved by the Department.
- c. When work resumes, place a test section not to exceed 500 tons (500 Mg) of the affected mixture for the Department to evaluate. If a few loads show that corrective actions were not adequate, follow the measures above beginning with step 1.a. above. If the problem is solved, Work may continue.

2. Unacceptable Segregation Suspected

When the Engineer observes segregation in the finished mat and suspects that it may be unacceptable, follow these measures:

- a. Allow work to continue at Contractor’s risk.
- b. Require Contractor to immediately and continually adjust operation until the visually apparent segregated areas are eliminated from the finished mat. The Department will immediately investigate to determine the severity of the apparent segregation as follows:
 - Take 6 in (150 mm) cores from typical areas of suspect segregation.

Section 400—Hot Mix Asphaltic Concrete Construction

- Test the cores for compliance with the mixture control tolerances in [Section 828](#).

When these tolerances are exceeded, suspend work for corrective action as outlined in [Subsection 400.3.06.E.3](#).

3. Corrective Work

- a. Remove and replace (at the Contractor's expense) any segregated area where the gradation on the control sieves is found to vary 10 percent or more from the approved job mix formula, the asphalt cement varies 1.0% or more from the approved job mix formula, or if in-place air voids exceed 13.5% based on [GDT 39](#). The control sieves for each mix type are shown in [Subsection 400.5.01.B—Determine Lot Acceptance](#).
- b. Subsurface mixes. For subsurface mixes, limit removal and replacement to the full lane width and no less than 10 ft. (3 m) long and as approved by the Engineer.
- c. Surface Mixes. For surface mixes, ensure that removal and replacement is not less than the full width of the affected lane and no less than the length of the affected areas as determined by the engineer.

Surface tolerance requirements apply to the corrected areas for both subsurface and surface mixes.

400.3.07 Contractor Warranty and Maintenance

A. Contractor's Record

Maintain a dated, written record of the most recent plant calibration. Keep this record available for the Engineer's inspection at all times. Maintain records in the form of:

- Graphs
- Tables
- Charts
- Mechanically prepared data

400.4 Measurement

Thickness and spread rate tolerances for the various mixtures are specified in [Subsection 400.4.A.2.b, Table 11, Thickness and Spread Rate Tolerance at Any Given Location](#). These tolerances are applied as outlined below:

A. Hot Mix Asphaltic Concrete Paid for by Weight

1. Plans Designate a Spread Rate

- a. Thickness Determinations. Thickness determinations are not required when the Plans designate a spread rate per square yard (meter).

If the spread rate exceeds the upper limits outlined in the [Subsection 400.4.A.2.b, Table 11, —Thickness and Spread Rate Tolerance at Any Given Location](#)", the mix in excess will not be paid for.

If the rate of spread is less than the lower limit, correct the deficient course by overlaying the entire lot.

The mixture used for correcting deficient areas is paid for at the Contract Unit Price of the course being corrected and is subject to the [Mixture Acceptance Schedule—Table 9 or 10](#).

Section 400—Hot Mix Asphaltic Concrete Construction

- b. Recalculate the Total Spread Rate. After the deficient hot mix course has been corrected, the total spread rate for that lot is recalculated, and mix in excess of the upper tolerance limit as outlined in the [Subsection 400.4.A.2.b, Table 11, -Thickness and Spread Rate Tolerance at Any Given Location](#)” is not paid for.

The quantity of material placed on irregular areas such as driveways, turnouts, intersections, feather edge section, etc., is deducted from the final spread determination for each lot.

2. Plans Designate Thickness

If the average thickness exceeds the tolerances specified in the [Subsection 400.4.A.2.b, Table 11, -Thickness and Spread Rate Tolerance at Any Given Location](#)”, the Engineer shall take cores to determine the area of excess thickness. Excess quantity will not be paid for.

If the average thickness is deficient by more than the tolerances specified in the Thickness and Spread Rate Tolerance at Any Given Location table below, the Engineer shall take additional cores to determine the area of deficient thickness. Correct areas with thickness deficiencies as follows:

- a. Overlay the deficient area with the same mixture type being corrected or with an approved surface mixture. The overlay shall extend for a minimum of 300 ft (90 m) for the full width of the course.
- b. Ensure that the corrected surface course complies with [Subsection 400.3.06.C.1, -Visual and Straightedge Inspection. II](#). The mixture required to correct a deficient area is paid for at the Contract Unit Price of the course being corrected.

The mixture is subject to the [Mixture Acceptance Schedule—Table 9 or 10](#). The quantity of the additional mixture shall not exceed the required calculated quantity used to increase the average thickness of the overlaid section to the maximum tolerance allowed under the following table.

Table 11—Thickness and Spread Rate Tolerance at Any Given Location

Course	Thickness Specified	Spread Rate Specified
Asphaltic concrete base course	± 0.5 in (±13 mm)	+40 lbs, -50 lbs (+20 kg, -30 kg)
Intermediate and/or wearing course	± 0.25 in (± 6 mm)	+20 lbs, -25 lbs (+10 kg, -15 kg)
Overall of any combination of 1 and 2	± 0.5 in (±13 mm)	+40 lbs, -50 lbs (+20 kg, -30 kg)

Note 1: For asphaltic concrete 9.5 mm OGFC and 12.5 mm OGFC, control the spread rate per lot within 5 lbs/yd² (3 kg/m²) of the designated spread rate. For asphaltic concrete 12.5 mm PEM, control the spread rate per lot within 10 lbs/yd² (6 kg/m²) of the designated spread rate.

Note 2: Thickness and spread rate tolerances are provided to allow normal variations within a given lot. Do not continuously operate at a thickness or spread rate not specified.

Section 400—Hot Mix Asphaltic Concrete Construction

When the Plans specify a thickness, the Engineer may take as many cores as necessary to determine the average thickness of the intermediate or surface course. The Engineer shall take a minimum of one core per 1,000 ft (300 m) per two lanes of roadway. Thickness will be determined by average measurements of each core according to [GDT 42](#).

If the average exceeds the tolerances specified in the [Subsection 400.4.A.2.b, Table 11, –Thickness and Spread Rate Tolerance at Any Given Location](#), additional cores will be taken to determine the area of excess thickness and excess tonnage will not be paid for.

B. Hot Mix Asphaltic Concrete Paid for by Square Yard (Meter)

1. The thickness of the base course or the intermediate or surface course will be determined by the Department by cutting cores and the thickness will be determined by averaging the measurements of each core.
2. If any measurement is deficient in thickness more than the tolerances given in the table above, additional cores will be taken by the Department to determine the area of thickness deficiency. Correct thickness deficiency areas as follows:
 - a. Overlay the deficient area with the same type mixtures being corrected or with surface mixture. Extend the overlay at least 300 ft (90 m) for the full width of the course.
 - b. Ensure that the corrected surface course complies with [Subsection 400.3.06.C.1, Visual and Straightedge Inspection](#).
 - c. The mixture is subject to the [Mixture Acceptance Schedule—Table 9 or 10](#).
3. No extra payment is made for mixtures used for correction.
4. No extra payment is made for thickness in excess of that specified.

<p>NOTE: Thickness tolerances are provided to allow normal variations within a given lot. Do not continuously operate at a thickness not specified.</p>

C. Asphaltic Concrete

Hot mix asphaltic concrete, complete in place and accepted, is measured in tons (megagrams) or square yards (meters) as indicated in the Proposal. If payment is by the ton (megagram), the actual weight is determined by weighing each loaded vehicle on the required motor truck scale as the material is hauled to the roadway, or by using recorded weights if a digital recording device is used.

The weight measured includes all materials. No deductions are made for the weight of the individual ingredients. The actual weight is the pay weight except when the aggregates used have a combined bulk specific gravity greater than 2.75. In this case the pay weight is determined according to the following formula:

Section 400—Hot Mix Asphaltic Concrete Construction

$$T1 = T \times \frac{\% AC + \frac{\% Aggregate \times 2.75}{\text{combined bulk Sp. Gr.}} + \% Y}{100}$$

Where:

T1	Pay weight, tonnage (Mg)
T=	Actual weight
% AC=	Percent asphalt cement by weight of total mixture
% Aggregate =	Percent aggregate by weight of total mixture
Combined Bulk Sp. Gr.=	Calculated combined bulk specific gravity of various mineral aggregates used in the mixture
% Y=	Percent hydrated lime by weight of mineral aggregate

D. Bituminous Material

Bituminous material is not measured for separate payment.

E. Hydrated Lime

When hydrated lime is used as an anti-stripping additive, it is not measured for separate payment.

F. Field Laboratory

The field laboratory required in this Specification is not measured for separate payment.

G. Asphaltic Concrete Leveling

Payment of hot mix asphaltic concrete leveling, regardless of the type mix, is full compensation for furnishing materials, bituminous materials, and hydrated lime (when required) for patching and repair of minor defects, surface preparation, cleaning, hauling, mixing, spreading, and rolling.

Mixture for leveling courses is subject to the acceptance schedule as stated in [Subsection 400.3.06.A](#) and [Subsection 400.3.06.B](#).

H. Asphaltic Concrete Patching

Hot mix asphaltic concrete patching, regardless of the type mix, is paid for at the Contract Unit Price per ton (Megagram), complete in place and accepted. Payment is full compensation for:

- Furnishing materials such as bituminous material and hydrated lime (when required)
- Preparing surface to be patched
- Cutting areas to be patched, trimmed, and cleaned
- Hauling, mixing, placing, and compacting the materials

Section 400—Hot Mix Asphaltic Concrete Construction

400.4.01 Limits

When the asphaltic concrete is paid for by the square yard (meter) and multiple lifts are used, the number and thickness of the lifts are subject to the Engineer's approval and are used to prorate the pay factor for the affected roadway section.

400.5 Payment

When materials or construction are not within the tolerances in this Specification, the Contract Price will be adjusted according to [Subsection 106.03, —Samples, Tests, Cited Specification sl](#) and [Subsection 400.3 .06, —Quality Acceptance.l](#)

Hot mix asphaltic concrete of the various types are paid for at the Contract Unit Price per ton (megagram) or per square yard (meter). Payment is full compensation for furnishing and placing materials including asphalt cement, hydrated lime when required, approved additives, and for cleaning and repairing, preparing surfaces, hauling, mixing, spreading, rolling, and performing other operations to complete the Contract Item.

Payment will be made under:

Item No. 400	Asphaltic concrete <u>type</u> Superpave, <u>group-blend</u> , Including bituminous materials, Gilsonite modifier, and hydrated lime	Per ton (megagram)
Item No. 400	<u> </u> inches asphaltic concrete, <u>type</u> Superpave, <u>group-blend</u> including bituminous materials, Gilsonite modifier and hydrated lime	Per square yard (meter)
Item No. 400	Asphaltic concrete <u>type</u> Stone Matrix Asphalt, <u>group-blend</u> , including polymer-modified bituminous materials and hydrated lime	Per ton (megagram)
Item No. 400	Asphaltic concrete <u>type</u> OGFC, <u>group 2</u> only, including bituminous materials and hydrated lime	Per ton (megagram)
Item No. 400	Asphaltic concrete <u>type</u> OGFC, <u>group 2</u> only, including polymer-modified bituminous materials and hydrated lime	Per ton (megagram)
Item No. 400	Asphaltic concrete <u>type</u> Porous European Mix, <u>group 2</u> only, including polymer-modified bituminous materials and hydrated lime	Per ton (megagram)

400.5.01 Adjustments

A. Materials Produced and Placed During the Adjustment Period

An adjustment period is allowed at the start of mixing operations for each type of mix placed on the Contract except for Asphaltic Concrete OGFC or PEM. The adjustment period is provided to adjust or correct the mix and to establish the construction procedures and sequence of operations.

The adjustment period consists of the tons (megagrams) of the affected mix produced and placed on the first day of operation. If this quantity is less than 500 tons (500 Mg), the Engineer may combine the tons (megagrams) produced and placed on the first day of operation with the tons (megagrams) produced and placed on the next production day of the affected mix for the adjustment period.

The material produced and placed during the mixture adjustment period is one lot. If the mix is adjusted during this period, a new lot may be necessary, but a new adjustment period will not be permitted.

Section 400—Hot Mix Asphaltic Concrete Construction

This material shall be paid for at 100 percent of the Contract Unit Price provided it meets the minimum requirements for a 1.00 pay factor for asphalt cement content and a 0.90 pay factor for gradation in the [Mixture Acceptance Schedule—Table 9 or 10](#).

If the material placed during the adjustment period fails to meet the above requirements, it will be paid for using the applicable acceptance schedule. When the same type Superpave mixture is placed at different mix design levels and a different blend of materials is specified in the job mix formula, a new adjustment period shall be granted. However, when a Superpave mixture with the same blend of materials specified in the job mix formula is placed at different mix design levels or when a mixture used for leveling at a spread rate of 90 lbs/yd² (50 kg/m²) or less is also used for the surface mix at a spread rate greater than 90 lbs/yd² (50 kg/m²), an additional adjustment period will be allowed for compaction only. This material will be paid for at a 1.00 pay factor provided it:

- Meets the minimum requirements for a 1.00 pay factor in the Mixture Acceptance Schedule—Table 9 or 10 for both asphalt content and gradation.
- Meets the minimum requirements for a 0.90 pay factor in Table 12 of [Subsection 400.5.01C, –Calculate Mean Pavement Air Voids](#).

Mixture which does not meet these requirements shall be paid for using the applicable acceptance schedule.

B. Determine Lot Acceptance

Pay factor adjustments are based on control sieves and asphalt cement content. The control sieves used in the mixture acceptance schedule for the various types of mix are indicated below:

Control Sieves Used in the Mixture Acceptance Schedule	
Asphaltic concrete 25 mm Superpave	1/2 in., No. 8 (12.5 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 19 mm SMA	1/2 in., No. 8 (12.5 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 19 mm Superpave	3/8 in., No. 8 (9.5 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 12.5 mm Superpave	3/8 in., No. 8 (9.5 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 12.5 mm SMA	3/8 in., No. 8 (9.5 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 12.5 mm PEM	3/8 in., No. 8 (9.5 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 12.5 mm OGFC	3/8 in., No. 8 (9.5 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 9.5 mm Superpave	No. 4, No. 8 (4.75 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 9.5 mm SMA	No. 4, No. 8 (4.75 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 9.5 mm OGFC	No. 4, No. 8 (4.75 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 4.75 mm Mix	No. 8 (2.36 mm) sieve and asphalt cement

For projects which do not have milling quantities established as a Pay Item, the Department will pay for 12.5 mm OGFC and PEM placed on ramps and end of project transitions under the appropriate mixture pay item, but the mix shall be subject to the same gradation and control sieve requirements as asphaltic concrete 9.5 mm OGFC. Add polymer-modified bituminous material, hydrated lime, and stabilizing fiber to this mix.

Section 400—Hot Mix Asphaltic Concrete Construction

The Department will perform the following tasks:

1. Using the [Mixture Acceptance Schedule—Table 9 or 10](#), determine the mean of the deviations from the job mix formula per test results per lot.
2. Determine this mean by averaging the actual numeric value of the individual deviations from the job mix formula; disregard whether the deviations are positive or negative amounts.
3. Use the Asphalt Cement Content and Aggregate Gradation of Asphalt Concrete [Mixture Acceptance Schedule—Table 9](#) to determine acceptance of surface mixes and the [Mixture Acceptance Schedule—Table 10](#) to determine acceptance of subsurface mixes.

On Contracts involving 1,000 tons (1000 Mg) or less of asphaltic concrete, the mixture is accepted for 100 percent payment of the asphaltic concrete Unit Price provided it meets the following:

1. Minimum requirements for a 1.00 pay factor for asphalt cement content and a 0.90 pay factor for gradation in the applicable [Mixture Acceptance Schedule—Table 9 or 10](#).
2. Minimum requirements for a 0.90 pay factor in Table 12 of [Subsection 400.5.01 C, -Calculate Pavement Mean Air Voids](#).

If the material placed on Contracts involving 1,000 tons (1000 Mg) or less of asphaltic concrete does not meet the above requirements, the material will be paid for using the applicable acceptance schedule.

C. Calculate Pavement Mean Air Voids

The Department will determine the percent of maximum air voids for each lot by dividing the pavement mean air voids by the maximum pavement mean air voids acceptable.

The Department will determine the payment for each lot by multiplying the Contract Unit Price by the adjusted pay factor shown in the following Air Voids Acceptance schedule:

Table 12 - Air Voids Acceptance Schedule

Pay Factor	Percent of Maximum Air Voids (Lot Average-5 Tests)	Percent of Maximum Air Voids (Lot Average-10 Tests) (for Reevaluations)
1.00	≤100	≤100
0.97	100.1 — 105	100.1 — 104
0.95	105.1 — 112	104.1 — 109
0.90	112.1 — 124	109.1 — 118
0.80	124.1 — 149	118.1 — 136
0.70	149.1 — 172	136.1 — 153
0.50	172.1 — 191	153.1 — 166

When the range tolerance is exceeded, the Department will apply a pay factor of 0.95 as described in [Subsection 400.3.06.B.2](#).

Section 400—Hot Mix Asphaltic Concrete Construction

D. Asphaltic Concrete For Temporary Detours

Hot mix asphaltic concrete placed on temporary detours that will not remain in place as part of the permanent pavement does not require hydrated lime. Hot mix used for this purpose is paid for at an adjusted Contract Price.

Where the Contract Price of the asphaltic concrete for permanent pavement is let by the ton (megagram), the Contract Price for the asphaltic concrete placed on temporary detours is adjusted by subtracting \$0.75/ton (\$0.85/mg) of mix used.

Where the Contract price of the mix in the permanent pavement is based on the square yard (meter), obtain the adjusted price for the same mix used on the temporary detour by subtracting \$0.04/yd² (\$0.05/ m²) per 1-in (25-mm) plan depth.

Further price adjustments required in [Subsection 400.3.06, –Quality Acceptance.I](#) are based on the appropriate adjusted Contract Price for mix used in the temporary detour work.

E. Determine Lot Payment

Determine the lot payment as follows:

1. When one of the pay factors for a specific acceptance lot is less than 1.0, determine the payment for the lot by multiplying the Contract Unit Price by the adjusted pay factor.
2. When two or more pay factors for a specific acceptance lot are less than 1.0, determine the adjusted payment by multiplying the Contract Unit Price by the lowest pay factor.

If the mean of the deviations from the job mix formula of the tests for a sieve or asphalt cement content exceeds the tolerances established in the [Mixture Acceptance Schedule—Table 9 or 10](#) and if the Engineer determines that the material need not be removed and replaced, the lot may be accepted at an adjusted unit price as determined by the Engineer. If the pavement mean air voids exceed the tolerances established in the [Air Voids Acceptance Schedule – Table 12](#), remove and replace the materials at the Contractor's expense.

If the Engineer determines that the material is not acceptable to leave in place, remove and replace the materials at the Contractor's expense.

106.01 Source of Supply and Quantity of Materials

The materials used in The Work shall meet all quality requirements of the Contract. Materials will not be considered as finally accepted until all tests, including any to be taken from the finished Work have been completed and evaluated. To expedite the inspection and testing of materials, the Contractor shall notify the Engineer in writing of his proposed sources of materials at least 2 weeks before delivery, or earlier if blend determinations or mix designs are required. When required, representative preliminary samples of the character and quality prescribed shall be submitted for examination and testing. The approval of preliminary samples does not obligate the Engineer to accept materials from the same source delivered later. If, after trial, it is found that sources of supply for previously approved materials do not produce uniform and satisfactory products, or if the product from any source proves unacceptable at any time, the Contractor shall furnish materials from other sources. The Engineer shall have the right to reject the entire output of any source from which he finds it is impractical to secure a continuous flow of uniformly satisfactory material.

Upon request by the Department, the Contractor shall furnish formal written invoices from the materials suppliers. The invoice shall show the date shipped, the quantities, and the unit prices.

The Contractor shall purchase materials from suppliers who are willing for the Contractor to furnish the Department copies of invoices as noted herein upon request by the Department.

Materials used and operations performed under [Section 400- Hot Mix Asphaltic Concrete Construction](#), shall be controlled and tested by the Contractor. This shall be done in such a manner as to produce a uniform product that meets Specification requirements. In the event the Contractor's quality control procedures do not achieve the desired objective, operations shall be suspended until satisfactory results are obtained.

The Contractor's quality control personnel shall be properly instructed and trained to perform all tests and make calculations, and shall be competent to control all processes so that the requirements are met.

109.01 Measurement and Quantities

The method of measurement and computations to be used in determination of quantities of material furnished and of work performed under the Contract will be those methods generally recognized as conforming to good engineering practice.

Unless otherwise specified, longitudinal measurements for area computations will be made along the surface, and no deductions will be made for individual fixtures having an area of 9 ft² (1 m²) or less. Unless otherwise specified, transverse measurements for area computations will be the neat dimensions shown on the Plans or ordered in writing by the Engineer.

Where payment is to be made by the square yard (square meter) for a specified thickness, the length will be measured on the surface along the centerline and the pay width shall be that width specified on the plans for the Final surface of the completed section. Intermediate courses shall be placed at a width sufficient to support successive courses with no detriment to the stability of the successive courses. The width of material required beyond the pay width will not be eligible for payment and shall be considered incidental to the work.

Structures will be measured according to neat lines shown on the Plans or as altered to fit field conditions.

All items which are measured by the linear foot (linear meter), such as pipe culverts, guard rail, underdrains, etc., will be measured parallel to the base or foundation upon which such structures are placed, unless otherwise shown on the Plans.

In computing volumes of excavation, the average end area method or other acceptable methods will be used.

The term “gage,” when used in connection with the measurement of steel plates, will mean the U.S. Standard Gage.

When the term “gage” refers to the measurement of electrical wire it will mean the wire gage specified in the National Electrical Code.

The term “ton” will mean the short ton consisting of 2,000 pounds avoirdupois. The term “megagram” will mean one metric ton, equivalent to 1,000 kg. Any commodity paid for by weight shall be weighed on scales that have been approved as specified below and which are furnished at the expense of the Contractor or Supplier. Weighing and measuring systems including remote controls shall be subject to type-approval by the Department of Transportation. The manufacture, installation, performance, and operation of such devices located in Georgia shall conform to, and be governed by, the Official Code of Georgia, Annotated, Section 10-2-5 of the Georgia Weights and Measures Act, the Georgia Weights and Measures Regulations, as amended and adopted, the current edition of the National Bureau of Standards Handbook 44, and these Specifications. Weighing and measuring systems located outside Georgia which are utilized for weighing materials to be used in Department work shall be manufactured, installed, approved, and operated in accordance with applicable laws and regulations for the state in which the scales are located.

All weighing, measuring, and metering devices used to measure quantities for payment shall be suitable for the purpose intended and will be considered to be “commercial devices.” Commodity scales located in Georgia shall be certified before use for accuracy, condition, etc., by the Weights and Measures Division of the Georgia Department of Agriculture, its authorized representative, or the Georgia Department of Transportation Office of Materials and Research. Scales located outside Georgia shall be certified in accordance with applicable laws and regulations for the state in which the scales are located. The Georgia Department of Transportation Office of Materials and Research may certify the scales. This certification shall have been made within a period of not more than one year prior to date of use for weighing commodity.

All equipment and all mechanisms and devices attached thereto or used in connection therewith shall be constructed, assembled, and installed for use so that they do not facilitate the perpetration of fraud. Any scale component or mechanism, which if manipulated would alter true scale values (including manual zero setting mechanisms) shall not be accessible to the scale operator. Such components and mechanisms that would otherwise be accessible to the scale operator shall be enclosed. Provisions shall be made for security seals where appropriate on equipment and accessories. A security seal shall be affixed to any adjustment mechanism designed to be sealed. Scale or accessory devices shall not be used if security seals have been broken or removed.

Section 109—Measurement and Payment

Any certified scale or scale component which has been repaired, dismantled, or moved to another location shall again be tested and certified before it is eligible for weighing.

Whenever materials that are paid for based on weight are from a source within the State, the scales shall be operated by and the weights attested to by signature and seal of a duly authorized Certified Public Weigher in accordance with Standard Operating Procedure 15 and the Official Code of Georgia, Annotated, Section 10-2-5 of the Georgia Weights and Measures Act as amended and adopted. When such materials originate from another state that has a certified or licensed weigher program, the scales shall be operated by a weigher who is certified by that state in accordance with applicable laws, and weight ticket recordation shall be in accordance with Standard Operating Procedure 15.

When materials are paid for based on weight and originate from another state which has no program for certifying or licensing weighers, the materials shall be weighed on scales located in the State of Georgia by a Certified Public Weigher in accordance with Standard Operating Procedure 15 and the Official Code of Georgia, Annotated, Section 10-2-5 of the Georgia Weights and Measures Act as amended and adopted.

No scale shall be used to measure weights greater than the scale manufacturer's rated capacity. A digital recorder shall be installed as part of any commodity scale. The recorder shall produce a printed digital record on a ticket with the gross, tare, and net weights of the delivery trucks, along with the date and time printed for each ticket. Provisions shall be made so that the scales or recorders may not be manually manipulated during the printing process. The system shall be so interlocked as to allow printing only when the scale has come to rest. Either the gross or net weight shall be a direct scale reading. Printing and recording systems that are capable of accepting keyboard entries shall clearly and automatically differentiate a direct scale weight value from any other weight values printed on the load ticket.

All scales used to determine pay quantities shall be provided to attain a zero balance indication with no load on the load receiving element by the use of semi-automatic zero (push-button zero) or automatic zero maintenance.

Vehicle scales shall have a platform of sufficient size to accommodate the entire length of any vehicle weighed and shall have sufficient capacity to weigh the largest load. Adequate drainage shall be provided to prevent saturation of the ground under the scale foundation.

The Engineer, at his discretion, may require the platform scales to be checked for accuracy. For this purpose the Contractor shall load a truck with material of his choosing, weigh the loaded truck on his scales, and then weigh it on another set of certified vehicle scales. When the difference exceeds 0.4 percent of load, the scales shall be corrected and certified by a registered scale serviceman registered in the appropriate class as outlined in the Georgia Weights and Measures Regulations or in accordance with applicable requirements of the state in which the scales are located. A test report shall be submitted to the appropriate representative of the Department of Agriculture.

Materials to be measured by volume in the hauling vehicle shall be hauled in approved vehicles and measured therein at the point of delivery. Vehicles for this purpose may be of any size or type acceptable to the Engineer, provided that the body is of such shape that the actual contents may be readily and accurately determined. All vehicles shall be loaded to their water level capacity as determined by the Engineer, provided that the body is of such shape that the actual contents may be readily and accurately determined.

Cement and lime will be measured by the ton (megagram). Whenever cement or lime is delivered to the Project in tank trucks, a certified weight shall be made at the shipping point by an authorized Certified Public Weigher who is not an employee of the Department. Whenever cement and lime are from a source within the State, the scales shall be operated by the weights attested to by signature and seal of a duly authorized Certified Public Weigher in accordance with Standard Operating Procedure 15 and the Official Code of Georgia, Annotated, Section 10-2-5 of the Georgia Weights and Measures Act as amended and adopted. When such materials originate from another state that has a certified or licensed weigher program, the scales shall be operated by a weigher who is certified by that state in accordance with applicable laws, and the weight ticket recordation shall be in accordance with Standard Operating Procedure 15. When cement and lime originate from another state that has no program for certifying or licensing weighers, the materials shall be weighed on scales located

Section 109—Measurement and Payment

in the State of Georgia by a Certified Public Weigher in accordance with Standard Operating Procedure 15 and the Official

Code of Georgia, Annotated, Section 10-2-5 of the Georgia Weights and Measures Act as amended and adopted.

The shipping invoice shall contain the certified weights and the signature and seal of the Certified Public Weigher. A security seal shall also be affixed to the discharge pipe cap on the tank truck before leaving the shipping point. The number on the security seal shall also be recorded on the shipping invoice. The shipping invoice for quicklime shall also contain a certified lime purity percentage. Unsealed tank trucks will require reweighing by a Certified Public Weigher.

Timber will be measured by the thousand feet board measure (MFBM) (cubic meter) actually incorporated in the structure. Measurements will be based on nominal widths and thickness and the actual length in place. No additional measurement will be made for splices except as noted for overlaps as shown on the Plans.

The term “Lump Sum” when used as an item of payment will mean complete payment for the Work described in the

Contract.

When a complete structure or structural unit (in effect, “Lump Sum” work) is specified as the unit of the measurement, the

unit will be construed to include all necessary fittings and

accessories. Rental of equipment will be measured as defined

in [Subsection 109.05.B.4](#).

When standard manufactured items are specified as fence, wire, plates, rolled shapes, pipe conduits, etc., and these items are identified by gage, unit weight, section dimensions, etc., such identification will be considered to be nominal weights or dimensions. Unless more stringently controlled by tolerance in cited Specifications, manufacturing tolerances established by the industries involved will be accepted.

Section 400: Appendix 3

424.3.02 Equipment

Have the Engineer approve equipment types and quantities before using equipment on the Project.

Ensure that the equipment used to construct the surface treatment:

- Produces work that complies with the standards in this section
- Is on the Project and in proper working order before construction begins

A. Aggregate Spreader

The Department will inspect annually the aggregate spreader before it is used in the work. If the spreader is approved, the Department will attach an equipment certification sticker to the spreader.

Use a self-propelled aggregate spreader that can apply aggregate at the desired rate uniformly and accurately without corrugation, overlaps, or excess deficient areas.

Ensure that the spreader can spread courses to the required widths. Provide spreaders to promptly cover the full width of the asphalt application.

B. Pressure Distributor

The Department will inspect annually the pressure distributor before it is used in the work. If the distributor is approved, the Department will attach an equipment certification sticker to the distributor. The pressure distributor should be equipped as follows:

1. Mount the pressure distributor on pneumatic tires wide enough to prevent damage to the road surface.
2. Design, equip, maintain, and operate the distributor so that the bituminous material will be heated and applied evenly throughout the length of the spray bars. Ensure that it maintains a constant, uniform pressure on the nozzles.
3. Install screens between the tank and the nozzles and clean them frequently to prevent clogging.
4. Use an adjustable distributor that can deliver controlled amounts of bituminous material from 0.04 to 1.0 gal/yd², ± 0.02 gal/yd² (0.18 to 4.53 L/m², ± 0.10 L/m²) up to 24 ft (7.2 m) wide without atomization, streaking, or pulsation in the flow.
5. Use a distributor equipped with the following:
 - A tachometer and thermometers to indicate the application rate and the temperature of the tank contents
 - Measuring devices to accurately indicate the amount of bituminous material, in gallons (liters), in the distributor before and after each application
 - Full circulating spray bars that can be adjusted laterally to conform to a stringline and capable of vertical and horizontal adjustment.
 - A positive shut-off control to prevent dripping bituminous material on the roadway

Section 424—Bituminous Surface Treatment

- A distributor tank equipped with a sample valve in a safe and convenient location to obtain bituminous material samples

C. Heating Equipment

Ensure that heating equipment will heat and maintain the bituminous material uniformly at the temperature required. Provide an accurate thermometer.

D. Smooth-Wheeled Rollers

Use self-propelled, tandem-type smooth-wheeled rollers that can be alternated with pneumatic-tired wheels. The rollers shall weigh from 3 to 8 tons (3 to 7 Mg). Ensure that the roller weights within these limits can properly compact the materials.

E. Pneumatic-Tired Rollers

Use self-propelled pneumatic-tired rollers with treads that will not disturb the aggregates. Rollers with pneumatic-tired wheels that can be alternated with a steel drum are also permitted.

F. Power Broom and Power Blower

Provide at least one power broom and one power blower, or a combination power broom and blower, that can remove dust or loose materials from the road surface.

413.3 Construction Requirements

413.3.01 Omitted.

413.3.02 Equipment

Provide equipment in good repair, including the following units that meet the requirements of [Subsection 424.3.02, Equipment.](#)

- Power broom and blower
- Pressure distributor

413.3.03 Omitted.

413.3.04 Omitted

413.3.05 Construction

A. Seasonal and Weather Limitation

Do not apply tack coat if the existing surface is wet or frozen. Do not place emulsified asphalt if the air temperature in the shade is less than 40 °F (4 °C).

B. Application

Coat the entire areas to be paved with the tack coat unless directed otherwise by the Engineer. Apply tack coat with distributor spray bars instead of hand hoses, except in small areas that are inaccessible to spray bars.

C. Temperature of Material

Apply bituminous materials within the temperature ranges specified below.

Bituminous Materials	Temperature of Application °F (°C)
Asphalt cement	350 - 400 (175 - 205)
CRS-2h	140 - 180 (60 - 80)
CRS-3	140 - 180 (60 - 80)

D. Cleaning

Immediately before applying the tack coat, clean the entire area free of loose dirt, clay, and other foreign materials.

E. Application Rate

The Engineer will determine the application rate of the bituminous tack coat.

F. Limitations and Areas Coated

Apply only enough tack coat to the prepared road surface that can be covered with the new pavement course the same working day the tack coat is applied.

G. Maintenance and Protection

After applying the tack coat material, allow it to break until it is tacky enough to receive the surface course. Do not allow traffic on the tack.

Section 400: Appendix 5

828.2.03 Superpave Asphalt Concrete Mixtures

A. Requirements for Superpave Mixtures (except Parking Lot Mixtures)

Produce the mixture according to an approved mix design and Job Mix Formula. Ensure Superpave Asphalt Concrete mixtures meet the following mixture control tolerances and mix design limits:

I. Gradation limits for Superpave mixtures are as follows:

Sieve Size	Mixture Control Tolerance	Design Gradation Limits, Percent Passing				
		9.5mm Superpave Type I	9.5mm Superpave Type II	12.5 mm Superpave (Note 1)	19mm Superpave	25mm Superpave
1 1/2 in (37.5 mm)						100*
1- in (25.0 mm)	± 8.0			100*	100*	90-100
3/4 in (19.0 mm)	±8.0**	100*	100*	98-100****	90-100	55-89**
1/2 in (12.5 mm)	±6.0***	98-100****	98-100****	90-100	60-89***	50-70
3/8 in (9.5 mm)	±5.6	90-100	90-100	70-89	55-75	
No.4 (4.75 mm) s	±5.6	65-85	55-75			
No. 8 (2.36 mm)	±4.6	48-55	42-47	38-46	32-36	30-36
No. 200 (75 1-1m)	±2.0	5.0-7.0	5.0-7.0	4.5-7.0	4.0-6.0	3.5-6.0
Range for % AC (Note 3)	±0.4 (Note 2)	5.50-7.25	5.25-7.00	5.00-6.25	4.25-5.50	4.00-5.25

• Mixture control tolerance is not applicable to this sieve for this mix.

**Ensure mixture control tolerance is within ± 10.0% for this sieve for 25 mm Superpave.

***Ensure mixture control tolerance is within ± 8.0% for this sieve for 19 mm Superpave.

****Ensure mixture control tolerance is within ± 2.0% for this sieve for 12.5 mm and 9.5 mm mixes.

Note 1: Use PG 76-22 in 12.5 mm Superpave, excluding shoulder construction, on all projects with ADT greater than

25,000 as detailed in the Contract Pay Item.

Note 2: Quality Acceptance Test Results for AC content deviating >± 0.3% from the approved Job Mix Formula (JMF) consistently over three Lots may subject the mix to a revised AC content on the project JMF at the discretion of the State Materials Engineer based on statistical trend.

Note 3: Range for % AC is Original Optimum AC (OOAC) at 65 gyrations prior to the Corrected Optimum AC (COAC)

calculation detailed in SOP 2 (Appendix D).

2. Volumetric limits are as follows:

Design Parameter	Mix Type	Limits
% of Max. Specific Gravity (Gmm) at design gyrations, (Ndes)	All	96%
% Gmm at the initial number of gyrations, Ni	All	91.5% maximum
% voids filled with asphalt (VFA) at Ndes	9.5 mm Type I	Min. 72; Max. 80
	9.5 Type II and 12.5 mm	Min. 72; Max. 76
	19mm	Min. 71; Max 76
	25mm	Min. 69; Max 76
Fines to effective asphalt binder ratio (F/Pbe)	9.5 mm Type I	0.6 to 1.4
	All other types	0.8 to 1.6
Minimum Film Thickness (microns)*	All	> 7.00
Minimum % Voids in Mineral Aggregate (VMA) Note: VMA shall be calculated using the effective specific gravity of the aggregate (Gse). See SOP-2SP.	25mm	13.0
	19mm	14.0
	12.5 mm	15.0
	9.5 Type I	16.0
	9.5 Type II	16.0

*Superpave Mixtures approved prior to January 31, 2012, may be adjusted to meet Minimum Film Thickness requirements by the State Materials Engineer.

Note 2: Quality Acceptance Test Results for AC content that deviate $> \pm 0.3\%$ from the approved Job Mix Formula (JMF) consistently over three lots may subject the mix to a revised AC content on project JMF at the discretion of the State Materials Engineer based on statistical trend.

August 30, 2007
Revised: November 3, 2008
Revised: March 18, 2009
Revised: April 29, 2010
Revised: March 21, 2012
Revised July 13, 2012
First Use: December 14, 2012

DEPARTMENT OF TRANSPORTATION STATE OF GEORGIA

SPECIAL PROVISION

Section 820—Asphalt Cement

Section 400: Appendix 6

820.1 General Description

This section includes the requirements for asphalt cements prepared from crude petroleum.

820.1.01 Related References

A. Standard Specifications

General Provisions 101 through 150.

B. Referenced Documents

Standard Operating Procedure (SOP 4)

AASHTO R 28

AASHTO T 48

AASHTO T 179

AASHTO T 240

AASHTO T 313

AASHTO T 314

AASHTO T 315

AASHTO T 316

AASHTO TP70 / ASTM D7405

820.2 Materials

820.2.01 Asphalt Cement

A. Requirements

1. Type

Use a material homogenous and water-free and will not foam when heated to 347 °F (175 °C).

Ensure blend used to produce a specified performance grade meets the following requirements:

Is uniform and homogeneous without separation

Uses PG 64-22 or PG 67-22 described below for the base asphalt

Consists of production materials not being “air-blown”.

Contains < 0.5% acid (including Polyphosphoric Acid (PPA) modification, when approved by the Office of Materials and Research).

2. Grade

Use the various grades of asphalt cement meeting the requirements shown in the test requirements for Petroleum Asphalt Cements.

Add Styrene-Butadiene-Styrene (SBS) or Styrene-Butadiene (SB) to neat asphalt to produce a binder meeting requirements for PG 76-22 when roadway ADT is equal to or greater than 100,000 for Stone Matrix Asphalt and Porous European Mix (PEM) or Open Graded Friction Course (OGFC) Mixtures.

Styrene Butadiene Rubber (SBS) or Crumb rubber modified PG 76-22 is an acceptable alternative to SBS or SB modified asphalt cement at contractor's discretion, when roadway ADT is less than 100,000, provided the SBR or crumb rubber modified asphalt cement meets the tests' requirements of PG 76-22. For SBR modified PG 64-22 or PG 67-22 to meet PG 76-22, use only SBR currently approved on QPL-65 "Georgia's List of Approved Latex Suppliers". For crumb rubber modified PG 64-22 or PG 67-22 to meet PG 76-22, use 30 mesh size ambient or cryogenic ground tire rubber at minimum 10% of weight of total asphalt cement content. Ensure Trans-Polyoctenamer is added at 4.5% of the weight of the crumb rubber to achieve better particle distribution. Varying percentage blends of crumb rubber and approved additives may be used, at the discretion of the Office of Materials and Research, provided the end product meets all specified requirements of PG76-22 including Phase Angle. Ensure the end product is homogenous and shows no separation or coagulation. Percentage of ambient or cryogenic ground tire rubber is neat asphalt source dependent to meet specification requirements for PG 76-22.

The maximum Phase Angle requirement is not applicable to the crumb rubber modified PG 76-22 incorporating $\geq 10\%$ crumb rubber with approved additive equivalent to 4.5% of crumb rubber (see notes f, g, i and j).

Test Requirements for Petroleum Asphalt Cements

Test And Method	Test Temperature				Original Binder	Residue Of Binder After:	
	PG 58-22 (Note e)	PG 64-22	PG 67-22	PG 76-22 (Note d)		Rolling Thin Film Oven, AASHTO:T 240	Pressure Aging AASHTO: R 28
Flash Point, Min., AASHTO T 48					446 °F (230 °C)		
Viscosity, Max.,					3Pa-S		
AASHTO T 316, (Note a)	275 °F (135 °C)				(3000CP)		
Mass Loss (%), Max., AASHTO T 240, (Note b)						0.5	
Dynamic Shear, G*/sin							
, AASHTO T 315, 10 Rad/Sec	136 °F (58 °C)	147 °F (64 °C)	153 °F (67 °C)	169 °F (76 °C)	≥ 1.0 kPa	≥ 2.2 kPa	
Dissipated Energy, Dynamic Shear, G*·sin , AASHTO T 315, 10 Rad/Sec	72 °F (22 °C)	77 °F (25 °C)	80 °F (26.5 °C)	88 °F (31 °C)			≤ 5000 kPa
Creep Stiffness, 60 sec., AASHTO T 313, (Note c)	(°C) [h]						
Direct Tension, 1.0 mm/min., AASHTO T314, Failure Strain Multiple Stress Creep & Recovery (MSCR) test, ASTM D7405, AASHTO TP70 (proposed), J _{nr 3.2} kPa, (Notes f, g, i and j)	Notes:						
Polymer Separation Test ASTM D7173 AASHTO T53 Softening Point (°F)							

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- a. The Department may waive this requirement if the supplier warrants the asphalt binder can be adequately pumped and mixed at temperatures meeting all applicable safety standards.
- b. Heat loss by AASHTO: T 179 may be accepted in lieu of mass loss by AASHTO: T 240.
- c. If the creep stiffness is below 300,000 kPa, the direct tension test is not required. If the creep stiffness is $\geq 300,000$ kPa, report the Direct Tension Failure Strain value. Satisfy the m-value requirement in either case.
- d. Ensure the maximum Phase Angle measured by DSR is ≤ 75 degrees.
- e. The maximum Mass Loss shall be $\leq 1\%$, when used in conjunction with Bituminous Surface Treatment (Section 424).
- f. MSCR requirement is applicable to the SBR, Crumb Rubber & TOR (or other OMR approved additive) combination modified PG 76-22 asphalt cement. Additionally, ensure the materials meet all PG 76-22 requirements except for phase angle as detailed in sub-section 820.2.01.A.2.
- g. Ensure MSCR requirement for Average Percent Recovery at 3.2 kPa is $\geq 35\%$ for laboratory or terminally blended PG 64-22 or PG 67-22 modified using SBR or GTR to meet PG 76-22 requirements.
- h. Polymer Separation Test is performed by the Department for SBR and crumb rubber modified PG 76-22.
- i. PG 64-22 or PG 67-22 modified to meet PG 76-22 using crumb rubber, via dry method, will be evaluated using complete analysis for compliance with PG 76-22 requirements prior to mixture production using laboratory blended materials. PG 64-22 or PG 67-22 modified to meet PG 76-22 using crumb rubber via dry method, will be evaluated for compliance with original DSR testing requirements for PG 76-22 during mixture production using abson recovery in accordance with GDT 119 in compliance with AC sampling frequencies established in GSP 21 sub-section A.9.
- j. PG 64-22 or PG 67-22 modified to meet PG 76-22 using crumb rubber, via the dry method, will be evaluated for MSCR (Jnr @ 3.2 kPa) requirements, in accordance with GDT 119, on AC samples obtained for project assurance at frequencies established in GSP 21 sub-section A.9.

Thoroughly blend the composite materials at the supply facility prior to being loaded into the transport vehicle if modification is required in accordance with 820.2.01. Ensure all blending procedures, formulation, and operations are approved by the Office of Materials and Research.

3. Certification:

Provide certified test results from an approved, certified laboratory of blends for proposed PG asphalt for each specification characteristic of the asphalt cement proposed for shipment. Provide the certified results to the State Materials and Research Engineer as required in Standard Operating Procedure (SOP 4).

The State Materials and Research Engineer may interrupt production until test results are known in the event there is reason to suspect a sample will be outside specification limits. Mixture placed incorporating modified binders determined to not meet specification requirements may be subject to removal at the recommendation of the State Materials and Research Engineer.

B. Materials Warranty: Omitted

Section 413—Bituminous Tack Coat

413.1 General Description

This work includes furnishing and applying a bituminous tack coat on a prepared road surface including cleaning the road surface.

413.1.01 Definitions

General Provisions 101 through 150.

413.1.02 Related References

A. Standard Specifications

[Section 109—Measurement and Payment](#)

[Section 400—Hot Mix Asphaltic Concrete Construction](#)

[Section 424—Bituminous Surface Treatment](#)

[Section 427—Emulsified Asphalt Slurry Seal](#)

[Section 820—Asphalt Cement](#)

[Section 824—Cationic Asphalt Emulsion](#)

B. Referenced Documents

General Provisions 101 through 150.

413.1.03 Submittals

General Provisions 101 through 150.

413.2 Materials

Ensure that materials meet the following Specifications:

Material	Section
Asphalt cement, performance grade PG 58-22, PG 64-22, or PG 67-22	820.2.01
Cationic emulsified asphalt CRS-2h or CRS-3	824.2.01

Asphalt cement of performance grade PG 58-22, PG 64-22 or PG 67-22 is used for bituminous tack coat in work performed in [Section 400](#). Use cationic emulsified asphalt as a special application material only if directed by the Engineer.

The Department may change the grade or type of bituminous materials without a change in the Contract Unit Price if the Engineer determines that the grade or type selected is not performing satisfactorily.

413.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

413.3 Construction Requirements

413.3.01 Personnel

General Provisions 101 through 150.

413.3.02 Equipment

Provide equipment in good repair, including the following units that meet the requirements of [Subsection 424.3.02, Equipment.](#)

- Power broom and blower
- Pressure distributor

413.3.03 Preparation

General Provisions 101 through 150.

Section 413—Bituminous Tack Coat

413.3.04 Fabrication

General Provisions 101 through 150.

413.3.05 Construction

A. Seasonal and Weather Limitation

Do not apply tack coat if the existing surface is wet or frozen. Do not place emulsified asphalt if the air temperature in the shade is less than 40 °F (4 °C).

B. Application

Coat the entire areas to be paved with the tack coat unless directed otherwise by the Engineer. Apply tack coat with distributor spray bars instead of hand hoses, except in small areas that are inaccessible to spray bars.

C. Temperature of Material

Apply bituminous materials within the temperature ranges specified below.

Bituminous Materials	Temperature of Application °F (°C)
Asphalt cement	350 - 400 (175 - 205)
CRS-2h	140 - 180 (60 - 80)
CRS-3	140 - 180 (60 - 80)

D. Cleaning

Immediately before applying the tack coat, clean the entire area free of loose dirt, clay, and other foreign materials.

E. Application Rate

The Engineer will determine the application rate of the bituminous tack coat.

F. Limitations and Areas Coated

Apply only enough tack coat to the prepared road surface that can be covered with the new pavement course the same working day the tack coat is applied.

G. Maintenance and Protection

After applying the tack coat material, allow it to break until it is tacky enough to receive the surface course. Do not allow traffic on the tack.

413.3.06 Quality Acceptance

General Provisions 101 through 150.

413.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

413.4 Measurement

Bituminous materials for tack coat applied and accepted are measured as outlined in [Subsection 109.02, "Measurement of Bituminous Materials."](#)

Diluting emulsified tack coat is not ordinarily allowed except when used underneath slurry seal. The composition of diluted emulsified tack coat defined in [Subsection 427.3.05, "Construction"](#) is measured by the gallon (liter) of diluted mix.

413.4.01 Limits

General Provisions 101 through 150.

413.5 Payment

The accepted volume of bituminous material will be paid for at the Contract Unit Price per gallon (liter) for bituminous tack coat of the type and grade approved by the Engineer, complete in place. Payment is full compensation for preparing, cleaning, furnishing, hauling, applying material, and providing incidentals to complete the work.

Payment will be made under:

Section 413-Bituminous Tack Coat

Item No. 413	Bituminous tack coat	Per gallon (liter)
Item No. 413	Diluted emulsified asphalt tack coat	Per gallon (liter)

413.5.01 Adjustments

General Provisions 101 through 150.

Section 430—Portland Cement Concrete Pavement

430.1 General Description

This work includes constructing pavement composed of Portland cement concrete, with or without reinforcement as specified, on a prepared subgrade or subbase course.

Follow the requirements of these Specifications and conform to the lines, grades, thicknesses, and cross sections shown on the Plans or by the Engineer.

430.1.01 Definitions

General Provisions 101 through 150.

430.1.02 Related References

A. Standard Specifications

[Section 106—Control of Materials](#)

[Section 152—Field Laboratory Building](#)

[Section 431—Grind Concrete Pavement](#)

[Section 461—Sealing Roadway and Bridge Joints and Cracks](#)

[Section 500—Concrete Structures](#)

[Section 800—Coarse Aggregate](#)

[Section 801—Fine Aggregate](#)

[Section 830—Portland Cement](#)

[Section 831—Admixtures](#)

[Section 832—Curing Agents](#)

[Section 833—Joint Fillers and Sealers](#)

[Section 853—Reinforcement and Tensioning Steel](#)

[Section 880—Water](#)

[Section 886—Epoxy Resin Adhesives](#)

B. Referenced Documents

AASHTO T 126

AASHTO T 97

AASHTO T 22

AASHTO T 23

ACI 214

ASTM C 94, Requirements for Uniformity

ASTM C 684, Method A

[GDT 26](#)

[GDT 27](#)

Section 430—Portland Cement Concrete Pavement

[GDT 28](#)

[GDT 31](#)

[GDT 32](#)

[GDT 72](#)

[GDT 78](#)

SOP 34

Report form, furnished by the Engineer

Requests for certification

430.1.03 Submittals

A. Profilograph Equipment and Operator Certification

Include in the Contract Unit Bid Price the cost to furnish and operate a Rainhart (Model 860) Profilograph to measure pavement profile deviations.

Before paving, ensure that the operator and the profilograph are certified by the Office of Materials and Research in accordance with Standard Operating Procedure No. 34, Certification of Contractor Personnel and Equipment for Smoothness Testing of Portland Cement Concrete Pavement with the Rainhart Profilograph. Certification includes a mechanical check of the profilograph functions and a written examination by the operator.

Request certification in writing to the Office of Materials and Research at least two weeks before it is needed.

B. Concrete Design

Submit for approval a concrete design that is prepared by a testing laboratory approved by the Office of Materials and Research. The Contractor will transmit the design to the Engineer for approval at least 35 days before use.

C. Approval of Mix Design Proportions

Obtain approval from the Office of Materials and Research for proposed concrete mix designs. Class 1 and 2 concrete mix designs will be verified for early compressive strength according to ASTM C-684, Method A. Class HES concrete mix designs will be verified for compressive strength development at 72 hours according to AASHTO T 126 and AASHTO T 22.

430.2 Materials

Ensure that materials meet the requirements of the following Specifications:

Material	Section
Portland cement	830.2.01
Portland Pozzolan cement	830.2.03
Water	880.2.01
Fine Aggregate, Size No. 10	801.2.02
Coarse Aggregate, Class A or B Crushed Stone or Gravel, Sizes as Specified	800.2.01
Steel Bars for Reinforcement	853.2.01
Steel Wire for Concrete Reinforcement	853.2.06
Welded Steel Wire Fabric for Concrete Reinforcement	853.2.07

Section 430—Portland Cement Concrete Pavement

Dowel Bars and Bar Coatings	853.2.08
Curing Agents	832
Air Entraining Admixtures	831.2.01
Fly Ash and Slag	831.2.03
Joint Fillers and Sealers	833
Low Modulus Silicone Sealant for Roadway Construction Joints	833.2.06
Epoxy Adhesive for Repairing Cracks	886.2.01
Chemical Admixtures	831.2.02

A. Fly Ash

Use fly ash, if appropriate, as a concrete additive to promote workability and plasticity. It may be used as a partial replacement for Portland cement in concrete, but follow these limits:

1. Do not replace the cement quantity more than 15 percent by weight.
2. Replace cement with fly ash at the rate of 1.25 to 2.0 lbs (1.25 to 2.0 kg) of fly ash to 1 lb (1.0 kg) of cement.
3. Ensure that the fly ash mix conforms to [Subsection 430.3.06](#), “Quality Acceptance.”
4. Do not use Type IP cement in fly ash mixes.

B. Granulated Iron Blast-Furnace Slag

If high early strengths are not desired, use granulated slag as a partial replacement for Portland cement in concrete. Follow these limits:

1. Replace the quantity of cement 50 percent or less by weight if the 5-day forecast of the National Weather Service expects temperatures higher than 60 °F (15 °C).
 - a. If the 5-day expected low temperature is less than 60 °F (15 °C) but not less than 40 °F (4 °C), replace the quantity of cement 30 percent or less by weight.
 - b. If the 5-day expected low temperature is less than 40 °F (4 °C), do not use granulated slag.
2. Replace cement with slag at the rate of 1 lb (1 kg) of slag to 1 lb (1 kg) of cement.
3. Ensure that the granulated slag mix conforms to [Subsection 430.3.06](#), “Quality Acceptance.”
4. Do not use Type IP cement or fly ash in slag mixes.

C. Composition of Concrete

Design the concrete mix to conform to the following requirements:

1. Coarse Aggregate

Use coarse aggregate size No. 467, 67, or 57 for plain Portland cement concrete pavement.

Use size No. 67 or 57 coarse aggregate for continuous reinforced concrete pavement.

Separate size No. 467 or 456 in individual stockpiles of size No. 4 and size No. 67. Blend according to approved mix proportions.
2. Fine Aggregate

Use fine aggregate that meets the requirements for size No. 10.

When using two sizes or sources of fine aggregate to produce the proper gradation, blend according to the approved design proportions.

D. Protective Materials

Provide materials to protect the concrete edges and surface from rain, including:

Section 430—Portland Cement Concrete Pavement

- Standard metal forms or wood planks to protect the pavement edges
- Covering material such as burlap or cotton mats, curing paper, or plastic sheeting material to protect the pavement surface

430.2.01 Delivery, Storage, and Handling

Store aggregate from different sources in separate stockpiles.

430.3 Construction Requirements

430.3.01 Personnel

A. Certified Operator

Before paving, have the Office of Materials and Research, certify a profilograph equipment operator. Certification includes a written examination by the operator.

430.3.02 Equipment

A. Equipment Requirements

Provide equipment and tools to perform the work. Provide equipment that allows the paver to operate at a constant production rate and rarely start and stop. The Engineer may limit the production rate or batch size if equipment does not keep pace with the other operations or causes poor workmanship.

B. Scales

Before use, the Engineer will inspect and approve the scales to weigh concrete materials and the devices to measure water. Tolerances are ± 1.0 percent throughout the operating range. Measure admixtures to ± 3.0 percent.

C. Paving Equipment

Ensure that equipment operating on the pavement has rubber-tired wheels or flat steel wheels. Wait to operate concrete or shoulder paving equipment on the pavement until the concrete slab is 14 days old or has 2,500 psi (15 MPa) compressive strength.

Paving equipment may be either slip-form or fixed form.

D. Surface Finish Equipment

Use mechanical equipment to produce the surface finish of the mainline and transverse plastic concrete grooving. Ensure that the equipment uses rectangular-shaped steel tines of the same size and uniform length. Use tines with a width between 0.08 in (2 mm) and 0.130 in (3.5 mm). Space the tines approximately 1/2 in (13 mm) apart.

E. Field Laboratory

Provide a field laboratory according to [Section 152](#).

F. Mechanical Sprayers

Provide fully atomizing spraying equipment with a tank agitator to place curing compounds.

430.3.03 Preparation

A. Prepare the Road Bed

Prepare the roadbed as required by the Plans and Specifications before placing concrete pavement.

B. Observe Condition of Subgrade and Subbase

Check the subgrade and subbase as follows:

1. Prepare the full width of the subgrade and subbase according to the Plans and Specifications.

Section 430—Portland Cement Concrete Pavement

2. Ensure that the surface immediately under the concrete pavement allows proper pavement thickness and yield.
3. Trim high areas to the proper elevation.
4. Ensure that the subbase can support paving equipment without rutting or bogging.

430.3.04 Fabrication

General Provisions 101 through 150.

430.3.05 Construction

A. Mix the Concrete

Produce Portland cement concrete by combining authorized proportions of materials in batches according to the construction methods in this Specification.

Mix the concrete produced in a stationary central mix plant for at least 60 seconds after all materials have entered the drum. Reduce the mix time if representative tests show that the concrete meets requirements of ASTM C 94, Requirements For Uniformity. Never reduce the mix time to less than 50 seconds.

B. Set Forms

Set the forms as follows:

1. Compact the foundation under the forms true to grade. Set the form so that it firmly contacts the foundation for the entire length at the specified grade.
2. Prevent the forms from settling or springing under the finishing machine.
3. Clean and oil the forms before placing the concrete.

C. Dowel Bars

Provide dowel bars at transverse joints unless otherwise noted in the Contract Plans.

D. Place Concrete

After depositing the concrete on the grade, avoid rehandling. Unload and place it as follows:

1. Unload the concrete into an approved spreading device and mechanically spread it on the grade.
2. Place the concrete continuously between transverse joints without using intermediate bulkheads.
3. Hand spread the concrete with shovels, not rakes.

NOTE: Do not allow personnel to walk in freshly mixed concrete with shoes coated with dirt or other materials.

4. Thoroughly consolidate the concrete against the faces of forms and along the full length and sides of joint assemblies.
5. Ensure that vibration does not cause puddling or grout accumulation on the surface.
For construction or expansion joints, do not use grout that accumulates ahead of the paver.
6. Deposit concrete near the formed joints. Dump or discharge concrete only in the center of a joint assembly.
7. Take slab depth measurements as follows:
 - a. Probe the plastic concrete behind the paver.
 - b. Record the station number and depth measurements at least every 500 ft (150 m) at 3 random increments across the slab.
 - c. Provide these measurements to the Engineer when requested.
8. Take air and slump determination tests at a rate of at least three of each test evenly distributed during the workday. Provide the results to the Engineer when requested.

Section 430—Portland Cement Concrete Pavement

9. Keep reinforcing steel free of dirt, oil, paint, grease, mill scale, and loose or thick rust that could impair the bond of the steel to the concrete.
10. Arrange operations to prevent “leave-outs” in continuous reinforced concrete pavement. The Engineer may approve “leave-outs” in emergencies if a Plan is approved to increase the reinforcement. The Department will not pay for extra leave-outs.

E. Place Reinforcement

Place reinforcement according to the Plans and as follows:

1. Do not insert lane tie bars in unsupported sides of fresh concrete.
2. Ensure that the steel placement method does not damage or disrupt concrete.
3. Use bent lane tie bars if needed in longitudinal formed joints construction. However, replace broken or damaged bars at no additional cost to the Department.

F. Construct the Ramps

Prevent pavement slab stress by constructing a ramp of compacted earth or other material for movement on and off the pavement. Do not allow equipment that exceeds legal load limits on the pavement.

G. Consolidate and Finish

Ensure that the sequence of operations is continuous from placement to final finish.

1. Consolidation

Perform vibration for the full width and depth of the pavement as follows:

- a. Do not allow the vibrators to misalign load transfer devices, or to contact forms or base.
- b. Ensure that the vibrator amplitude is within the range recommended by the manufacturer.
 - Use spud vibrators with an adjustable operating frequency between 8,000 and 12,000 vibrations per minute.
 - Use surface pan vibrators with an adjustable operating frequency between 3,000 and 6,000 vibrations per minute.
- c. If appropriate, use surface vibrators and internal vibrators on concrete greater than 8 in (200 mm) thick.
- d. If appropriate, use surface vibrators exclusively on pavements less than 8 in (200 mm) thick.
- e. Stop vibration when the machine cannot go forward.
- f. Obtain uniform consolidation and density throughout the pavement.

If it is not uniform, stop the operation and provide methods or equipment that will produce pavement that conforms to the Specifications.

2. Finishing

After striking off and consolidating the concrete, follow these steps:

- a. Smooth and true the concrete using a float or finishing machine to minimize or eliminate hand finishing.

Perform hand finishing only under the following conditions:

- Irregular dimension areas where operating mechanical equipment is impractical
 - Mechanical equipment breakdown (only finish the concrete already deposited when the breakdown occurred)
 - Abnormal circumstances approved by the Engineer
- b. Ensure that the pavement surface final finish is true to grade, uniform in appearance, and free of irregular, rough, or porous areas.

Section 430—Portland Cement Concrete Pavement

- c. Prevent the surface within 6 in (150 mm) of the pavement edge to deviate more than 0.25 in (6 mm) in 10 ft (3 m) when tested with a 10 ft (3 m) straightedge in both transverse and longitudinal directions.
- d. Use mechanical equipment to produce a surface finish of transverse plastic concrete grooving for the mainline and ramps.
- e. Have the Engineer determine the texture depth by conducting pavement surface tests such as [GDT 72](#) at selected locations.
- f. Transversely saw-groove mainline and ramp areas with a surface texture depth less than 0.018 in (0.5 mm). Meet the depth requirement of 0.035 in (0.9 mm) or greater.

Perform saw-grooving to meet the following dimensions:

Width	1/8 in (3 mm)
Depth	3/16 in (5 mm)
Spacing	3/4 in (19 mm) center-to-center

- g. If required, use hand tools to texture ramps, acceleration lanes, and deceleration lanes to surface texture mainline requirements. Finish irregular sections to a surface texture of at least 0.025 in (0.64 mm) as shown in [GDT 72](#).

3. Numbering Stations

Cast station numbers with a die in the pavement every 500 ft (200 m) and 1 ft (300 mm) from the right edge of the travel lane.

4. Protection From Rain

Protect the unhardened concrete from rain. See [Subsection 430.2.D, "Protective Materials."](#)

When rain is imminent, stop paving operations and place forms against the sides of the pavement. Cover the surface of the unhardened concrete with the protective covering.

H. Remove Forms

Do not remove forms from freshly placed concrete until it has set for at least 12 hours, unless otherwise provided.

1. Remove forms carefully to avoid damaging the pavement.
2. After removing the forms, immediately cure the sides of the slab using the same method used to cure the pavement surface.
3. Remove and replace major honeycombed areas.

I. Work at Night

Provide adequate lighting for work performed at night. If lighting will not be provided at night, stop the concreting operation in time to finish and saw during daylight hours.

J. Provide Joints

Ensure that joints are designed, configured, and located as shown on the Plans or required by the Specifications.

1. Provide dowel bars at transverse joints unless otherwise noted.
2. Remove and replace plain concrete pavement that cracks during construction with no additional cost to the Department, at the Engineer's discretion.
3. When chipping out random cracks for sealing, use nonrigid epoxy on cracks that are not under expansion-contraction influence and that meet [Subsection 886.2.01](#).
4. Seal continuous cracks that are under movement with sealant that meets [Subsection 833.2.06](#).

5. When removing and replacing a pavement section, remove an area at least 6 ft (1.8 m) long and the full width of the lane.
 - a. Saw to vertical face the sections to be removed and replace the concrete as a construction joint with dowels.
 - b. Use deformed bars as dowels in the saw-cut construction joint. Use the size specified for contraction joints in the Plans.
6. Thoroughly clean the drilled holes of contaminants and set the dowels into the hardened concrete face of the existing pavement with a Type VIII epoxy bonding compound. See [Section 886](#) for epoxy bonding requirements.
7. For contraction joints, use undamaged and properly positioned dowels in existing construction or slab replacement areas. Coat the protruding dowel portions with a thin film of heavy grease.
8. When both sides of an existing construction or contraction joint require slab replacements, replace slabs continuously from saw-cut construction joint to saw-cut construction joint. Use dowels specified for contraction joints.
9. Before placing concrete, uniformly apply a thin coat of heavy grease to epoxy-coated dowels.
10. When placing slabs continuously across transverse contraction joint locations, use saw-cuts to provide planes of weakness according to the requirements of this Specification and the standard drawing for contraction joints.

K. Types of Joints

1. Longitudinal Joints

For longitudinal joints, use unpainted and uncoated deformed steel bars that are the size and length specified on the Plans.

Place the bars perpendicular to the joint using a mechanical device, or rigidly secure the bars in place with supports.

2. Longitudinal Formed Joints

Construct longitudinal formed joints while the concrete is in a plastic state.

Use methods and equipment that locate the joint reinforcement properly without disrupting it during construction.

3. Longitudinal Sawed Joints

Cut longitudinal sawed joints with a mechanical saw within three days after the concrete is placed and before traffic or equipment enters the pavement.

4. Transverse Joints

Transverse joints consist of construction joints, contraction joints, or expansion joints constructed at required locations.

- a. Construct transverse joints in partial width or adjoining lanes to abut the same joint of adjacent lanes unless otherwise specified on the Plans.
- b. Ensure that transverse joints in plain Portland cement concrete requiring load transfer devices contain either plastic-coated or epoxy-coated dowels.
- c. Before placing concrete, secure dowel bars in place with supporting assemblies.
- d. Secure the assemblies in position on the subbase to keep the dowels from moving during concrete placement.
- e. Place dowel bars to a vertical and horizontal tolerance of plus or minus 1 in (25 mm) of the Plan position. Do not misalign the dowel bar more than 3/8 in per 1 ft (10 mm per 300 mm) in the horizontal or the vertical plane.
- f. Remove and replace dowel assemblies displaced from the Plan position more than the tolerances in [Subsection 430.3.05.J](#).
- g. When using epoxy-coated dowels, coat the entire surface with a thin film of heavy waterproof grease.
- h. Ensure accurate positioning of transverse sawed joints by marking the position of dowel bar assembly locations.

5. Construction Joints

Section 430—Portland Cement Concrete Pavement

Construct transverse construction joints when interrupting concreting operations for more than one hour.

NOTE: Do not construct transverse construction joints within 10 ft (3 m) of an expansion joint, contraction joint, or transverse plane of weakness.

- a. Move an unanticipated construction joint back to the last Plan joint, if necessary. Remove and dispose of excess concrete.
- b. Form construction joints by securing in place a removable bulkhead or header board.
 - 1) Place the board so that it conforms to the full cross section of the pavement. Secure it flush with the subbase and parallel to the normal transverse joints.
 - 2) Slot or drill the board to allow placement of reinforcement as required by the Plans.

NOTE: Do not use the roll of laitance and grout that forms in front of the paver adjacent to transverse construction joints.

- c. Consolidate to full width and depth concrete adjacent to transverse construction joints with mechanical hand-type spud vibrators. Keep one auxiliary vibrator available in case of mechanical malfunctions.
 - d. Before applying the final finish to the concrete, stringline and correct variations of the concrete surface within 30 ft (9 m) on either side of the transverse construction joints. Provide equipment and tools such as:
 - Work bridges
 - Personnel
 - String lines
 - Straightedges
 - Lighting
 - e. While the concrete is in a plastic condition, stringline the surface longitudinally and correct surface deviations greater than 1/8 in per 15 ft (3 mm per 4.6 m) in any direction.
 - f. When using plain Portland cement concrete pavement, place dowel bars in construction joints. Cast half the length of each dowel bar in the concrete during each phase of joint construction.
 - g. When using epoxy coated dowels, coat the protruding half of each dowel bar with a thin film of heavy waterproof grease before resuming joint construction. Grease coating is not required on plastic coated dowels.
 - h. After the concrete has hardened, dismantle the bulkhead supporting the dowels. Do not disturb the dowels.
6. Contraction Joints

Create planes of weakness in plain Portland cement concrete pavement by cutting joints in the pavement surface. Create the planes according to the Plans as follows:

- a. Saw transverse contraction joints before the pavement cracks. Begin sawing when the concrete has hardened enough to prevent surface raveling, usually 4 hours after placement, but no more than 24 hours.
- b. Continue sawing day and night regardless of weather conditions.

7. Expansion Joints

Transverse expansion joints are required at locations shown on the Plans.

- a. Form expansion joints by securing a removable bulkhead that conforms to the full cross section of the pavement. Use bulkheads that can construct a vertical expansion wall without offsets, indentations, or burrs.
- b. Use expansion joint filler required by the Plans.
- c. Furnish and install preformed joint filler in lengths equal to the pavement width or the width of one lane. Do not use damaged or repaired joint fillers.

Section 430—Portland Cement Concrete Pavement

- d. Position the expansion joint filler vertically in the joint and at the proper grade. Use an installing bar or other device to secure the expansion joint filler at the proper grade and alignment.

L. Cure the Concrete

Immediately after finishing the concrete, cure the entire surface when the concrete will not mar. Use one or more of these methods:

1. Impervious Membrane Method

To use this method:

- a. Spray the entire surface of the pavement with white pigmented curing compound immediately after finishing the surface and before the concrete has set.
If the pavement is cured initially with cotton mats, burlap, or cotton fabric, apply the compound after removing the mats.

NOTE: Do not apply curing compound during rain.

- b. Use mechanical sprayers to apply curing compound under pressure at a minimum rate of 1 gal per 150 ft² (1 L per 3.5 m²).
- c. Thoroughly mix the compound with uniformly dispersed white pigments.
- d. During application, use a mechanical device to stir the compound continuously.
- e. Use a hand sprayer (if required) to spray odd widths, odd shapes, and concrete surfaces exposed by removing forms.
- f. Do not apply curing compound to the inside faces of joints to be sealed.
- g. If the membrane film becomes damaged within the curing period, repair the damaged portions immediately with additional compound.

2. White Polyethylene Sheeting

To use this method:

- a. Cover the top surface and sides of the pavement with polyethylene sheeting. Lap the units at least 18 in (450 mm).
- b. Place the sheeting and weigh it down so that it contacts the surface.
- c. Extend the sheeting beyond the edges of the slab at least twice the thickness of the pavement.
- d. Unless otherwise specified, maintain the covering in place for 72 hours after placing the concrete.

3. Burlap, Cotton Fabric, or Other Methods

Contractors may cure the pavement with burlap, cotton fabrics, or other materials if the section remains wet for the duration specified by the Engineer.

4. Cold Weather Curing

To use this method:

- a. Remove and replace concrete that freezes before the initial set time at no cost to the Department.
- b. Use polyethylene or canvas to protect concrete that has set but is exposed to freezing temperatures within 24 hours of placement. Ensure that the internal concrete temperature is above freezing for at least 24 hours after placing the concrete.
- c. Obtain approval from the Engineer to use other protection methods such as hay, straw, or grass, or to change the duration of the protection.

M. Seal the Joints

Clean and seal the joints according to [Section 461](#) and the Plans.

Section 430—Portland Cement Concrete Pavement

Immediately after completing the curing period, fill in the joints with joint sealing material before opening the pavement to traffic.

During sealing, do not spill the material on the concrete surface. Immediately remove excess material on the concrete surface and clean the surface.

Do not use sand or similar material as a cover for the seal. Seal joints according to the Plans.

N. Open Pavement to Traffic

Wait to open the pavement slab to traffic, except for joint sawing vehicles, until the concrete is 14 days old unless representative compressive tests show that the slab has a compressive strength of 2,500 psi (15 MPa). Cure compressive test specimens used for traffic opening as near as possible to the roadway.

Protect the pavement against traffic from the public, employees, and agents.

1. Erect and maintain barricades. Employ watchmen to block traffic from the newly constructed pavement for the period required in this Specification.
2. Arrange the barriers away from public traffic on lanes remaining open.
3. Maintain signs that clearly indicate the lanes open to public traffic.
4. If traffic must go across the pavement, construct crossings satisfactory to the Engineer to bridge over the concrete. Construct the crossing without additional compensation.
5. Repair or replace pavement damaged by traffic or other causes before Final Acceptance without additional compensation. Make repairs to the Engineer's satisfaction.

430.3.06 Quality Acceptance

The typical section sheet in the Plans gives specific uses for each concrete classification. Refer to this Specification for the minimum requirements of the concrete classifications for concrete design approval, concrete mix design proportions, batching control responsibilities, and acceptance of hardened concrete based upon compressive strength development.

A. Transit Mixed Concrete

Ensure that transit mixed concrete meets the requirements of [Subsection 500.2](#), "Materials."

B. Mix Design Criteria

Proportion concrete mix designs using the following requirements:

	Minimum Cement Content per Cubic Yard Concrete (CWT)	Max. Water-Cement Ratio (lbs/lb)	Design Air Content Range (%)
Class 1	5.41	0.53	4.0 to 5.5
Class 2	5.64	0.50	4.0 to 5.5
Class HES	6.58	0.47	4.0 to 5.5

	Minimum Cement Content per Cubic Meter Concrete (kg)	Maximum Water-Cement Ratio (kg/kg)	Design Air Content Range (%)
Class 1	320	0.53	4.0 to 5.5
Class 2	335	0.50	4.0 to 5.5
Class HES	390	0.47	4.0 to 5.5

Section 430—Portland Cement Concrete Pavement

Produce evidence that the mix design proportions for Class 1 and 2 concrete have strength development potential for 24 hours plus or minus 15 minutes and at 28 days as specified in [Subsection 430.3.06.C, “Approval of Mix Design Proportions”](#).

C. Approval of Mix Design Proportions

The Department will approve each proposed combination of materials and mix designs based on the use of approved materials, compliance with [Sub section 430.3.06.B, “Mix Design Criteria.”](#) and the following:

1. Flexural Strength

Prepare at least 9 normally cured flexural specimens and test according to AASHTO T 126 and T 97 to ensure that the demonstrated laboratory flexural design strength at 28 days meets the following minimum Design Acceptance Requirement (DAR).

NOTE: Take the 9 flexural specimens from 3 separate trial batches. Make 3 specimens from each batch.

Class No. 1	Concrete DAR = 600 psi + .67 s Concrete DAR = 4.1 MPa + .67 s
Class No. 2	Concrete DAR = 700 psi + .50 s Concrete DAR = 4.8 MPa + .50 s
Class HES	Concrete DAR = 700 psi + .50 s Concrete DAR = 4.8 MPa + .50 s

s = a standard deviation of all 28-day flexural specimens for a given combination of materials and mix proportions prepared together. Do not use a value of “s” greater than 37 psi (255 kPa) to calculate DAR.

2. Compressive Strength

Prepare and test at least 6 cylinders according to AASHTO T 126 and T 22 to ensure that the demonstrated laboratory compressive strength at 28 days for Class 1 and 2 concrete exceeds the minimum Job Performance Value (JPV).

Produce similar evidence that demonstrates strength development at 72 hours for Class HES concrete.

Class 1	Concrete JPV Minimum = 3,000 psi + .18 R Concrete JPV Minimum = 20 MPa + .18 R
Class 2	Concrete JPV Minimum = 3,500 psi + .21 R Concrete JPV Minimum = 25 MPa + .21 R
Class HES	Concrete JPV Minimum = 3,000 psi + .05 R Concrete JPV Minimum = 20 MPa + .05 R

R = the difference between the largest observed value and the smallest observed value for all compressive strength specimens at 28 days for a combination of materials and mix proportions prepared together.

a. Class 1 and 2 Concrete

- 1) Submit early compressive strength test results made at 24 hours plus or minus 30 minutes for at least 12 cylinders. Prepare and test according to ASTM C 684, Method A.
- 2) Prepare cylinders from three separate trial batches, and make four specimens from each batch.
- 3) Determine the average strength, standard deviation, and coefficient of variation for the design according to ACI 214. Do not use designs that produce a coefficient variation greater than 10 percent.

b. Class HES Concrete

Section 430—Portland Cement Concrete Pavement

Submit evidence that designs proposed for use as Class HES concrete have compressive strength development potential at 72 hours of 3,000 psi (20 MPa) plus .05 R.

D. Field Adjustments on Concrete Mixes

Determine the aggregate surface moisture and apply free moisture corrections to the approved mix design. The Engineer will verify that the corrections are made properly.

Adjust the approved proportions of the fine and coarse aggregate and water as desired, provided:

1. The cement factor is not decreased.
2. The water-cement ratio is not increased.
3. Adjustments produce concrete proportions according to this Specification.
4. The Engineer is notified before use.

E. Concrete Mix Tolerances

Keep concrete consistency and air content to vary within the following limits:

1. Consistency

Immediately before placement, use [GDT 27](#) to determine concrete slump. Do not use concrete for Portland cement concrete pavement with a slump value greater than 2.5 in (65 mm).

2. Air Content

Immediately before placement, use [GDT 26](#), [GDT 28](#), or [GDT 32](#) to determine the air content of the concrete. Concrete will not be accepted that has an air content outside of these limits:

Lower acceptance limit	3.0%
Upper acceptance limit	6.5%

F. Concrete Strength Acceptance

The concrete strength of Portland cement concrete pavement is accepted based upon the compressive strength development at a specific time.

Strength development is determined by a lot acceptance plan. The pavement is subdivided into separate concrete lots of approximately 5,334 yd² (4400 m²) placed continuously, except for required work stoppages.

1. Ramps

Ramps may be set apart as individual lots. Include acceleration or deceleration lanes, wedges, or other varied width sections in other lots if the total paving quantity is not greater than 7,500 yd² (6300 m²). The Engineer will randomly select three production units from each lot for strength determination tests.

2. Class 1 and 2 Concrete

- a. Cast at least two cylinder sets for each production unit selected for acceptance testing. A set is two 6 by 12 in (150 by 300 mm) cylinders. Cure one set according to ASTM C-684, Method A. Cure the other set according to AASHTO T 23.
- b. After curing, test each concrete cylinder according to AASHTO T 22. The test result is the average strength of the two cylinders.

3. Acceptance Based on 24-Hour Strength

Concrete may be accepted by early strength determinations. However, concrete will not be accepted based on early strength development when the difference between the largest observed strength value and the smallest observed strength value exceeds 35 percent of the average.

- a. Compute the average (X) and the range (R) from the three acceptance tests results.
- b. Have the Engineer establish the minimum early strength (S) to be used for concrete acceptance.

Section 430—Portland Cement Concrete Pavement

The minimum early acceptance strength is the average strength at 24 hours plus or minus 30 minutes of the laboratory design less 1.5 times the standard deviation of the laboratory design.

- c. If the average (X) of the three lot acceptance tests equal or exceed the value (S), the lot will be accepted at the full contract price, and 28 day cylinders for this lot can be discarded.
 - d. If the average of the three lot acceptance tests fails to meet the acceptance limit, the Engineer will contact the Contractor immediately. The Contractor may immediately remove the concrete in the lot or leave it in place pending acceptance or rejection from the 28-day strength test results.
4. Acceptance Based on 28-Day Strength Tests

When a lot is potentially defective based on the early strength determinations and the Contractor leaves the lot in place to be judged by the 28-day strength tests results, retain and cure all 3 sets of 28-day cylinders.

- a. If the average 28-day strength of the lot does not meet the lower acceptance limit for a 0.70 pay factor, the Engineer may either:
 - Order removal of the concrete in the lot
 - Apply a pay factor of 0.50 for the lot
- b. The Unit Price of concrete pavement will be reduced for areas represented by each lot that does not meet the specified compressive strength at 28 days according to the following schedule:

Pay Factor Schedule for Strength Determinations at 28 Days			
Acceptance Limits for Pay Factor Levels			
	1.00 LAL*	0.95 LAL	0.70 LAL
Concrete Class 1	3,000 psi (20 MPa) + 0.18 R	3,000 psi (20 MPa) - 0.07 R	3,000 psi(20 MPa)- 0.30 R
Concrete Class 2	3,500 psi (25 MPa)+ 0.21 R	3,500 psi (25 MPa)- 0.07 R	3,500 psi (25 MPa)-0.30 R
* Lower acceptance limit (LAL)			

5. Classification HES Concrete

Cast at least two sets of cylinders for each production unit selected for acceptance testing.

- a. Cure one set for 72 hours under conditions similar to those under which the pavement is cured. Cure the other set of cylinders for 28 days according to AASHTO T 23.
- b. Test each cylinder according to AASHTO T 22 when the specified curing is complete. The test results are the average strength of the two cylinders.
- c. The Engineer may accept the concrete at full contract price if the average of the three 72-hour test results exceeds the JPV established in [Subsection 430.3.06.C](#).
- d. When the 72-hour strength tests determine that a lot is potentially defective, the Engineer will immediately notify the Contractor. At this time, the Engineer may require the immediate removal of the pavement in question.

If the Engineer does not require immediate removal of the pavement, select removal or acceptance on the basis of the 28-day strength development.

- e. When the 72-hour strength tests determine that a lot is potentially defective and the concrete is retained for subsequent judgment, conduct acceptance tests at 28 days on selected cylinders cured according to AASHTO T 23.

Questionable lots will be accepted based on the 28-day strength and provisions for testing, computations, and payment for Classification No. 2 concrete in [Subsection 430.3.06.F.2](#), “Class 1 and 2 Concrete.”

G. Smoothness

Pavement smoothness will be accepted only after the Engineer determines that the work was performed according to this and other Specifications. The completed pavement, including corrective work, must meet the applicable profile index value requirements.

Perform smoothness testing as follows:

1. Ensure that the mainline riding surface produces a profile index value no greater than 7 in/mile (100 mm/ km) on each travel lane. Conduct tests according to [GDT 78](#).
2. Determine a profile index value for each tracing for each 0.25 mile (0.5 km) segment. Correct individual bumps or depressions that exceed the blanking band by more than 0.2 in (5 mm) at no additional expense to the Department.
3. If a paving operation exceeds a profile index value of 7 in/mile (100 mm/km) per lane for any segment, suspend the paving operation and take corrective action approved by the Engineer.
4. Use [GDT 78](#) to test ramps and acceleration and deceleration lanes to attain an average profile index value no greater than 12 in/mile (200 mm/km) by Rainhart Profilograph for the entire section length. Correct individual bumps or depressions that exceed 0.2 in (5 mm) from the blanking band at no additional expense to the Department.
5. Take pavement profiles that are 4 ft (1.2 m) away from and parallel to the new pavement edges on pavements greater than 16 ft(4.8 m) wide and up to 24 ft (7.2 m) wide.

Test pavement 6 to 16 ft (1.8 to 4.8 m) wide parallel to and at the center line of the pavement section.

6. Begin the 0.25 mile (0.5 km) record segments at the first day's placement and continue until Project completion, except as noted in this Specification.
7. Combine pavement sections less than 700 ft (200 m) long that approach a bridge. Use the previous 0.25 mile (0.5 km) segment to determine the profile index.
Calculate as a separate record segment 700 ft (200 m) sections or greater that approach a bridge. This exception applies also to sections at Project limits.
8. Determine a separate profile index value using [GDT 78](#) for the 100 ft (30 m) of roadway approaching each end of a bridge up to and including the joint with the approach slab.
Average the profile index from the right and left wheelpaths for each 100 ft (30 m) segment for each lane for each approach. The average profile index value shall not exceed 30 in/mile (500 mm/km).
9. Before paving farther, perform and evaluate profiles from the first day's placement.
 - a. After completing and evaluating this test run, adjust equipment as required by the Engineer to improve smoothness before paving continues.
 - b. Complete the report form furnished by the Engineer and attach to the profilograph tracings of each day. Include the following information in each trace:

- Project number
- Beginning and ending station numbers
- 500 ft (150 m) paving stations
- Traffic direction
- Lane number
- Date paved and tested
- Construction joint locations

Have the certified profilograph operator obtain and evaluate the traces and submit the evaluation to the Engineer. Provide results no later than the end of the second work day following placement.

Section 430—Portland Cement Concrete Pavement

10. For mainline pavement, correct 0.25 mile (0.5 km) segments not meeting the profile index requirement using one of these methods:
 - a. Grind the entire lane surface of the 0.25 mile (0.5 km) segment to a profile index value less than 7 in/mile (100 mm/km). Use equipment that meets requirements in [Section 431](#).
 - b. Grind roughness in small segment areas no more than 50 ft (15 m) of full lane width to produce a profile index value no greater than 7 in/mile (100 mm/km).
If more than 50 ft (15 m) of grinding is required, grind the complete 0.25 mile (0.5 km) segment according to Method a, above.
11. Correct ramps and acceleration and deceleration lanes that do not meet the profile index requirement to a profile index no greater than 12 in/mile (200 mm/km). Prevent individual bumps from exceeding 0.2 in (5 mm) from the blanking band. Use equipment specified in [Section 431](#).
12. Correct 100 ft (30 m) bridge approach sections that do not meet the profile index requirement.
 - a. Grind according to [Section 431](#).
 - b. If appropriate, use a bump grinder to correct bumps with a baseline of 5 ft (1.5 m) or less.
 - c. Grind the full lane width even when grinding including individual bumps.
 - d. Retest pavement segments containing corrective slab replacements for Final Acceptance.
13. Correct segments that do not meet the profile index criteria of this Specification at no additional expense to the Department. Retest segments after correction with the Rainhart Profilograph.
14. Notify the Engineer before profile testing. The Engineer will verify the results by randomly selecting a minimum of 1 out of every 10 consecutive record segment profiles to compute the profile index and to compare with Contractor results.

The Engineer may conduct profilograph tests at any time to verify Contractor results. The Department may test record segments if the Engineer determines that the Contractor test results are inaccurate. See [Subsection 430.5.01](#), “Adjustments.”

H. Thickness

The Engineer shall determine the pavement thickness using average core measurements tested according to [GDT 31](#).

The following table contains units for paving widths:

Paving Widths – Feet (meters)	Length of Unit (Bridges Excluded)—Feet (meters)
0 – 24.0 (0 – 7.2)	1000 (300)
24.1 – 36.0 (7.2 – 10.8)	750 (225)
36.1 – 48.0 (10.8 – 14.4)	500 (150)

Areas of equal depth in intersections, entrances, crossovers, ramps, etc. are considered one unit, and the thickness of each unit is determined separately. If appropriate, include small irregular areas as part of another unit.

1. Take one core for each 2,000 yd² (1675 m²) of pavement, or fraction of pavement, in each unit where the Engineer selects.

The Department will take one core at random in each unit.

- a. When the core measurement is deficient 0.2 in (5 mm) or less from the Plan thickness, full payment is made.
- b. When the measurement is deficient more than 0.2 in (5 mm) and not more than 1 in (25 mm) from the plan thickness, two additional cores are secured from the unit and used to determine the average thickness.

Section 430—Portland Cement Concrete Pavement

- c. A random selection process determines where to secure additional cores. However, do not secure cores within 50 ft (15 m) of other thickness measurement cores. The adjusted Unit Price in [Subsection 430.5.01.A](#), “Concrete Pavement Thickness Deficiency” is used to determine payment for the unit.
2. Consider pavement more than 0.2 in (5 mm) thicker than the specified thickness to be the specified thickness plus 0.2 in (5 mm). Measurements more than 1 in (25 mm) less than the specified thickness are not included in the average.
3. When the core measurement is at least 1 in (25 mm) less than the specified thickness:
 - a. Determine the pavement thickness in the affected location by taking additional cores at no less than 10 ft (3 m) intervals parallel to the center line in each direction.
 - b. Continue until a core is found that is not deficient by more than 1 in (25 mm).
 - c. Have the Engineer evaluate areas more than 1 in (25 mm) deficient in thickness. Remove deficient areas and replace with concrete pavement of the thickness shown on the Plans, if the Engineer requires.
Exploratory cores for deficient thickness are not used in averages for adjusted Unit Price.

430.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

430.4 Measurement

The area that will be paid for under this Item is the number of square yards (meters) of concrete pavement accepted as measured complete in place. The pavement width measured is shown on the typical cross section of the Plans, including additional widening as required or widening directed in writing by the Engineer.

The length is measured along the pavement surface.

Work is accepted lot-to-lot according to [Section 106](#) and this Specification.

430.4.01 Limits

General Provisions 101 through 150.

430.5 Payment

Concrete pavement completed and accepted that meets the Specification requirements will be paid for at the full Contract Unit Price per square yard (meter).

Payment for other accepted concrete pavement will be based on an adjusted Unit Price per square yard (meter). This price will be adjusted for payment for concrete pavement accepted but deficient in depth or compressive strength at 28 days. Price adjustments are specified in [Sub section 430.5.01, “Adjustments.”](#)

No additional payment over the Contract Unit Price will be made for pavement units with an average thickness greater than on the Plans. No additional payment over the Contract Unit Price will be made for a lot of concrete that develops more strength at 28 days than the compressive strength established in [Subsection 430.3.06.F, “Concrete Strength Acceptance.”](#)

Payment is full compensation for furnishing and placing materials, reinforcements, dowel and joint materials, supplies, and incidentals to complete the work.

Payment will be made under:

Item No. 430	Plain Portland cement concrete pavement, class no. 1 concrete _____ in (mm) thick	Per square yard (meter)
Item No. 430	Plain Portland cement concrete pavement class no. 2 concrete _____ in (mm) thick	Per square yard (meter)
Item No. 430	Plain Portland cement concrete pavement, class HES concrete _____ in	Per square yard (meter)

Section 430—Portland Cement Concrete Pavement

	(mm) thick	
Item No. 430	Continuously reinforced concrete pavement, class no. 1 concrete _____ in (mm) thick	Per square yard (meter)
Item No. 430	Continuously reinforced concrete pavement, class no. 2 concrete _____ in (mm) thick	Per square yard (meter)
Item No. 430	Continuously reinforced concrete pavement, class HES concrete _____ in (mm) thick	Per square yard (meter)

430.5.01 Adjustments

The Contract Unit Price per square yard (meter) of concrete pavement will be adjusted for concrete pavement accepted but deficient in thickness or compressive strength at 28 days. Adjusted Unit Prices per square yard (meter) of concrete pavement are based on one or both of the following conditions:

A. Concrete Pavement Thickness Deficiency

1. If the core is deficient 0.2 in (5 mm) or less from the Plan thickness, full payment will be made. If the core is deficient in thickness more than 0.2 in (5 mm), but not more than 1 in (25 mm) from the Plan thickness, 2 additional cores will be taken from the area.
 - a. If the average measurement of these 3 cores is deficient 0.2 in (5 mm) or less from the Plan thickness, full payment will be made.
 - b. Where the average pavement thickness is deficient by more than 0.2 in (5 mm), but not more than 1 in (25 mm), payment will be made at a portion of the Unit Price per square yard (meter) of concrete pavement as shown in the following table:

Concrete Pavement Deficiency	
Deficiency in Thickness Determined by Cores— in (mm)	Proportional Part of Contract Price Allowed
0.0 through 0.20 (0.0 through 5.0)	100 percent
0.21 through 0.25 (5.1 through 6.4)	95 percent
0.26 through 0.30 (6.5 through 7.6)	91 percent
0.31-0.40 (7.7 through 10.0)	86 percent
0.41-0.50 (10.1 through 12.8)	80 percent
0.51-0.75 (12.9 through 19.2)	70 percent
0.76-1.00 (19.3 through 25.0)	60 percent

- c. When the thickness of pavement is deficient by more than 1 in (25 mm) and the Engineer determines that the deficient area should not be removed or replaced, 50 percent of the Contract Unit Price will be paid.
2. No payment or compensation for cost will be made for removing concrete according to this provision.

B. Compressive Strength Deficiency

When the compressive strength at 28 days, expressed as an average strength (X) for a lot of concrete pavement is less than the values established by the Pay Factor Table, payment will be made at a reduced Unit Price per square yard (meter) as shown in the Pay Factor Table.

C. Combined Deficiencies

When a pavement section is deficient in thickness and compressive strength, the Contract Unit Price will be adjusted by the total reduction from applying the percentages in [Subsections 430.5.01.A](#) and [Subsection 430.5.01.B](#), above.

For combined deficiencies of 50 percent or more, the Engineer may leave the pavement in place at the combined payment reduction or order the deficient areas removed and replaced at no additional cost to the Department.

If the Engineer orders removal of the pavement, payment will not be made for the original pavement or removal. Pavement replaced will be paid for at the appropriate Unit Price.

D. Profilograph Testing

If, based on the Department's profilograph tests, the Engineer determines that the Contractor profilograph test results are inaccurate, the Contractor will be charged for profilograph testing at \$500 for each trace mile (\$250 for each trace kilometer), with a minimum charge of \$500.

Section 432—Mill Asphaltic Concrete Pavement

432.1 General Description

This work includes milling existing asphaltic concrete pavement to restore proper grade and/or transverse slope, removing structurally unsound material, providing clearance for overlay in curb and gutter sections, or other purposes deemed necessary due to existing conditions. Perform the work according to these Specifications and Plan details.

432.1.01 Omitted

432.1.02 Related References

A. Omitted

B. Referenced Documents

[GDT 126](#)

432.1.03 Omitted.

432.2 Materials

432.2.01 Delivery, Storage, and Handling

When specified, stockpile the milled material at locations shown on the Plans.

1. Uniformly stockpile the materials approximately 6 – 8 ft (1.8 – 2.4 m) high.
2. Maintain the existing drainage pattern of water from the stockpile storage area.
3. Dress the reclaimed asphalt area to drain rainwater from the material.
4. Obtain the Engineer's approval of the stockpile locations and the method used to prevent milled material degradation, segregation, and reconsolidation.

432.3 Construction Requirements

432.3.01 Omitted

432.3.02 Equipment

A. Milling Equipment

Use power-driven, self-propelled milling equipment that is the size and shape that allows traffic to pass safely through areas adjacent to the work. Also, use equipment that is:

- Designed to mill and remove a specified depth of existing asphalt paving
- Equipped with grade and slope controls operating from a stringline or ski and based on mechanical or sonic operation
- Capable of removing pavement to an accuracy of 1/8 in (3 mm)
- Furnished with a lighting system for night work, as necessary
- Provided with conveyors capable of side, rear, or front loading to transfer the milled material from the roadway to a truck

Section 432—Mill Asphaltic Concrete Pavement

B. Dust Control

Provide power brooms, vacuum sweepers, power blowers, or other means to remove loose debris or dust. Do not allow dust control to restrict visibility of passing traffic or to disrupt adjacent property owners.

432.3.03 Omitted

432.3.04 Omitted.

432.3.05 Construction

A. Milling Operation

Follow the Plans to mill the designated areas and depths including bridge decks, shoulders, and ramps, as required.

Ensure the following requirements are met:

1. Schedule the construction operation. Use milling methods that will produce a uniform finished surface and maintain a constant cross slope between extremities in each lane.
2. Provide positive drainage to prevent water accumulation on the milled pavement, as shown on the Plans or directed by the Engineer.
3. Bevel back the longitudinal vertical edges greater than 2 in (50 mm) that are produced by the removal process and left exposed to traffic. Bevel them back at least 3 in for each 2 in (75 mm for each 50 mm) of material removed. Use an attached mold board or other approved method.
4. When removing material at ramp areas and ends of milled sections, taper the transverse edges 10 ft (3 m) to avoid creating a traffic hazard and to produce a smooth surface.
5. Protect with a temporary asphaltic concrete tie-in (paper joint) vertical edges at other areas such as bridge approach slabs, drainage structures, and utility appurtenance greater than 1/2 in that are left open to traversing vehicles. Place the temporary tie-in at taper rate of at least 6 to 1 horizontal to vertical distance.
6. Remove dust, residue, and loose milled material from the milled surface. Do not allow traffic on the milled surface and do not place asphaltic concrete on the milled surface until removal is complete.
7. The contractor must provide disposal tickets from a certified scale to verify the amount of millings removed from the job site. The reclaimed asphaltic pavement becomes the Contractor's property unless otherwise specified.

432.3.06 Quality Acceptance

Ensure that the milling operation produces a uniform pavement texture that is true to line, grade, and cross section.

Milled pavement surface acceptance testing will be performed using the Laser Road Profiler method in [GDT 126](#). Milled pavement will be evaluated on individual test sections, normally 1 mile (1 km) long.

Remill mile (kilometer) areas to meet the specified limits when the indices are exceeded. Remill at no additional cost to the Department.

Milled pavement surfaces are subject to visual and straightedge inspection. Keep a 10 ft (3 m) straightedge near the milling operation to measure surface irregularities of the milled pavement surface. Remill irregularities greater than 1/8 in per 10 ft (3 mm in 3 m) at no additional cost to the Department.

Ensure that the cross slope is uniform and that no depressions or slope misalignments greater than 1/4 in per 12 ft (6 mm in 3.6 m) exist when the slope is tested with a straightedge placed perpendicular to the center line.

432.3.07 Omitted

432.4 Measurement

Milling existing asphaltic concrete pavement is measured by the ton.

432.4.01 Omitted

432.5 Payment

Milling asphaltic concrete pavement, measured as specified, will be paid for at the Contract Unit Price bid per ton. The price bid for this item includes the credit value of all Reclaimed Asphalt Pavement (RAP) recovered, and no adjustment in the unit price for this item or other items will be considered for variations in the amount of RAP actually recovered.

Payment is full compensation for furnishing equipment, milling, hauling, stockpiling milled material, and satisfactorily performing the work.

Section 653—Thermoplastic Traffic Stripe

653.1 General Description

This work includes furnishing and applying thermoplastic reflectorized pavement marking compound. Ensure that markings conform to Plan details and locations, these Specifications, and the Manual on Uniform Traffic Control Devices.

Thermoplastic traffic stripe consists of solid or broken (skip) lines, words, and symbols according to Plan color, type, and location.

653.1.01 Definitions

Thermoplastic Marking Compound: A compound extruded or mechanically sprayed on the pavement that cools to pavement temperature. When combined with glass spheres it produces a reflectorized pavement marking.

Short Lines: Crosswalks, stop bars, arrows, symbols, and crosshatching. Extrude short lines rather than spraying them on. Unless otherwise specified, spray all other lines.

653.1.02 Related References

A. Standard Specifications

[Section 652—Painting Traffic Stripe](#)

B. Referenced Documents

[QPL 46](#)

Federal Test Method Standard 141, Method 4252

ASTM D 1155

ASTM D 620

ASTM D 570

ASTM D 256

ASTM D 2240

ASTM E 28

ASTM 121

653.1.03 Submittals

Ensure that the producers of the thermoplastic compound and glass spheres furnish to the Department copies of certified test reports showing results of all tests specified in this Section. Also ensure that producers certify that the materials meet the other requirements of this Section by submitting copies of certification at the time of sampling. Final Acceptance, however, will be based on satisfactory test results from samples obtained by the Department before delivery.

653.2 Materials

A. General Characteristics of Thermoplastic

1. Deterioration

Use thermoplastic material with the following characteristics:

- a. Does not deteriorate upon contact with:
 - Pavement materials
 - Petroleum droppings from traffic
 - Chemicals, such as sodium chloride or calcium chloride, used to prevent formation of ice on roadways or streets
- b. Does not scorch, discolor, or deteriorate if kept at the manufacturer's recommended application temperature, or at least 375 °F (190 °C), for up to 4 hours.
- c. Has a temperature versus viscosity characteristic that remains constant from batch to batch through four re-heatings.

Section 653—Thermoplastic Traffic Stripe

2. Fumes

Use material that in the plastic state does not give off fumes that are toxic or harmful to persons or property.

B. Detailed Characteristics of Thermoplastic

1. Material Composition

Use material binder with the following characteristics:

- A mixture of synthetic resins, with at least one resin that is solid at room temperature, and high boiling point plasticizers
- A total binder content of 18 percent to 35 percent by weight
- A pigmented binder that is well-dispersed and free of dirt, foreign objects, or ingredients that cause bleeding, staining, or discoloration

The binder shall be Type A—alkyd. Ensure that at least 33% of the binder composition or at least 8% by weight of the entire material formulation is a maleic-modified glycerol ester of resin. Ensure that the finished thermoplastic pavement marking material is not adversely altered by contact with oily pavement materials or by contact from oil dropping onto the pavement surface from traffic.

Ensure that the filler has the following characteristics:

- White calcium carbonate or equivalent
- Compressive strength of 5,000 psi (34.5 MPa)

2. Suitability for Markings

Use thermoplastic material that is especially compounded for traffic markings and has the following characteristics:

- Prevents markings from smearing or spreading under normal traffic conditions at temperatures below 120 °F (49 °C)
- Gives a uniform cross section, with pigment evenly dispersed throughout the material
- Has a uniform material density and character throughout its thickness
- Allows the stripe to maintain its original dimensions and placement
- Ensures that the exposed surface is free from tack and is not slippery when wet
- Does not lift from the pavement in freezing weather
- Has cold ductility properties that permit normal movement with the road surface without chipping or cracking

3. Drying Time

When applied at a temperature range of 400 °F to 425 °F (204 °C – 218 °C) and a thickness of 1/8 in. to 3/16 in. (3 mm to 5 mm), the material shall set to bear traffic in a maximum of 2 minutes when the air temperature is 50 °F ± 3 °F (10 °C ± 2 °C) and shall set to bear traffic in a maximum of 10 minutes when the air temperature is 90 °F ± 3 °F (32 °C ± 2 °C).

4. ReflectORIZATION

Ensure that during manufacturing, reflectorizing glass spheres were mixed into the compound to the following specifications:

- At least 16 percent by weight using glass spheres with a minimum refractive index of 1.65
- At least 25 percent by weight using glass spheres with a minimum refractive index of 1.50

C. Physical Requirements of Thermoplastic

1. Color

Confirm the color of thermoplastic as follows:

- a. White thermoplastic material contains at least 8 percent by weight titanium dioxide that meets the requirements of ASTM D 476, Type II, Rutile. The white thermoplastic material shall be pure white and free from dirt or tint.

The material, when compared to the magnesium oxide standard using a standard color spectrophotometer according to ASTM D 4960, shall meet the following:

Scale	Definition	Magnesium Oxide Standard	Sample
Rd	Reflectance	100	75 min.

Section 653—Thermoplastic Traffic Stripe

a	Redness-Greenness	0	-5 to + 5
b	Yellowness-Blueness	0	-10 to + 10

Compare yellow material to match Federal Test Standard Number 595, Color 13538.

2. Color Retention

Use thermoplastic stripe tested for color retention as follows:

- a. Test specimens prepared from samples submitted according to ASTM D 620 by the Department Inspector.
- b. Use an ultraviolet light source as specified in the test procedure, or use a 275 watt sunlamp with a built-in reflector.
- c. Ensure that after 100 hours of exposure to the light source, the test specimens show no color change when compared to an unexposed specimen.

3. Water Absorption

Ensure that materials have no more than 0.5 percent by weight of retained water when tested by ASTM D 570, procedure (a).

4. Softening Point

Ensure that materials have a softening point of at least 175 °F (79 °C) as determined by ASTM E 28.

5. Specific Gravity

Ensure that the specific gravity of the thermoplastic compound at 77 °F (25 °C) is between 1.9 to 2.5.

6. Impact Resistance

Use material with an impact resistance of at least 10 in-lbs at 77 °F (1.13 N·m at 25 °C), tested as follows:

- a. Heat for 4 hours at 400 °F (204 °C).
- b. Cast into bars of 1 in² (625 mm²) cross sectional area, 3 in (75 mm) long.
- c. Place with 1 in (25 mm) extending above the vise in a cantilever beam (Izod type) tester using the 25 in-lbs (2.82 N·m) scale. This instrument is described in ASTM D 256.

7. Indentation Resistance

Measure the hardness by a Shore Durometer, Type A2, as described in ASTM D 2240. Maintain the temperature of the Durometer, 4.4 lb. (2 kg) load and the specimen at 115 °F (45 °C). Apply the Durometer and 4.4 lb. (2 kg) load to the specimen and the reading shall be between 50 to 75 units, after 15 seconds.

8. Low Temperature Stress Resistance

- a. Furnish sample test blocks as follows:
 - 1) Coat the samples using the same method as the planned installation of the compound.
 - 2) Coat the samples with at least 32 in² (206 mm²) of the compound.
- b. Have the samples tested as follows:
 - 1) Immerse a sample in cold water for one hour.
 - 2) Immediately place the sample in a freezer chest or other insulated cold compartment and maintain at a temperature of -20 °F (-29 °C) for 24 hours.
 - 3) After 24 hours, remove the sample and bring it to normal room temperature.

Following the test, confirm that the sample does not crack, flake, or fail to adhere to the substrate.

9. Reheating

Ensure that the compound does not break down, deteriorate, scorch, or discolor if held for 6 hours at the plastic temperature of 425 °F (218 °C); or if reheated up to the plastic temperature 4 times.

10. Abrasion Resistance

Have the material tested for abrasion resistance as follows:

- a. Ensure that the maximum loss of the material does not exceed 0.4 grams when subjected to 200 revolutions on a Taber Abraser at 77 °F (25 °C), using H-22 Calibrade wheels that are weighted to 500 grams.
- b. Keep the wearing surface wet with distilled water throughout the test.

Section 653—Thermoplastic Traffic Stripe

- c. Prepare the panel by forming a representative lot of material at a thickness of 0.125 in. (3.18 mm) on a 4 in (100 mm) square steel plate with a thickness of 0.050 ± 0.001 in ($1.27 \text{ mm} \pm 0.03 \text{ mm}$), on which a primer has been previously applied.

11. Yellowness Index

The white thermoplastic material shall not exceed a yellowness index of 0.12 according to AASHTO T 250.

12. Flowability

After heating the thermoplastic material for 240 ± 5 minutes at $425 \text{ }^\circ\text{F} \pm 3 \text{ }^\circ\text{F}$ ($218 \text{ }^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$) and testing the flowability, ensure that the white thermoplastic has a maximum of 21 percent residue according to AASHTO T 250.

13. Flowability-Extended Heating

After heating the thermoplastic material for 8.0 ± 0.5 hours at $425 \text{ }^\circ\text{F} \pm 3 \text{ }^\circ\text{F}$ ($218 \text{ }^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$), while stirring the last 6 hours and testing for flowability, ensure that the thermoplastic has a maximum percent residue of 28 according to AASHTO T 250.

14. Storage Life

The material shall meet the requirements of this specification for 1 year. Ensure that the thermoplastic melts uniformly with no evidence of skins or unmelted particles during the 1-year period.

D. Physical Requirements of Glass Spheres

1. Premixed Glass Spheres

Ensure that the compound has been manufactured with glass spheres in the proportion specified in [Subsection 653.2.B.4. —Reflectorization.I](#). The glass spheres contained in the material shall meet the following requirements:

- a. **Index of Refraction.** Determine the index of refraction of the premixed glass spheres by the liquid immersion method at $77 \text{ }^\circ\text{F}$ ($25 \text{ }^\circ\text{C}$).
- b. **Roundness.** Ensure that the minimum percentages of premixed glass spheres are true spheres according to the following table:

Percent of Premixed Glass Spheres That are True Spheres (when tested according to ASTM D 1155)		
Minimum Index of Refraction	Percent of Overall Beads	Percent of Beads Retained on any Sieve
1.65	At least 75%	At least 70%
1.50	At least 70%	At least 60%

- c. **Imperfections.** Ensure that no more than 5 percent of the spheres show air inclusions, bubbles, lap lines, chill wrinkles, or other imperfections when viewed through a 60-power microscope in the refractive index liquid.
- d. **Foreign Matter.** Ensure that the quantity of foreign matter does not exceed 1 percent.
- e. **Gradation.** Have the beads tested using ASTM: D 1214 to ensure they have the following gradations:

U.S. Sieve Standard Sieve Size	Percent Passing
No. 16 (1.18 mm)	100
No. 30 (600 μm^*)	60 to 90
No. 50 (300 μm)	15 to 40
No. 80 (180 μm)	0 to 10
No. 100 (150 μm)	0 to 5
* μ = micro meter	

- f. **Chemical Resistance.** Use material manufactured with glass spheres that withstand immersion in water and acids without corroding or etching, and withstand sulfides without darkening or decomposing. Have the chemical resistance tested by placing a 3 g to 5 g sample in each of three glass beakers or porcelain dishes and immersing as follows:

- Cover the first with distilled water.

Section 653—Thermoplastic Traffic Stripe

- Cover the second with a 3N solution of sulfuric acid.
- Cover the third with a solution of 50 percent sodium sulfide, 48 percent distilled water, and 2 percent Aerosol 1B or similar wetting agent.

Ensure that after one hour no darkening, hazing, or other evidence of instability is evident when examined microscopically.

2. Drop-On Glass Spheres

Ensure that these spheres meet the requirements of [Subsection 652.2](#).

E. Requirements of Sealing Primer

Place the particular type of two-part epoxy binder-sealer at the application rate as recommended in writing by the thermoplastic material manufacturer.

653.2.01 Delivery, Storage, and Handling

Use material delivered in 50 lb (22.7 kg) unit cardboard containers or bags strong enough for normal handling during shipment and on-the-job transportation without loss of material.

Ensure that each unit container is clearly marked to indicate the following:

- Color of the material
- Process batch number or similar manufacturer's identification
- Manufacturer's name
- Address of the plant
- Date of manufacture

653.3 Construction Requirements

653.3.01 Personnel

General Provisions 101 through 150.

653.3.02 Equipment

Depending on the marking required, use hand equipment or truck-mounted application units on roadway installations.

A. Spray Application Machine

Ensure that each spray application machine is equipped with the following features:

- Parts continuously mix and agitate the material.
- Truck-mounted units for lane, edge, and center lines can operate at a minimum of 5 mph (8 kph) while installing striping.
- Conveying parts between the main material reservoir and the shaping die or gun prevent accumulation and clogging.
- Parts that contact the material are easily accessible and exposable for cleaning and maintenance.
- Mixing and conveying parts, including the shaping die or gun, maintain the material at the plastic temperature with heat transfer oil or electrical element controlled heat. Do not use an external source of direct heat.
- Parts provide continuously uniform stripe dimensions.
- Applicator cleanly and squarely cuts off stripe ends and applies skip lines. Do not use pans, aprons, or similar appliances that the die overruns.
- Parts produce varying widths of traffic markings.
- Applicator is mobile and maneuverable enough to follow straight lines and make normal curves in a true arc.

B. Automatic Bead Dispenser

Apply glass spheres to the surface of the completed stripe using a dispenser attached to the striping machine to automatically dispense the beads instantaneously upon the installed line. Synchronize the glass sphere dispenser cutoff with the automatic cutoff of the thermoplastic material.

Section 653—Thermoplastic Traffic Stripe

C. Special Kettles

Use special kettles for melting and heating the thermoplastic material. Kettles equipped with automatic thermostatic control devices provide positive temperature control and prevent overheating. Ensure that the applicator and kettles are equipped and arranged according to the requirements of the National Fire Underwriters.

D. Hand Equipment

Use hand equipment for projects with small quantities of lane lines, edge lines, and center lines, or for conditions that require the equipment. Use hand equipment approved by the Engineer.

Ensure that hand equipment can hold 150 lbs (68 kg) of molten material and is maneuverable to install crosswalks, arrows, legends, lane, edge, and center lines.

E. Auxiliary Vehicles

Supply the necessary auxiliary vehicles for the operation.

653.3.03 Preparation

General Provisions 101 through 150.

653.3.04 Fabrication

General Provisions 101 through 150.

653.3.05 Construction

A. General Application

Thoroughly clean pavement areas to be striped. Use hand brooms, rotary brooms, air blasts, scrapers, or other approved methods that leave the pavement surface clean and undamaged. Take care to remove all vegetation and road film from the striping area. All new Portland Cement Concrete pavement surfaces shall be mechanically wire brushed or abrasive cleaned to remove all laitance and curing compound before being striped.

Lay stripe with continuous uniform dimensions.

Apply the type of stripe at each location according to the Plans, using one of the following methods:

- Spray techniques
- Extrusion methods wherein one side of the shaping die is the pavement, and the other three sides are contained by or are part of the suitable equipment to heat and control the flow of material.

1. Temperature

Apply thermoplastic traffic stripe only when the pavement temperature in the shade is above 40 °F (4 °C).

To ensure optimum adhesion, install the thermoplastic material in a melted state at the manufacturer's recommended temperature but not at less than 375 °F (190 °C).

2. Moisture

Do not apply when the surface is moist. When directed by the Engineer, perform a moisture test on the Portland cement concrete pavement surface. Perform the test as follows:

- a. Place approximately 1 yd² (1m²) of roofing felt on the pavement surface.
- b. Pour approximately 1/2 gallon (2 L) of molten thermoplastic onto the roofing felt.
- c. After 2 minutes, lift the roofing felt and inspect to see if moisture is present on the pavement surface or underside of the roofing felt.
- d. If moisture is present, do not proceed with the striping operation until the surface has dried sufficiently to be moisture free.

3. Binder-Sealer

To ensure optimum adhesion, apply a binder-sealer material before installing the thermoplastic in each of the following cases:

- Extruded thermoplastic
- Where directed by the Engineer for sprayed thermoplastic
- Old asphaltic concrete pavements with exposed aggregates

Section 653—Thermoplastic Traffic Stripe

- Portland cement concrete pavements as directed by the Engineer

Ensure that the binder-sealer material forms a continuous film that mechanically adheres to the pavement and dries rapidly. Use a binder-sealer currently in use and recommended by the thermoplastic material manufacturer according to [QPL 46](#).

To ensure optimum adhesion, apply a two-part epoxy binder-sealer on all Portland cement concrete pavements for either sprayed or extruded thermoplastic material.

Apply the epoxy binder-sealer immediately in advance of, but concurrent with, the application of the thermoplastic material. Apply in a continuous film over the pavement surface.

4. Bonding to Old Stripe

The old stripe may be renewed by overlaying with new material. Ensure the new material bonds to the old line without splitting or cracking.

5. Offset from Construction Joints

Off-set longitudinal lines at least 2 in (50 mm) from construction joints of Portland cement concrete pavements.

6. Crosswalks, Stop Bars, and Symbols

Make crosswalks, stop bars, and symbols at least 3/32 in (2.4 mm) thick at the edges and no more than 3/16 in (4.8 mm) thick at the center.

7. Film Thickness

a. Maintain the following minimum average film thicknesses on all open graded asphalt concrete friction courses:

- 0.120 in (3.0 mm)* for lane lines
- 0.090 in (2.3 mm)* for edge lines
- 0.150 in (3.8 mm)* for gore area lines

b. Maintain the following minimum average film thicknesses on all other pavement types:

- 0.090 in (2.3 mm)* for lane lines
- 0.060 in (1.5 mm)* for edge lines
- 0.120 in (3.0 mm)* for gore area lines

(See below for * reference.)

Compute the minimums by the amount of material used each day, as follows:

(For 5 in wide stripe)	
* Average Film Thickness (in) =	$[(\text{lbs used}) \div (\text{total linear feet})] \times 0.236$
(For 125 mm wide stripe)	
* Average Film Thickness (mm) =	$[(\text{kg used}) \div (\text{total linear meters})] \times 4.0$
(For 10 in wide stripe)	
* Average Film Thickness (in) =	$[(\text{lbs used}) \div (\text{total linear feet})] \times 0.118$
(For 250 mm wide stripe)	
* Average Film Thickness (mm) =	$[(\text{kg used}) \div (\text{total linear meters})] \times 2.0$

8. Glass Spheres

- Apply glass spheres to installed stripe surface at a minimum rate of 14 lbs of spheres to each 100 square feet ((700 g/m²) of thermoplastic material.
- Apply the glass sphere top-coating with a pressure-type gun specifically designed for applying glass spheres that will embed at least one-half of the sphere's diameter into the thermoplastic immediately after the material has been applied to the pavement.

B. Removing Existing Stripe

Remove existing stripe according to [Section 656](#).

Remove 100 percent of existing traffic stripe from:

Section 653—Thermoplastic Traffic Stripe

- Portland cement concrete pavement where the new stripe will be placed at the same location as the existing marking
- Pavement where the new stripe will be placed at a different location from the existing markings

C. Tolerance and Appearance

No traffic stripe shall be less than the specified width and shall not exceed the specified width by more than 1/2 in (13mm). The length of the 10 ft (3 m) segment for skip stripe and the 30 ft (9 m) gap between segments may vary plus or minus 1 ft (300 mm). The alignment of the stripe shall not deviate from the intended alignment by more than 1 in (25 mm) on tangents and on curves up to and including 1 degree (radius of 1745 m or greater). On curves exceeding 1 degree (radius less than 1745 m), the alignment of the stripe shall not deviate from the intended alignment by more than 2 in (50 mm).

Stop work when deviation exceeds the above dimensions, and remove the nonconforming stripe.

653.3.06 Quality Acceptance

Segments of the thermoplastic traffic stripe that have been placed according to the Plans and Specifications may be accepted 30 days after the required work is complete in that segment.

If thermoplastic traffic stripe fails to meet Plan details or Specifications or deviates from stated dimensions, correct it at no additional cost to the Department. If removal of pavement markings is necessary, perform it according to Section 656 and place it according to this Specification. No additional payment will be made for removal and replacement of unsatisfactory striping.

653.3.07 Contractor Warranty and Maintenance

After segments are accepted, the Contractor will be relieved of maintenance on those segments.

653.4 Measurement

When stripe will be paid for by the square yard (meter), the actual number of square yards (meters) painted will be measured. The space between the stripes will be included in the overall measurement.

Linear measurements may be made by electronic measuring devices attached to a vehicle.

Thermoplastic traffic stripe, complete in place and accepted, is measured as follows:

A. Solid Traffic Stripe

Stripe is measured by the linear foot (meter), linear mile (kilometer), or square yard (meter). Breaks or omissions in solid lines or stripes at street or road intersections are not measured for payment.

B. Skip Traffic Stripe

Skip stripe is measured by the gross linear mile (kilometer) as specified. The unpainted space between the painted stripes is included in the overall measurement if the Plan ratio of one to three (10 ft [3 m] segment and 30 ft [9 m] gap or other patterns as designated on the Plans) remains uninterrupted. Measurement begins and ends on a stripe.

C. Words and Symbols

Each word or symbol complete according to Plan dimensions is measured by the Unit.

653.4.01 Limits

General Provisions 101 through 150.

653.5 Payment

Payment is full compensation for the Work under this section, including:

- Cleaning and preparing surfaces
- Furnishing all materials
- Applying, curing, and protecting stripe
- Protecting traffic, including providing necessary warning signs
- Furnishing tools, machines, and other equipment necessary to complete the Item

Section 653—Thermoplastic Traffic Stripe

Measurement and payment for removing pavement markings will be according to [Section 656](#) when shown in the Proposal as a payment Item. Otherwise, removal will not be paid for separately, but will be included in the payment for other Work under this section.

Payment will be made under:

Item No. 653	Thermoplastic solid traffic stripe, __ in (mm), (color)	Per linear foot (meter)
Item No. 653	Thermoplastic solid traffic stripe, __ in (mm), (color)	Per linear mile (kilometer)
Item No. 653	Thermoplastic skip traffic stripe, __ in (mm), (color)	Per gross linear foot (meter)
Item No. 653	Thermoplastic skip traffic stripe, __ in (mm), (color)	Per gross linear mile (kilometer)
Item No. 653	Thermoplastic pavement markings, words, and symbols (color), type _____	Per each
Item No. 653	Thermoplastic traffic stripe	Per square yard (meter)

653.5.01 Adjustments

General Provisions 101 through 150.

Section 654—Raised Pavement Markers

654.1 General Description

This work includes furnishing and placing raised pavement markers according to the Plans or as directed by the Engineer. Use markers that conform to Plan shapes, dimensions, and tolerances.

654.1.01 Definitions

General Provisions 101 through 150.

654.1.02 Related References

A. Standard Specifications

[Section 868—Bituminous Adhesive for Raised Pavement Markers](#)

[Section 886—Epoxy Resin Adhesives](#)

[Section 919—Raised Pavement Marker Materials](#)

B. Referenced Documents

[QPL 74](#)

654.1.03 Submittals

General Provisions 101 through 150.

654.2 Materials

Ensure that materials meet the requirements of the following Specifications:

Material	Section
Bituminous Adhesive	868
Epoxy Resin Adhesives	886
Pavement Markers	919

654.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

654.3 Construction Requirements

654.3.01 Personnel

General Provisions 101 through 150.

654.3.02 Equipment

Before beginning construction, clean marker replacement equipment and ensure that it is mechanically sound.

A. Containers and Stirring Devices

Clean containers and stirring devices (paddles, propellers for drills, etc.) before hand-mixing epoxy.

B. Automatic Mixing Device

1. Cleaning

Clean the mixing head to the automatic epoxy mixing equipment after stopping work for any extended period of time. The length of down-time allowed depends on the pot life of the adhesive system being used.

2. Mixing Ratio

Use an automatic mixing device that delivers separate components to the mixing head in a one-to-one ratio by volume.

3. Sample Valves

Equip the lines feeding the mixing head with suitable valves to allow samples to be taken for checking the ratio of each component.

Section 654—Raised Pavement Markers

C. Bituminous Adhesive Equipment

Clean and maintain equipment for melting, stirring, and dispensing bituminous adhesive according to the bituminous adhesive manufacturer's requirements.

654.3.03 Preparation

General Provisions 101 through 150.

654.3.04 Fabrication

General Provisions 101 through 150.

654.3.05 Construction

A. Adhesive Types

Cement markers to pavement surfaces with a Type I-R Epoxy or Type I-S Epoxy (see [Section 886](#)), or with a bituminous adhesive (see [Section 868](#)). Space markers according to the Plans.

1. **Type I-R Epoxy.** Use Type I-R Epoxy when the pavement temperature is above 50 °F (10 °C), or when traffic conditions require a rapid setting system.
2. **Type I-S Epoxy.** Use Type I-S Epoxy when the pavement temperature is above 60 °F (15 °C) and traffic conditions permit a slower setting system.
3. **Bituminous Adhesive.** Use bituminous adhesive when the pavement temperature is above 40 °F (4 °C) or when traffic conditions require a rapid setting material.

B. Handling and Applying Adhesives

Obtain an epoxy adhesive furnished as two separate components. Combine and use the components as follows:

1. Immediately before use, thoroughly stir the individual components with separate paddles. Reject material permanently increasing in viscosity or showing settling of pigments, filler, or thixotropic additives that cannot be readily redispersed.
2. After stirring or agitating the two separate components, mix them in a one-to-one ratio and blend thoroughly until obtaining a uniform color without streaks.
3. At time of mixing, ensure that the temperature of both components is 60 ° to 80 °F (15 ° to 27 °C). If necessary, heat components using indirect heat to avoid locally overheating and decomposing the material. Do not heat adhesive above 120 °F (49 °C).
4. Place markers between the start of mixing the epoxy system and the termination of the pot life. The Engineer will designate the allowable pot life based on environmental factors. Never use a partially set mixed system that does not readily extrude around the perimeter of the marker when pressed to the roadway.
5. When using an approved fast-setting epoxy system, mix the separate components with a two-component type automatic mixing and extrusion apparatus, and place markers immediately.
6. Use bituminous adhesive furnished in approximately 30 lb (14 kg) cubes.
 - a. Heat the cubes in an oil-jacketed melting pot.
 - b. Maintain the bituminous adhesive at the manufacturer-recommended temperature during placement of the markers.
 - c. Discard bituminous adhesive heated above 450 °F (232 °C).

C. Placement of Markers

1. Surface Cleaning

Clean pavement of dirt, curing compound, grease, oil, paint, moisture, loose or unsound layers, or other material that would impair the bond between the adhesive and the roadway.

- a. Use either sand-blasting or grinding equipment to clean. Remove the dust before placing the marker.
- b. Provide cleaning equipment air lines with suitable traps to prevent oil or moisture from being redeposited on the road surface.

2. Placement Limits

Place markers as follows:

- a. Do not place markers over joints in rigid pavement.

Section 654—Raised Pavement Markers

- b. Do not place markers when pavement temperature is below 40 °F (4 °C).
 - c. When possible, wait 60 to 90 days before placing markers using epoxy adhesive on newly constructed asphaltic concrete pavements.
3. Marker Placement Using Epoxy Adhesives
- Place markers using epoxy adhesives as follows:
- a. Place enough adhesive on the cleaned pavement or the bottom of the marker to completely cover the contact area of the marker.
 - b. Press the marker firmly to the pavement.
 - c. Allow a slight bead of epoxy adhesive to extrude from under the marker edges.
 - d. Remove adhesive on the face of the marker or adhesive that obscures the marker. Do not use thinners or solvents to clean epoxy adhesives from the markers.
4. Marker Placement Using Bituminous Adhesives
- Place markers using bituminous adhesives as follows:
- a. Place enough bituminous adhesive on the cleaned pavement or the bottom of the marker to completely cover the contact area of the marker.
 - b. Press the marker firmly to the pavement.
 - c. Allow a slight bead of adhesive to extrude from under the marker edges.
 - d. Remove adhesive on the face of the marker or adhesive that obscures the marker.
 - e. Place the marker before the bituminous adhesive cools and does not extrude around the perimeter of the marker when pressed to the roadway.

654.3.06 Quality Acceptance

Refer to [OPL 74](#) for raised pavement markers that have met these requirements.

654.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

654.4 Measurement

The number of each type of installed and accepted pavement marker is counted separately for payment.

654.4.01 Limits

General Provisions 101 through 150.

654.5 Payment

Raised pavement markers will be paid for by the linear mile installed. Payment is full compensation for furnishing and installing each marker.

654.5.01 omitted

654.6 Submittals

Para #	Description	Date required	Date received
654.3.05.A	Adhesive Type	7 days prior	_____

Section 868—Bituminous Adhesive For Raised Pavement Markers

868.1 General Description

This section includes the requirements for bituminous hot-melt adhesive used to place raised pavement markers.

868.1.01 Related References

A. Standard Specifications

[Section 106—Certification of Materials](#)

B. Referenced Documents

AASHTO	ASTM	
T 48	C 430	D 1856
T 49	D 70	D 2669
T 53	D 1754	D 2712
T 202	D 1796	D 3407

868.2 Materials

868.2.01 Bituminous Adhesive

A. Requirements

1. Adhesive

Use an adhesive made of asphaltic material and a homogeneously mixed filler that meets the following physical requirements:

- a. Adhesive Properties: Use the asphaltic material with filler.

	Min.	Max.	Test Method
Softening point	200° F (95 °C)	—	AASHTO T 53
Penetration, mm 3.5 oz (100 g), 5 sec., 77 °F (25 °C)	10	20	AASHTO T 49
Flow	—	0.2 in (5 mm)	ASTM D 3407 (modified in Subsection 868.2.01.C)
Viscosity, 400 °F (204 °C)	—	75 Poises (7.5 Pa-s)	ASTM D 2669 (modified in Subsection 868.2.01.C)
Flash point, C.O.C.	550 °F (285 °C)	—	AASHTO T 48

- b. Asphalt Properties: Use the filler-free material derived from the extraction and Abson recovery process explained in [Subsection 868.2.01.C](#).

	Min.	Max.	Test Method
Penetration, mm 3.5 oz (100 g), 5 sec., 77 °F (25 °C)	25	—	AASHTO T 49
Viscosity, 275 °F (135 °C)	12 Poises (1.2 Pa-s)	—	AASHTO T 202

Section 868—Bituminous Adhesive For Raised Pavement Markers

Viscosity ratio, 275 °F (135 °C)	—	2.2	See Subsection 868.2.01.C
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- c. Filler Properties: Use the filler separation techniques described in [Subsection 868.2.01.C](#).

	Min.	Max.	Test Method
Filler content, percent by weight	50	75	See Subsection 868.2.01.C
Filler fineness, percent passing			
No. 325 (45 µm)	75		ASTM C 430 (modified in Subsection 868.2.01.C)
No. 200 (75 µm)	95		
No. 100 (150 µm)	100		

- d. Certification: Submit a certification from the manufacturer that includes the physical properties of the bituminous adhesives and that the material conforms with this Specification, as stated in [Subsection 106.05, “Materials Certification”](#)

2. Packaging and Labeling

- Pack the adhesive in a self-releasing cardboard container of approximately 10 in (250 mm) that can be stacked properly.
- Fill the containers with two 30 lb (13.5 kg) cubes that have a net weight of 60 lbs (27 kg).
- Put the manufacturer, quantity, and batch number on the label.
- Print “Bituminous Adhesive for Pavement Markers” on the label.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

1. Flow

Determine flow according to Section 6, Flow, of ASTM D 3407.

- Set the oven temperature at 158 ° ± 2 °F (70 ° ± 1 °C).
- Prepare samples according to Subsection 7.1 of AASHTO T 49.

2. Viscosity

Determine viscosity according to ASTM D 2669 using a spindle speed of 10 rpm.

- Heat the adhesive to approximately 410 °F (210 °C) and then let cool.
- Determine viscosity at 400 ° ± 1°F (204 ° ± 0.6 °C).

3. Asphalt Properties

Determine the base asphalt properties based on the material obtained from the following extraction and Abson recovery methods:

- Extract the asphalt by heating the adhesive to the point where it will easily flow.
- Add 125 to 150 g of adhesive to 400 mL of trichloroethylene that has a temperature of 125 ° to 150 °F (51 ° to 66 °C).
- Stir the mixture to dissolve the asphalt.
- Decant the trichloroethylene-asphalt mixture.
- Recover the asphalt using the Abson recovery method described in ASTM D 1856, except do not use the extraction methods of ASTM D 2712, and do not filter the solvent-asphalt mixture.

Section 868—Bituminous Adhesive For Raised Pavement Markers

- f. Centrifuge the extraction solution of trichloroethylene and asphalt for at least 30 minutes at 770 times gravity in a batch centrifuge.
- g. Decant the solution into a distillation flask. Do not include any filler sediment.
- h. Apply heat and bubble carbon dioxide slowly until the solution reaches a temperature of 300 °F (149 °C).
- i. Increase the carbon dioxide flow to between 800 to 900 mL per minute.
- j. Maintain the decanted solution temperature between 320 ° and 335 °F (160 ° and 168 °C) with this carbon dioxide flow for at least 20 minutes and until the trichloroethylene vapors are completely removed from the distillation flask.
- k. Repeat the extraction-recovery method as necessary to obtain the desired quantity of asphalt.
- l. Determine penetration, 275 °F (135 °C) viscosity, and viscosity ratio with the recovered asphalt.

4. Viscosity Ratio

Determine the 275 °F (135 °C) viscosity ratio by comparing the 275 °F (135 °C) viscosity on the base asphalt before and after the Thin-Film Oven Test.

- a. Perform the Thin-Film Oven Test as described in ASTM D 1754.
- b. Determine the specific gravity with a pycnometer as described in ASTM D 70 for use in the Thin-Film Oven Test.
- c. Calculate the 275 °F (135 °C) viscosity ratio by dividing the viscosity after the Thin-Film Oven Test by the original 275 °F (135 °C) viscosity.

5. Filler Material

Separate the filler material from the asphalt to determine filler content and filler fineness.

a. Filler Content

- 1) Determine the portion by weight of the adhesive that is insoluble in 1, 1, 1-trichloroethane by weighing 10.00 ± 0.01 g of solid adhesive into a centrifuge flask with a volume of approximately 100 mL, as specified in ASTM D 1796.
- 2) Add 50 mL of 1, 1, 1-trichloroethane to the adhesive.
- 3) Break the adhesive into small pieces to dissolve the solids.
- 4) Place the sample flask in a balanced centrifuge and spin with a minimum relative centrifugal force of 150 (as determined in Section 6 of ASTM D 1796) for 10 minutes.
- 5) Remove the sample flask and decant the solvent, without losing any solids.
- 6) Repeat the application of solvent and centrifuging until the solvent is clear and the filler is visually free of asphalt.
- 7) Dry the filler at $160^\circ, \pm 5^\circ\text{F}$ ($71^\circ, \pm 3^\circ\text{C}$) to remove solvent and weigh the resulting filler.
- 8) Filter the decanted solvent to verify that no filler was lost.
- 9) Calculate the percent filler content as follows:

$$\text{Filler Content, \% by weight (g)} = \frac{\text{Filler Wt. (g)} \times 100}{\text{Original Adhesive Wt. (g)}}$$

b. Filler Fineness

- 1) Determine filler fineness according to ASTM C 430, using No. 325 (45 μm), No. 200 (75 μm), and No. 100 (150 μm) sieves.
- 2) Modify this method by using a water-soluble, non-ionic wetting agent, such as Triton X-100, to aid the wetting action. Use a surfactant solution that is approximately 1 percent by weight.
- 3) Thoroughly wet the 1-gram dry sample in the surfactant solution.

Section 868—Bituminous Adhesive For Raised Pavement Markers

- 4) Soak the sample for 30 minutes.
- 5) Transfer the filler to the sieve cup.
- 6) Spray water on the filler for two minutes.
- 7) Add surfactant solution as needed and physically disperse clumped particles.
- 8) Dry the sample and handle as directed in ASTM C 430.

The Department will reject any bituminous adhesive if it meets all requirements of this Specification but fails in actual use.

D. Materials Warranty

General Provisions 101 through 150.

Section 886—Epoxy Resin Adhesives

886.1 General Description

This section includes the requirements for all epoxy adhesives used in highway construction or maintenance.

886.1.01 Related References

A. Standard Specifications

General Provisions 101 through 150.

B. Referenced Documents

AASHTO T 237

ASTM 2240

Federal Hazardous Products Labeling Act

[GDT 58](#)

[QPL 15](#)

886.2 Materials

886.2.01 Epoxy Resin Adhesives

A. Requirements

1. Use the types of epoxy adhesives below:
 - a. Type I-R: Rapid-setting marker adhesive for bonding raised pavement markers to pavement.
 - b. Type I-S: Standard setting marker adhesive for bonding raised pavement markers to pavement.
 - c. Type II: Epoxy adhesive for bonding plastic concrete to hardened concrete.
 - d. Type III: Epoxy adhesive for bonding hardened concrete to hardened concrete, or for bonding miscellaneous materials such as metals.
 - e. Type IV: Epoxy adhesive for creating an epoxy mortar for use with clean concrete or mortar sand.
 - f. Type V: Epoxy adhesive for repairing cracks in concrete by intrusion grouting.
 - g. Type VI: Epoxy adhesive for a complete application or as a component in the application of a skid resistant or protective coating on hardened Portland cement concrete or asphaltic concrete.
 - h. Type VII: Discontinued.
 - i. Type VIII: Epoxy adhesive used for anchors and dowel bar implants. Either mix this epoxy by machine to the proper ratio or package it in a two-component cartridge with a mixing nozzle that thoroughly mixes the two components as they are dispensed. Use a nozzle at least 8 in (200 mm) long.
2. Furnish the epoxy adhesive as two separate components.
3. Viscosity

Ensure that the viscosities of the separate components are similar and conducive to easy blending of the epoxy adhesive system.

 - a. Submit the viscosity for the epoxy adhesive system to the Engineer.
 - b. Ensure that the viscosity of the mixed system is compatible with the intended use of the system.
4. Labeling

Clearly label each container of the separate components of an epoxy adhesive system with the following information:

Table 1
Mixed Epoxy Adhesive Systems Requirements

- Specification number and type
- Component designation (A or B)
- Manufacturer’s batch number—a batch is a single charge of all components in a mixing chamber
- Expiration date (shelf life for separate components in original containers)
- Mixing ratio and directions (by volume or weight as designated by the manufacturer)
- Potential hazards and precautions according to the Federal Hazardous Products Labeling Act

5. Stencil the component designation on the top of each container.

6. Physical Requirements

Ensure that the mixed epoxy adhesive system meets the applicable requirements of [Table 1](#).

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

Each epoxy adhesive system shall meet the requirements of this Section.

If the Department qualifies or disqualifies a system for one of the types specified, it will not affect the qualification or disqualification of any other type.

The Department will reject any epoxy adhesive system that meets all the requirements of this Section, but fails in actual use. For a list of sources, see [QPL 15](#).

D. Materials Warranty

General Provisions 101 through 150.

Table 1
Mixed Epoxy Adhesive Systems Requirements

Property	Type Designation									Test Method
	I-R	I-S	II	III	IV	V	VI	VII	VIII	
Pot Life at 77 °F (25 °C) (minutes)	6-11	8-13	30	10-45	30-60	10-45	30-60	—	3-10	GDT 58
Elongation at 77 °F (25 °C) (percent)	—	—	—	—	30**	—	30**	—	5% Max.	GDT 58
Bond Strength, psi (MPa) at 1 hr and 77 °F (25 °C)	180 (1.2)	—	—	—	—	—	—	—	—	GDT 58
at 3 hr and 77 °F (25 °C)	—	180 (1.2)	—	—	—	—	—	—	250 (1.7)	
at 24 hr and 77 °F (25 °C)	400 (2.8)	400 (2.8)	400 (2.8)	400 (2.8)	250 (1.7)	400 (2.8)	250 (1.7)	—	400 (2.8)	
Shore D Hardness at 77 °F (25 °C)	—	—	—	—	75 Max.	—	35-65	—	—	ASTM: 2240
SAG Test	—	—	—	—	—	—	—	—	No Sag	AASHTO: T 237

Table 1
Mixed Epoxy Adhesive Systems Requirements

Wet Bond Test ,psi (MPa)	—	—	400 (2.8)	—	—	—	—	—	—	AASHTO: T 237 Section 31
Shelf Life*** (months)	6	6	6	24	12	24	6	—	6	

Note: * Values are minimums except where a range is shown, or otherwise noted.

** Epoxy adhesive system only. *** For separate components in original containers.

886.3 Submittals

Para #	Description	Date required	Date received
886.2.01.A.1	Epoxy specs	21 days prior	_____

**DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA
SUPPLEMENTAL SPECIFICATION**

Section 870—Paint

Section 652 Appendix A:

870.1 General Description

This section includes the requirements for all paints, including pigments, vehicles, and the compositions of prepared paints for all purposes specified.

870.1.01 Related References

A. Standard Specifications: Omitted

B. Referenced Documents

[OPL 46](#)

SOP 14

AASHTO M 69

Military Specifications MIL-E-698 B

MIL-P-23236 or US Corps of Engineers Specification C-200

Federal Test Methods, Standard No. 141

Federal Specifications		ASTM			
TT-E-489	TT-P-791a	D 209	D 476	D 768	D 3021
TT-P-103b	TT-P-1952E	D 211	D 600	D 822	D 3721
TT-P-104b	TT-R-266	D 234	D 602	D 1199	D 4462
TT-P-320c	TT-T-291	D 235	D 604	D 1648	E 97
TT-P-460	TT-V-119	D 263	D 605	D 2805	G 23
		D 324	D 711		

870.2 Materials

A. Requirements

1. Ingredients

The Engineer shall approve all paint ingredients. Mix the paints in the proportions specified in this section for each kind of paint. The formulas given represent the proportions by weight of the materials to be used.

2. Condition of Mixed Paints

Ensure that mixed paints do not liver or curdle, and that the pigments remain in suspension to a reasonable degree satisfactory to the Engineer.

3. Filling and Packaging

The manufacturer shall strain paints before filling the containers. The manufacturer also shall ship paints in strong, substantial containers (according to [QPL 46](#)) plainly marked with the paint name and number, color, volume, manufacturer name and address, date of manufacture, and the manufacturer's lot number on every package. The inspection stamp on the paint container will be evidence of approval.

Traffic line paint manufactured for the Department shall be delivered in 55 gallon (208 L) drums or 250 gallon (946 L) totes. The manufacturer shall stencil on the head of each drum the kind of paint, requisition number, purchase order number, and gross and net weights. Ensure that the drums are the removable head types. Ensure the totes are labeled appropriately.

4. Finished Paints

Unless otherwise specified, deliver paints to the Project or the Department completely mixed and ready for use without adding oils or thinner. Use well ground paints that do not settle or badly cake in the container, and can readily be broken up to a smooth, uniform paint with good brushing consistency.

When brushed or rolled on a smooth, vertical surface, the paint shall dry hard and elastic without running, streaking, sagging, or spotting. Use paint for spray application that sprays satisfactorily and does not run, sag, or streak.

The first coat of paint applied in the shop or in the field to uncoated structural steel or wood is called the primer coat. The paint covering the primer coat is called the second coat, and the paint covering the second coat is called the third coat.

B. Fabrication

The formulas given in this specification represent proportions by weight.

C. Acceptance

1. Testing

Test methods for paint analyses shall be according to the Federal Test Methods, Standard No. 141 or the ASTM standard methods of tests for paint.

2. Color

Match color visually by comparing with standard color chips obtained from the Office of Materials and Research.

3. Inspection

Inspection and analysis will be made at the point of manufacture according to SOP 14. The manufacturer shall assist as necessary, permit the Inspector to test the ingredients before the paint is made, and witness the paint grinding.

The Department reserves the right to sample and test all paint at any time before it is used.

4. Tolerances

The Department will accept a tolerance of 1 percent of the required value for the paint formulation and property requirements.

EXCEPTION: This tolerance does not apply where maximum and minimum values are noted.

D. Materials Warranty

The following people shall furnish the Department a certificate of analysis and manufacturer's guarantee:

The manufacturer of each brand of paint submitted for acceptance under these Specifications

All Contractors proposing to use any paint specified in this Section

Ensure that the certificate of analysis shows the paint trade name to be furnished, including a facsimile of the label if the paint is ready-mixed, and an analysis showing the percentage of each of the chemical elements and compounds in the pigment and vehicle. The guarantee shall assert that all paint furnished conforms to the analysis shown on the certificate filed and to the statement of percentages of ingredients shown on the labels, which are required to be on each container. The guarantee shall be sworn to by a person having authority to bind the manufacturer into an agreement.

870.2.01 Paints for Structural Steel

A. Requirements

1. Use structural steel paint that meets the applicable requirements of [Subsection 870.2](#) and the following:

No. 1A, Red Primer (see [Table 1](#)). Apply this paint with brush, roller, or airless spray.

No. 1W, Waterborne Red Primer (see [Table 2](#)).

No. 1 Z, Inorganic Zinc Rich Primer (See [Table 3](#))

No. 2A, Buff (see [Table 4](#)). Apply this paint with brush, roller, or airless spray.

No. 2B, Aluminum (See [Table 5](#) and [Subsection 870.2.01.B, "Fabrication"](#)).

No. 2W, Waterborne Intermediate Coat (see [Table 6](#)).

No. 3A, Brown (see [Table 7](#)). Apply this paint with brush, roller, or airless spray.

No. 3B, Green (see [Table 8](#)). Apply this paint with brush, roller, or airless spray.

No. 3W, Waterborne Green (see [Table 9](#)).

Table 1—No. 1A, Red Primer, Brushing, Roller, or Airless Spray Type

Requirement	Maximum	Minimum
Paint Composition, percent by weight		
Pigment	—	53
Vehicle	47	—
Coarse Particles, total residue retained on No. 325 sieve, based on paint, percent by weight	1.0	—
Fineness of Grind, North Standard	—	4.5
Viscosity, Krebs Units	81	75
Moisture Content, percent by weight	0.5	—
Drying Time, hours		
Set to touch	6	—
Dry through	18	—
Weight, lbs/gal (kg/L)	—	12.7 (1.52)
Pigment Composition, percent by weight		
Zinc Hydroxy Phosphite, ASTM D 4462	—	73
Red Iron Oxide ASTM D 3721	—	24
Organo Montmorillonite ¹	1.0	0.8

Requirement	Maximum	Minimum
Vehicle Composition, percent by weight		
Non-Volatile ²	—	66
Raw Linseed Oil, ASTM D 234		
Alkyd Resin Solution, Federal		
Specification TT-R-266, Type I,		
Class "A"		
Thinners and Driers		
Thinners, Federal Specification	34	—
TT-T-291		
Driers, ASTM D 600 Class "C"		
<p>Notes: ¹ Prewet Organo Montmorillonite with 20-30% (95%) methyl alcohol by weight.</p> <p>² Ensure that the non-volatile vehicle is composed of 1:1 proportions by weight of raw linseed oil and alkyd resin, respectively.</p>		

Table 2—No. 1W, Waterborne Red Primer

Requirement	Maximum	Minimum
Paint Composition, percent by weight		
Pigment	—	24
Vehicle	76	—
Coarse Particles, total residue retained on 60 µm sieve, based on paint, percent by weight	0.5	—
Fineness of Grind, North Standard	—	4
Viscosity, Krebs Units	100	90
Drying Time, hours		
Set to touch	3	—
Dry through	24	—
Weight, lbs/gal (kg/L)	—	9.85 (1.18)
Pigment Composition, percent by weight		
Red Iron Oxide	—	45
Zinc Phosphate	—	15
Vehicle Composition, percent by weight		
Non-Volatile Binder Solids, HG-54 or HG-56 ¹	—	30
Methyl Carbitol	—	5
Texanol	—	2
Dibutyl Phthalate	—	2

Requirement	Maximum	Minimum
Other Additives	5	—
NOTE: ¹ or approved equivalent		

Table 3—No. 1Z, Inorganic Zinc Rich Primer

Requirement	Maximum	Minimum
Zinc dust, percent by weight		
Zinc	—	99.00
Lead	0.6	—
Percent by weight of zinc in dried paint film	—	85
Elcometer Adhesion of dried paints, psi (MPa)	—	300 (2.1)
<p>Note: The primer shall be self-curing and shall consist of two components, Zinc dust and Ethyl Silicate vehicle. A manufacturer's product data sheet and a material safety data sheet (MSDS) shall accompany each shipment of Inorganic Zinc Rich Primer. The product data sheet shall contain the following information for the mixed primer: Unit Weight, Viscosity, Volatile Organic Content (VOC), Pot Life, Percent Solids by Volume.</p>		

Table 4—No. 2A, Buff, Brushing, Roller, or Airless Spray Type

Requirement	Max.	Min.
Paint composition, percent by weight		
Pigment	—	52
Vehicle	48	—
Coarse particles, total residue retained on No. 325 (45 µm) sieve, based on paint, percent by weight	1.0	—
Fineness of grind, North Standard	—	4
Viscosity, Krebs units	82	75
Moisture content, percent by weight	0.5	—
Drying time, hours	18	—
Weight, lbs/gal (kg/L)	—	12.5 (1.50)
Color: Match the Department's Standard Color Chip		

Requirement	Max.	Min.
Pigment composition, percent by weight Zinc Hydroxy Phosphite, ASTM D 4462 Titanium Dioxide ASTM D 476 Type IV Organo Montmorillonite—prewet with 20-30% (95%) methyl alcohol by weight Tinting Pigments (may be added as predispersed pigments): Yellow Oxide ASTM D 768 Red Iron Oxide ASTM D 3721 Lampblack ASTM D 209	— — 1.0 3.5	75 19 0.75 3.0
Vehicle composition, percent by weight Non-Volatile, 1:1 proportions by weight, of: Raw Linseed Oil, ASTM D 234 Alkyd Resin Solution, Federal Specification TT-R-266, Type I, Class "A"	—	66
Thinners and Driers Thinners, Federal Specification TT-T-291 Driers, ASTM D 600 Class "C"	34	—
<p>Note 1: For the greatest effectiveness, the Organo Montmorillonite should be prewetted with 20 – 30% (95%) methyl alcohol by weight.</p> <p>Note 2: The non-volatile vehicle shall be composed of 1:1 proportions by weight of raw linseed oil and alkyd resin, respectively.</p>		

Table 5—No 2B, Aluminum

Requirement	Maximum	Minimum
Paint Composition		
Aluminum Paste, AASHTO M 69, lbs (kg)	—	2 (0.24)
Aluminum Vehicle, AASHTO M 69, gal (L)	1 (1)	—
Drying Time, hours		
Set to touch	8	2
Dry through	24	—
Note: Refer to Subsection 870.2.01.B, "Fabrication" , for additional requirements.		

Table 6—No. 2W, Waterborne Intermediate Coat

Requirement	Maximum	Minimum
Pigment Composition, percent by weight		
Pigment	—	38
Vehicle	62	—

Requirement	Maximum	Minimum
Coarse Particles, total residue retained on 60 µm sieve, based on paint, percent by weight	0.5	—
Fineness of Grind, North Standard	—	4
Viscosity, Krebs Units	100	90
Drying Time, hours		
Set to touch	3	—
Dry through	24	—
Weight, lbs/gal (kg/L)	—	11.0 (1.32)
Pigment Composition, percent by weight		
Zinc Phosphate	—	10
Calcium Carbonate	—	30
Magnesium Silicate ASTM D 605	12	—
Titanium Dioxide ASTM D 476 Type IV	—	40
Vehicle Composition, percent by weight		
Non-Volatile Binder Solid, HG-54 or HG-56 ¹	—	30
Methyl Carbitol	—	5
Texanol	—	2
Dibutyl Phthalate	—	2
Other Additives	5	—
Notes: ¹ or approved equivalent		

Table 7—No. 3A, Brown, Brush, Roller, or Airless Spray Type

Requirement	Maximum	Minimum
Paint composition, percent by weight		
Pigment	47.0	45.0
Vehicle	55.0	53.0
Pigment composition, percent by weight		
Basic Lead Silico Chromate, ASTM D 1648	38.0	36.0
Red Iron Oxide—85%, ASTM D 3721	28.0	27.0
Titanium Dioxide, Rutile, Chalk		
Resistant, ASTM D 476, Type IV	16.5	15.5
Barium Sulfate, ASTM D 602	—	14.5
Organo Montmorillonite	—	0.6
Tinting Colors (Phthalocyanine blue, Lampblack, and Yellow Iron Oxide)	Remainder	

Requirement	Maximum	Minimum
Vehicle composition, percent by weight		
Alkyd Resin, TT-R-266, Type I, Class A	—	57.0
Raw Linseed Oil, ASTM D 234	—	20.0
Mineral spirits, driers, antiskinning agents and methanol/water 95/5—prewet Organo Montmorillonite with 95/5 methanol/ water before adding to grind	23.0	—
Percent non-volatile vehicle	—	59.0
Color: Match Federal Standard Colors No. 595-30111		
Properties of finished paint		
Weight, lbs/gal (kg/L)	—	11.5 (1.38)
Viscosity, Krebs units	75	68
Fineness of grind, North Standard	—	4.0

Table 8—No. 3B, Green, Brushing, Roller, or Airless Spray Type

Requirement	Maximum	Minimum
Paint Composition, percent by weight		
Pigment	—	40
Vehicle	60	—
Coarse Particles, total residue retained on No. 325 sieve, based on paint, percent by weight	0.5	—
Fineness of Grind, North Standard	—	4
Viscosity, Krebs Units	85	75
Moisture Content, percent by weight	0.5	—
Drying Time, hours	8	—
Weight, lbs/gal (kg/L)	—	10.1(1.21)
Color: Shall match the Department's Standard Color Chip		
Pigment Composition, percent by weight		
Zinc Hydroxy Phosphite, ASTM D 4462	—	25
Titanium Dioxide, ASTM D 476, Type IV	—	2
Magnesium Silicate, ASTM D 605	45	40
Organo Montmorillonite ¹	1.5	1.2
Chromium Oxide, ASTM D 263	18	15
Pure Tinting Colors (No chrome green allowed)	Remainder	
Yellow Iron Oxide, ASTM D 768		
Red Iron Oxide, ASTM D 3721		
Lamp Black, ASTM D 209		

Requirement	Maximum	Minimum
Phthalocyanine Green, ² ASTM D 3021		
Vehicle Composition, percent by weight		
Non-Volatile	—	55
Alkyd Resin Solution, Federal Specification TT-R-266, Type I, Class "A"		
Thinners and Driers	45	—
Thinners, Federal Specifications, TT-T-291		
Driers, ASTM D 600 Class "C"		
NOTE: ¹ Prewet Organo Montmorillonite with 20-30% (95%) methyl alcohol by weight.		
² Chlorinated Copper Phthalocyanine, full strength, oil dispersable.		

Table 9—No. 3W, Waterborne Green

Requirement	Maximum	Minimum
Paint Composition, percent by weight		
Pigment	—	15
Vehicle	85	—
Coarse Particles, total residue retained on 60 µm sieve, based on paint, percent by weight	0.5	—
Fineness of Grind, North Standard	—	4
Viscosity, Krebs Units	100	90
Drying time, hours		
Set to touch	3	—
Dry through	24	—
Weight, lbs/gal (kg/L)	—	9.35 (1.12)
Color: Shall match the Department's standard color chip		
Pigment Composition, percent by weight		
Zinc Phosphate	—	10
Titanium Dioxide, ASTM D 476, Type IV	—	5
Magnesium Silicate ASTM D 605	25	—
Calcium Carbonate	35	—
Pure Tinting Colors (No chrome green allowed)	Remainder	
Yellow Iron Oxide ASTM D 768		
Red Iron Oxide ASTM D 3721		
Lamp Black ASTM D 209		
Phthalocyanine Green ASTM D 3021		

Requirement	Maximum	Minimum
Vehicle Composition, percent by weight		
Non-Volatile Binder Solids, HG-54 or HG-56 ¹	—	30
Methyl Carbitol	—	5
Texanol	—	4
Other Additives	5	—
NOTE: ¹ or approved equivalent		

B. Fabrication

1. No. 2B, Aluminum

Prepare the aluminum paint by thoroughly mixing aluminum paste with mixing vehicle.

- a. Ensure the paints are well ground, do not settle or cake badly in the container, and are readily broken up to a smooth, uniform paint of good brushing consistency.
- b. Use 2 lbs (0.24 kg) of paste to 1.0 gal (1.0 L) of vehicle. Mix this at the factory.
- c. Ensure a thorough mix with a minimum of stirring. Ensure that the paint shows satisfactory leafing qualities and solidly covers in one coat without running, streaking, or sagging.
- d. If applying two coats of aluminum paint, tint the first coat with iron blue paste to help distinguish the two coats.

C. Acceptance

See [Subsection 870.2.C](#).

D. Materials Warranty

See [Subsection 870.2.D](#).

870.2.02 Traffic Line Paints

A. Requirements

Use traffic line paints that meet the applicable requirements of [Subsection 870.2](#) and the following:

1. No. 4C, Black Traffic Line Paint

- a. Paint Composition: (See [Table 10](#)).
- b. Finished Paint:
 - 1) Flexibility: Ensure paint flexibility by following this procedure:
 - a. Use a doctor blade or other suitable means to apply the paint to a 30-gauge (0.39 mm) clean tin plate panel. Apply to a wet film thickness of approximately 2 mils (0.05 mm).
 - b. Dry the panel in a horizontal position for 18 hours, and then bake it for 5 hours at 220 °F to 225 °F (105 °C to 110 °C).
 - c. Cool the panel to approximately 77 °F (25 °C) and bend double over a ½ inch rod (13 mm rod). Ensure that the film does not show cracking or flaking upon bending or straightening.
 - 2) Color: Ensure that the paint dries to a pure, flat black and furnishes the maximum amount of opacity and visibility under both daylight and artificial light.

Ensure that the paint does not discolor when exposed to weather or traffic and does not appreciably discolor with stains during service life on either concrete or bituminous surfaces.
 - 3) Weight per gallon (liter): Use paint weighing at least 14.0 lb/gal (67 kg/L) at 77 °F (25 °C).

- 4) Consistency: The paint viscosity when measured at 77 °F shall be 85 to 100 Krebs Units.
- 5) Moisture content: The paint shall contain no more than 0.5% water.
- 6) Drying: The paint shall dry to no pickup within 45 minutes when tested according to ASTM D 711.
- 7) Spraying: The paint shall be factory-mixed ready for application through spray machines without using thinners.
- 8) Storage: The paint shall not cake, liver, thicken, curdle, gel, or show other objectionable properties after storage for 6 months.
- 9) Coarse particles and skins: The paint shall not contain more than 1.0 percent of coarse particles and skins.
- 10) Fineness of Grind: The paint shall have a grind of 3 to 5 Hegman scale.
- 11) Packaging: The finished paint shall be passed through a No. 40 mesh screen while filling the containers.

Table 10—No 4C, Black Traffic Line Paint

Requirement	Maximum	Minimum
Paint composition, percent by weight		
Pigment	43.0	41.0
Vehicle	59.0	57.0
Non-volatile vehicle, percent by weight of vehicle	—	42.0
Pigment composition, percent by weight		
Lamp Black, ASTM D 209	—	3.0
Calcium Carbonate, ASTM D 1199, Type GC (Note 1), Grade 1	34.0	32.0
Diatomaceous Silica, ASTM D 604, Type B	23.0	21.0
Magnesium Silicate, ASTM D 605	44.0	42.0
Organo Montmorillonite (Note 2)	0.8	0.3
Vehicle Composition, percent by weight		
Alkyd resin solution	—	70.0
Petroleum thinner, driers, and other additives	30.0	—
Alkyd Resin Solution Characteristics		
Type	Pure Drying Alkyd	
Type of oil	Soya, Linseed, or a mixture of the two	
Non-volatile, percent by weight	61	59
Volatile type	VM & P Naphtha	
Viscosity, Gardner-Holdt	Z ⁵	Z ³
Viscosity, at 45% solids	G	D
Color, Gardner—1953	10	3
Acid number, solids basis	8	—
Alkyd Resin Solution Characteristics,		
lbs/gal (kg/L) solution	7.75 (0.93)	7.66 (0.92)

Requirement	Maximum	Minimum
Modifying oil iodine number (Note 3)	—	115
Phthalic Anhydride, percent by weight of non-volatile	—	33
Oil Acids, percent	55	48
Compatibility	500% in VM & P Naphtha	
Resin and/or Derivatives	None	
Phenolic Resin Modifiers	None	

Notes for Table 10:

1. You may use the following chemical composition requirements for calcium carbonate in lieu of those for Type GC. However, all physical properties prescribed for Type GC, Grade 1, are required.

Requirement	Maximum	Minimum
Moisture and other volatile matter, percent by weight	0.2	—
Total Calcium and Magnesium Carbonates, percent by weight Magnesium Carbonate	— 3	95

2. Prewet Organo Montmorillonite with 20-30% (95%) methyl alcohol by weight.
3. Use modifying oil acids, isolated by Federal Test Method No. 141, Method 7031 that have an Iodine Number as specified in Table 870.8, Alkyd Resin Solution Characteristics.

2. No. 5A, Waterborne White Traffic Line Paint

a. Paint Composition: (See [Table 11](#)).

b. Finished Paint

- 1) Flexibility: Apply the paint to a 30 gauge (0.39 mm), clean tin plate panel, to a wet film thickness of approximately 2 mils (0.05 mm). Use a doctor blade or other suitable means.
 - a. Dry the panel horizontally for 18 hours.
 - b. Bake the panel for 5 hours at 220 ° to 230 °F (105 ° to 110 °C).
 - c. Cool the panel to about 77 °F (25 °C) and bend it double over a 1/2 in (13 mm) rod. Ensure that the film does not crack or flake when bent or straightened.
- 2) Bleeding: Ensure that the paint does not bleed over a bituminous surface type used in Georgia.
- 3) Color: Ensure that the paint dries to a pure, intense white and furnishes the maximum amount of opacity and visibility under both daylight and artificial light.
Ensure that the paint does not discolor when exposed to weather or traffic and does not appreciably discolor with stains during service life on either concrete or bituminous surfaces.
- 4) Consistency: Use paint with a viscosity of 80 - 100 Krebs units at 77 °F (25 °C).
- 5) Drying: Ensure that the paint dries to no-pick-up within six minutes when tested according to ASTM D 711. Ensure that the paint dries through within 20 minutes when applied at 15 mils (0.38 mm) wet thickness at 77 °F (25 °C).
- 6) Spraying: Mix the paint at the factory so it can be applied by spray machines without adding thinners.
- 7) Storage: Ensure that the paint does not cake, liver, thicken, curdle, gel, or show any other objectionable properties after storage for six months.

- 8) Coarse Particles and Skins: Ensure that the paint contains less than 1 percent of coarse particles and skins.
- 9) Fineness of Grind: Ensure that the paint has a grind of 2 to 5 Hegman scale.
- 10) Weight per gallon (liter): Use paint weighing at least 14.00 lb/gal. at 77 °F (1.68 kg/L at 25 °C).
- 11) Packaging: Pass the finished paint through a No. 40 (425 µm) screen while filling the containers.
- 12) Freeze-Thaw and Heat Stability: Ensure that the paint shows no coagulation, discoloration, or change in consistency greater than 10 Krebs units, when tested according to TT-P-1952E.
- 13) pH: Ensure that the pH is greater than 9.5.

Table 11—No. 5A Waterborne White Traffic Line Paint

Requirement	Maximum	Minimum
Paint Composition, percent by weight		
Pigment	63.0	60.0
Vehicle	40.0	37.0
Non-Volatile Vehicle, percent by weight of vehicle	50.0	42.0
Pigment Composition, percent by weight		
Titanium Dioxide, ASTM D 476		
Type II, Rutile	—	13.0
Calcium Carbonate, ASTM A 1199		
Type GC Grade 1	87.0	—
Vehicle Composition, percent by weight		
Acrylic Emulsion E-2706 or DT211NA (50% NV) ¹	90.0	85.0
Methanol	3.0	1.0
Texanol Coalsecent	5.0	4.0
Other Additives	5.0	0.0
Propylene Glycol	—	3.0
NOTE: ¹ Or approved equivalent		

3. No. 5B, Waterborne Yellow Traffic Line Paint

a. Paint Composition: (See [Table 12](#)).

b. Finished Paint:

- 1) Flexibility: Apply the paint with a doctor blade to a 30 gauge (0.39 mm), clean tin plate panel, to a wet film thickness of approximately 2 mils (0.05 mm).
 - a. Dry the panel horizontally for 18 hours.
 - b. Bake the panel for 5 hours at 220 ° to 230 °F (105 ° to 110 °C).
 - c. Cool the panel to about 77 °F (25 °C) and bend it double over a 1/2 in (13 mm) rod. Ensure that the film does not crack or flake when bent or straightened.
- 2) Bleeding: Ensure that the paint does not bleed on any bituminous surface type used in Georgia.
- 3) Color: Ensure that the paint dries to a bright yellow that matches color chip #33538 of Federal Color Standard #595B, within the limits of the Highway Yellow Color Tolerance Chart.

Ensure that the paint does not discolor when exposed to weather or traffic and does not appreciably discolor from stains during service life on either concrete or bituminous surfaces.

- 4) Consistency: Ensure a viscosity of 80 - 100 Krebs units at 77 °F (25 °C).
- 5) Drying: Ensure that the paint dries to no-pick-up within 6 minutes when tested according to ASTM D 711. Ensure that the paint dries through within 20 minutes when applied at 15 mils (0.38 mm) wet thickness at 77 °F (25 °C).
- 6) Spraying: Mix the paint at the factory so it can be applied by spray machines without adding thinners.
- 7) Storage: Ensure that the paint does not cake, liver, thicken, curdle, gel, or show any other objectionable properties after storage for 6 months.
- 8) Coarse Particles and Skins: Ensure that the paint contains less than 1 percent of coarse particles and skins.
- 9) Fineness of Grind: Ensure that the paint has a grind of 3 to 5 Hegman scale.
- 10) Weight per gallon (liter): Use paint weighing at least 13 lb/gal (1.56 kg/L) at 77 °F (25 °C).
- 11) Packaging: Pass the finished paint through a No. 40 (425 µm) screen while filling the containers.
- 12) Freeze-Thaw and Heat Stability: Ensure that the paint shows no coagulation, discoloration, or change in consistency greater than 10 Krebs units, when tested according to TT-P-1952E.
- 13) pH: Ensure that the pH is greater than 9.5.

Table 12—No. 5B, Waterborne Yellow Traffic Line Paint

Requirement	Maximum	Minimum
Paint Composition, percent by weight		
Pigment	63.0	60.0
Vehicle	40.0	37.0
Non-Volatile Vehicle, percent by weight of vehicle	50.0	42.0
Pigment Composition, percent by weight		
Titanium Dioxide, ASTM D 476 Type II, Rutile	—	4.0
Lead-free organic yellow No. 65	—	5.0
Calcium Carbonate, ASTM D 1199 Type GC Grade 1	91.0	—
Vehicle Composition, percent by weight		
Acrylic Emulsion E-2706 or DT211NA (50% NV) ¹	90.0	85.0
Methanol	3.0	1.0
Texanol Coalsecent	5.0	4.0
Other Additives	5.0	—
Propylene Glycol	—	3.0
NOTE: ¹ or approved equivalent		

4. No. 6A, Waterborne High Build White Traffic Line Paint
 - a. Paint Composition: (See [Table 13](#)).
 - b. Finished Paint

- 1) Flexibility: Apply the paint to a 30 gauge (0.39 mm), clean tin plate panel, to a wet film thickness of approximately 2 mils (0.05 mm). Use a doctor blade or other suitable means.
 - a. Dry the panel horizontally for 18 hours.
 - b. Bake the panel for 5 hours at 220 ° to 230 °F (105 ° to 110 °C).
 - c. Cool the panel to about 77 °F (25 °C) and bend it double over a 1/2 in (13 mm) rod. Ensure that the film does not crack or flake when bent or straightened.
- 2) Bleeding: Ensure that the paint does not bleed over a bituminous surface type used in Georgia.
- 3) Color: Ensure that the paint dries to a pure, intense white and furnishes the maximum amount of opacity and visibility under both daylight and artificial light.
Ensure that the paint does not discolor when exposed to weather or traffic and does not appreciably discolor with stains during service life on either concrete or bituminous surfaces.
- 4) Consistency: Use paint with a viscosity of 80 - 100 Krebs units at 77 °F (25 °C).
- 5) Drying: Ensure that the paint dries to no-pick-up within six minutes when tested according to ASTM D 711. Ensure that the paint dries through within 20 minutes when applied at 25 mils (0.635 mm) wet thickness at 77 °F (25 °C).
- 6) Spraying: Mix the paint at the factory so it can be applied by spray machines without adding thinners.
- 7) Storage: Ensure that the paint does not cake, liver, thicken, curdle, gel, or show any other objectionable properties after storage for six months.
- 8) Coarse Particles and Skins: Ensure that the paint contains less than 1 percent of coarse particles and skins.
- 9) Fineness of Grind: Ensure that the paint has a grind of 2 to 5 Hegman scale.
- 10) Weight per gallon (liter): Use paint weighing at least 14.00 lb/gal. at 77 °F (1.68 kg/L at 25 °C).
- 11) Packaging: Pass the finished paint through a No. 40 (425 µm) screen while filling the containers.
- 12) Freeze-Thaw and Heat Stability: Ensure that the paint shows no coagulation, discoloration, or change in consistency greater than 10 Krebs units, when tested according to TT-P-1952E.
- 13) pH: Ensure that the pH is greater than 9.5.

Table 13—No. 6A Waterborne High Build White Traffic Line Paint

Requirement	Maximum	Minimum
Paint Composition, percent by weight		
Pigment	63.0	60.0
Vehicle	40.0	37.0
Non-Volatile Vehicle, percent by weight of vehicle	50.0	42.0
Pigment Composition, percent by weight		
Titanium Dioxide, ASTM D 476, Type II, Rutile	—	13.0
Calcium Carbonate, ASTM A 1199, Type GC Grade 1	87.0	—
Vehicle Composition, percent by weight		
Acrylic Emulsion meeting TT-P_1952E, Type III ¹	90.0	85.0
Methanol	3.0	1.0
Texanol Coalsecent	5.0	4.0

Requirement	Maximum	Minimum
Other Additives	5.0	0.0
Propylene Glycol	—	3.0
NOTE: ¹ or approved equivalent		

5. No. 6B, Waterborne Yellow High Build Traffic Line Paint

a. Paint Composition: (See [Table 14](#)).

b. Finished Paint:

- 1) Flexibility: Apply the paint with a doctor blade to a 30 gauge (0.39 mm), clean tin plate panel, to a wet film thickness of approximately 2 mils (0.05 mm).
 - a. Dry the panel horizontally for 18 hours.
 - b. Bake the panel for 5 hours at 220 ° to 230 °F (105 ° to 110 °C).
 - c. Cool the panel to about 77 °F (25 °C) and bend it double over a 1/2 in (13 mm) rod. Ensure that the film does not crack or flake when bent or straightened.
- 2) Bleeding: Ensure that the paint does not bleed on any bituminous surface type used in Georgia.
- 3) Color: Ensure that the paint dries to a bright yellow that matches color chip #33538 of Federal Color Standard #595B, within the limits of the Highway Yellow Color Tolerance Chart.
Ensure that the paint does not discolor when exposed to weather or traffic and does not appreciably discolor from stains during service life on either concrete or bituminous surfaces.
- 4) Consistency: Ensure a viscosity of 80 - 100 Krebs units at 77 °F (25 °C).
- 5) Drying: Ensure that the paint dries to no-pick-up within 6 minutes when tested according to ASTM D 711. Ensure that the paint dries through within 20 minutes when applied at 25 mils (0.635 mm) wet thickness at 77 °F (25 °C).
- 6) Spraying: Mix the paint at the factory so it can be applied by spray machines without adding thinners.
- 7) Storage: Ensure that the paint does not cake, liver, thicken, curdle, gel, or show any other objectionable properties after storage for 6 months.
- 8) Coarse Particles and Skins: Ensure that the paint contains less than 1 percent of coarse particles and skins.
- 9) Fineness of Grind: Ensure that the paint has a grind of 3 to 5 Hegman scale.
- 10) Weight per gallon (liter): Use paint weighing at least 13 lb/gal (1.56 kg/L) at 77 °F (25 °C).
- 11) Packaging: Pass the finished paint through a No. 40 (425 µm) screen while filling the containers.
- 12) Freeze-Thaw and Heat Stability: Ensure that the paint shows no coagulation, discoloration, or change in consistency greater than 10 Krebs units, when tested according to TT-P-1952E.
- 13) pH: Ensure that the pH is greater than 9.5.

Table 14—No. 6B, Waterborne High Build Yellow Traffic Line Paint

Requirement	Maximum	Minimum
Paint Composition, percent by weight		
Pigment	63.0	60.0
Vehicle	40.0	37.0
Non-Volatile Vehicle, percent by weight of vehicle	50.0	42.0

Requirement	Maximum	Minimum
Pigment Composition, percent by weight		
Titanium Dioxide, ASTM D 476 Type II, Rutile	—	4.0
Lead-free organic yellow No. 65	—	5.0
Calcium Carbonate, ASTM D 1199 Type GC Grade 1	91.0	—
Vehicle Composition, percent by weight		
Acrylic Emulsion meeting TT-P-1952E, Type III ¹	90.0	85.0
Methanol	3.0	1.0
Texanol Coalsecent	5.0	4.0
Other Additives	5.0	—
Propylene Glycol	—	3.0
NOTE: ¹ or approved equivalent		

B. Fabrication

See [Subsection 870.2.B](#).

C. Acceptance

See [Subsection 870.2.C](#).

D. Materials Warranty

See [Subsection 870.2.D](#).

870.2.03 Sign Enamel

A. Requirements

1. Ensure that sign enamels, either baking or air-drying, except black, meet the requirements of Federal Specifications TT-E-489 and [Subsection 870.2](#).
2. Use the identified class shown in [Table 15](#) for the respective types. Also, ensure that each color matches Federal Standard 595A as designated.

Table 15—Sign Enamel Federal Specification Requirements

	Fed. Stand. No. 595 A	Fed. Spec. TT-E-489e	
Color	Number	Class	Type
Yellow	13538	B	Baking
		A	Air drying
White	17875	B	Baking
		A	Air drying
Red	11105	B	Baking
		A	Air drying

	Fed. Stand. No. 595 A	Fed. Spec. TT-E-489e	
Color	Number	Class	Type
Blue	15090	B A	Baking Air drying
Green	14109	B A	Baking Air drying

- For a black sign enamel, use a semi-gloss enamel that matches Federal Standard Number 595 A, Color 27038 and meets the requirements of Military Specifications MIL-E-698 B and [Subsection 870.2](#).

B. Fabrication

Prepare the surface and use a primer recommended by the manufacturer of the sign enamel.

C. Acceptance

See [Subsection 870.2.C](#).

D. Materials Warranty

See [Subsection 870.2.D](#).

870.2.04 Paint for Timber

A. Requirements

Ensure that paints for timber meet the requirements of [Subsection 870.2](#) and Federal Specification TT-P-104b, unless otherwise specified.

- If lead-free, fume-resistant paint is specified, ensure that it meets the requirements of Federal Specification TT-P-103b.
- If chalking is a specified requirement, ensure that the paint meets Federal Specification TT-T-103b modified to require that the percentage of anatase be equal to that specified in TT-P-103b for both rutile and anatase.

B. Fabrication

See [Subsection 870.2.B](#).

C. Acceptance

See [Subsection 870.2.C](#).

D. Materials Warranty

See [Subsection 870.2.D](#).

870.2.05 Miscellaneous Paints

A. Requirements

- Paint for Steel Piling and Sway Bracing

Use paint for steel piling and sway bracing that meets the requirements of [Subsection 870.2](#) and the following:

- No. 1P, General: Ensure that materials used as a primer and/or finish coat are formulated from either a coal tar pitch or a native pyrobitumen resin. You may use other types of material if they meet the requirements in [Table 16](#), below.

Table 16—Primer/Finish Coat Requirements

Properties	Requirements
Color	Black
Odor	Ensure coal tar materials have no pyridine, pyridine base, or tar acid odor.
Consistency	Easily applied by brush or spray to a coverage of 60 ft ² /gal (1.5 m ² /L), without sagging, yielding film thicknesses of about 26 mils (0.66 mm) wet and 13 mils (0.33 mm) dry.
Drying time	Apply at a rate of 60 ft ² /gal (1.5 m ² /L). Ensure that the material dries to a firm film within 24 hours at 70 ° - 80 °F (21 °- 27 °C) and can receive a second coat.
Chemical resistance	Ensure that the material remains intact and in good condition when immersed for 30 days in each of the following inorganic acids, alkalies, and salts: <ul style="list-style-type: none"> • 5% sulfuric acid • 5% hydrochloric acid • 2% phosphoric acid • 5% sodium hydroxide • 25% sodium chloride • 25% calcium chloride

- 1) Durability: Before initially accepting a product to be supplied under this Specification, the complete system—from primer, when required, to finish coat(s)—shall be subjected to accelerated weathering and atmospheric exposure tests according to ASTM D 822 and ASTM G 23, Type D.
 - 2) Ensure that the system remains intact without cracking, and prevents significant steel corrosion for at least 1,500 hours exposure in the accelerated weathering test, and 5 years atmospheric exposure in a coastal environment.
 - 3) The State Materials and Research Engineer may approve systems that perform satisfactorily for up to 3,000 hours of accelerated weathering pending completion of the 5-year atmospheric exposure tests.
 - 4) After the Department initially accepts the material, you do not need to test each lot of material. However, the Department will conduct other durability tests at its discretion.
- b. No. 2P, Special Provisions Coating: Use special protective coatings instead of any other coating required by the Specifications for steel-H piling, steel sway bracing, metal shells for cast-in-place concrete piling, or prestressed concrete piling in all intermediate bents of the cap and pile trestle-type.
- 1) Get approval from the Laboratory for the protective coating material.
 - 2) Use a two-component, chemically cured, coal-tar epoxy that meets the requirements of either Type I, Class 2, Military Specification MIL-P-23236 (Ships) or U.S. Corps of Engineers Specification C-200.
 - 3) Ensure that the coating exhibits optimum chemical and physical resistance to alkalies and mineral acids under continuous immersion service.
 - 4) Ensure that the cured coating withstands considerable physical abuse such as direct impact, abrasion, and flexing.
 - 5) Furnish a written certification to the Engineer that the material meets the requirements of these Specifications.
2. Galvanizing Repair Compound
- Use a compound that meets the general requirements of [Subsection 870.2](#) and [Table 17](#).

Table 17—Galvanizing Repair Compound Requirements

	Maximum	Minimum
Paint Composition, percent by weight		
Pigment	77	73
Vehicle	27	23
Pigment Composition, percent by weight		
Zinc dust, Federal Specification TT-P-460	99	95
Dust (Metallic Zinc Powder), Type 1 Lead Suboxide Stabilizer	0.15	—
Suspending Agent	1.85	—
Vehicle Composition, percent by weight		
Non-Volatile Vehicle	—	18
Volatile Vehicle	82	—

- a. Non-volatile Vehicle: Use chlorinated rubber and a suitable plasticizer for the non-volatile portion of the vehicle. Ensure that the chlorine content, based on the non-volatile vehicle, is at least 60 percent by weight.
- b. Volatile Vehicle: Use a volatile vehicle that is completely compatible with the other ingredients of the finished product. Ensure that the vehicle meets all the physical and chemical requirements of the end product.
- c. Finished Compound: Ensure that the finished compound meets the requirements of [Table 18](#).

Table 18—Finished Compound Requirements

Characteristic	Requirement
Condition in the container	No pigment component of the ready-mixed compound settles. When the package remains unopened for one year, you can readily disperse the pigment by hand mixing. The vehicle does not liver, curdle, or show excessive bodying.
Application	The material to repair galvanizing and to galvanize welds in the field shall be such that when applied, there is no unusual difficulty in horizontal, vertical, or overhead positions.
Adhesion	Expose test panels coated according to field application specifications to weather for at least 3 months in a position 45 degrees vertical, facing south. After this time, ensure that the test panels show no visible signs of peeling or flaking.
Gassing	No build up of gas or excessive pressure in the container when stored at room temperature for 3 months.
Dry film thickness	The compound leaves a dry film between 2 - 2-1/2 mils (0.051 - 0.064 mm) thick, when applied according to field application specifications.
Drying time	The compound is set to touch in 30 minutes and is dry to recoat in 4 hours. The material is thoroughly hard within 48 hours after application.
Hardness	Dry and cure the test panels coated under these Specifications for at least 48 hours. Brush a section by hand with a wire brush. Continue brushing until you see bright metal. Measure the dry film thickness. Accept the material if the brushing does not reduce the film below the specified thickness.

Characteristic	Requirement
Consistency	Viscosity at 77 °F (25 °C) is 123 ± 7 Krebs units, as measured by the Stormer Viscometer.
Weight per lb (liter)	22 ± 10% lbs (2.64 ± 10% kg) at 77 °F (25 °C).
Packaging	Commercial paint packaging is acceptable for containers smaller than 1 gal (3.8 L). For 1 gal (3.8 L) packages, use No. 26 gauge steel pails. Do not pack more than 1 gal (3.8 L) of compound in a single container.
Storage	Store the compound where the temperature stays above 45 °F (7 °C).

2. Aluminum Caulking Compound

Use a compound that meets the requirements of [Subsection 870.2](#), third bullet, and [Table 19](#).

Table 19—Aluminum Caulking Compound Requirements

Properties	Max.	Min.
Compound composition, percent by weight		
Pigment	—	72
Vehicle	28	—
Pigment composition, percent by weight		
Calcium carbonate, ASTM D 1199, Type GC	—	72
Mineral filler	17	—
Aluminum paste, Federal Specification TT-P-320c, Type II, Class III	—	10
Titanium Dioxide ASTM D 476, Type II, Class II	—	1
Vehicle composition, percent by weight		
Non-volatile	—	78.5
Refined vegetable oil	—	54
Polybutene oil	—	24.5
Fatty acid	—	3.5
Thinner and drier	18	—
Color: aluminum		

a. Other Properties

Properties	Requirement
Consistency	Can be applied by hand caulking gun, knife, or trowel.
Adhesion	Good adhesion to any dry, dust-free, or oil-free surface.
Curing	A light film forms in 48 to 72 hours. A tough metallic film develops in 2 to 3 weeks.
Exposure	Good resistance to water and weather.

B. Fabrication

See [Subsection 870.2.B.](#)

C. Acceptance

See [Subsection 870.2.C.](#)

D. Materials Warranty

See [Subsection 870.2.D.](#)

870.2.06 Miscellaneous Paint Materials

A. Requirements

Use other paint materials that meet the following requirements:

1. Raw Linseed Oil: Use oil that meets the requirements of ASTM D 234.
2. Boiled Linseed Oil: Use oil that meets the requirements of ASTM D260.
3. Turpentine: Use turpentine that meets the requirements of ASTM D 13.
4. Mineral Spirits: Use petroleum spirits (mineral spirits) that meets the requirements of ASTM D 235.
5. Spar Varnish: Use Varnish, Spar Phenolic Resin, as per Federal Specification TT-V-119.
6. Tinting Pigment Paste: Use lampblack, venetian blue, or iron blue as tinting pigments.

The Engineer may approve other tinting pigments, subject to limitations.

Add all tinting pigments in paste form.

7. Putty: Use putty that meets the requirements of Federal Specifications TT-P-791a, Type II.

B. Fabrication

See [Subsection 870.2.B.](#)

C. Acceptance

See [Subsection 870.2.C.](#)

D. Materials Warranty

See [Subsection 870.2.D.](#)

870.2 Submittals

Para #	Description	Date required	Date received
870.2.02	Traffic Lane Paints	21 days prior	_____

Section 919—Raised Pavement Markers

919.1 General Description

This section includes the requirements for raised pavement marker materials for use in reflective, ceramic, and channel markers.

919.1.01 Related References

A. Standard Specifications

General Provisions 101 through 150.

B. Referenced Documents

ASTM C 424

ASTM C 373

ASTM D 2240

ASTM D 4280

Federal Method TT-T-141, Method 4252

919.2 Materials

A. Requirements

Do not use any marker materials until the laboratory approves it.

1. Use raised pavement marker sources as listed in [QPL 76](#).
2. Use raised pavement markers of the type shown in the Plans or specified in the proposal. This Specification references markers as follows:

Type	Description
1	One-way, one-color, 4 x 2 in (100 mm x 50 mm), reflective
2	Two-way, one-color, 4 x 2 in (100 mm x 50 mm), reflective
3	Two-way, two color, 4 x 2 in (100 mm x 50 mm), reflective
4	Round white, yellow or black ceramic, non reflective
5	Oval white, yellow or black ceramic, non-reflective
6	Oval white or yellow ceramic, reflective
7	White or yellow ceramic jiggle bar, non-reflective
8	White or yellow ceramic jiggle bar, reflective
9	White or yellow channel, non-reflective
10	White or yellow channel, reflective
11	Two-way, one-color, 4 x 4 in (100 mm x 100 mm), reflective
12	One-way, one color, 4 x 4 in (100 mm x 100 mm), reflective
13	Two-way, two color, 4 x 4 in (100 mm x 100 mm), reflective

Section 919—Raised Pavement Markers

14	Two-way, one color, flexible reflective
15	One-way, one color, flexible reflective

3. Definitions

- a. Angle of Incidence: Formed by a ray from the light source to the marker, and the normal to the leading edge of the marker face.
- b. Angle of Divergence: Formed by a ray from the light source to the marker and the return ray from the marker to the measuring receptor.
- c. Specific Intensity: The mean candela of the reflected light at a given incidence and divergence angle for each lux at the reflector on a plane perpendicular to the incident light.

4. Sampling

The Department will select at random the required number of markers for initial tests for each shipment or lot, as follows:

Reflective Markers	Ceramic Markers	Channel Markers
50	25	5

5. Certification

Submit a certification to the Engineer from the manufacturer showing the physical properties of the markers and their conformance to this Specification.

6. Packaging

Pack shipments in containers that are acceptable to common carriers.

- a. Pack the containers to ensure delivery in perfect condition.
- b. Clearly mark each package of pavement markers with the size, color, type, and lot number.
- c. You are liable to replace any damaged shipments.

7. Acceptance

The Department will give conditional approval to raised pavement markers evaluated by the National Transportation Product Evaluation Program (NTPEP), the Georgia Department of Transportation, or other Department-approved test facilities and place them on [QPL 76](#).

All white raised pavement markers must meet the requirements of this Specification and the following field performance requirements.

- a. Conditional [QPL](#) Placement: The Department may add markers on a conditional basis to [QPL 76](#). These markers must maintain an average Coefficient of Retroreflected Luminous Intensity of 1.5 candles per footcandle (cd/fc)* after a one-year field evaluation period through at least one of the test facilities specified above.
- b. Final Acceptance or Rejection: The Department will accept or reject markers based on the marker maintaining an average Coefficient of Retroreflected Luminous Intensity of 0.5 candles per footcandle (cd/fc)* after a two-year field evaluation period through at least one of the test facilities specified above.

Section 919—Raised Pavement Markers

NOTE: Measure the coefficient of retroreflected luminous intensity at the 0 degree incident angle and 0.2 degree divergence angle.

919.2.01 Reflective Pavement Markers

A. Requirements

Plastic reflective pavement markers are types 1, 2, 3, 11, 12, and 13 (rigid plastic reflective) and types 14 and 15 (flexible reflective).

1. Rigid Plastic Reflective Markers

- a. Use prismatic markers made with a methyl methacrylate or acrylonitrile butadiene styrene, a high-impact plastic shell filled with a mixture of inert thermosetting compound and filler material.
 - 1) Ensure that the exterior shell surface is smooth and contains one or two prismatic faces, molded to reflect incident light from a single direction or from opposite directions.
 - 2) Ensure that the shell is one color or a combination of two colors that will be the same as reflective elements and shall match the size and shape in the Plans.
- b. Use two basic sizes—a standard (a base of 4 x 4 in [100 mm x 100 mm]) or a low-profile (a base of 4 x 2 in [100 mm x 50 mm]).
 - 1) Ensure that reflective raised pavement markers have one or two lens surfaces that meet the requirements of ASTM D 4280, designation H—a marker with a hard, abrasion-resistant lens surface.
 - 2) Ensure the marker base is clean and has no gloss or substance that may reduce the adhesive's bond. The Department will reject the marker if it has a soft or resin-rich film on the base.

2. Flexible Reflective Markers (Type 14 and 15)

Use markers manufactured by extruding plastic into an “L” shape, with nominal dimensions of 4 in (100 mm) long x 2 in (50 mm) high (vertical face) x 1 in (25 mm) wide (base leg). Ensure that the markers have the following:

- A pressure-sensitive adhesive with a paper release liner to the bottom of the base leg.
- Strips of metallized acrylic reflective sheeting on either one or both sides of the vertical face.
- A clear plastic cover to protect the reflective strip. Ensure that the cover withstands a chip-seal operation and is easily removed after the operation.

3. Color

Use clear, yellow, or red raised reflective pavement markers, as required.

If the reflection is off-color, the Department will reject the markers.

4. Specific Intensity

Ensure that the specific intensity of each reflective surface, when tested at 0.2 degree angle of divergence, has at least these values:

Incidence Angle	Clear	Yellow	Red
0°	3.0	1.50	0.75

Section 919—Raised Pavement Markers

20°	1.2	0.60	0.30
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Calculate the intensity as follows:

$$SI = (R_L \times D^2) \div I_L$$

Where:

R_L = Reflected Light

I_L = Incident Light

D = Test Distance

D = Test Distance

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

The Department will accept markers based on the results of the physical tests and on the manufacturer’s certification showing the physical properties of the markers and their conformance to this Specification.

The Department will conduct the following tests:

- Specific Intensity
- Compressive Strength
- Impact
- Temperature Cycle
- Shore A Hardness (Type 14 and 15 only)

1. Specific Intensity

- a. Place markers so the center of the reflecting face is 5 ft (1.5 m) from a uniformly bright light source. Use a source with an effective diameter of 0.21 in (5 mm).
If using a test distance other than 5 ft (1.5 m), modify the source and receptor in the same proportion as the test distance.
- b. Use a photocell receptor 0.5 in (13 mm) wide. Shield it to eliminate stray light.
- c. Place the center of the light source aperture 0.2 in (5 mm) from the center of the photocell.
- d. Use the following table to determine if the markers pass the tests (except the strength test), unless otherwise specified.

Markers that Pass	Department Action
48 of 50	Accept the lot.
44 or less of 50	Reject whole lot; no retest allowed.
45-47 of 50	Contractor can request a retest on 100 markers. The Department will pass each marker through all tests except the strength test.
96 of 100 retested	Accept the whole shipment
95 or less of 100 retested	Reject the whole shipment

Section 919—Raised Pavement Markers

2. Compressive Strength

Test for compressive strength as follows:

Standard Raised Markers 4 x 4 in (100 x 100 mm)	Low-Profile Markers 4 x 2 in (100 x 50 mm)
1. Select three random markers for the test.	
2. Center the base of the marker over the open end of a hollow, vertically positioned metal cylinder (1 in (25 mm) high, internal diameter of 3 in (75 mm), wall thickness of 0.25 in (6 mm)).	2. Position the marker on its base at the center of a flat, steel plate that has a minimum thickness of 0.5 in (13 mm).
3. Apply a load to the top center of the marker with a 1 in (25 mm) diameter solid steel plug at a rate of	
0.2 in (5 mm) per minute.	0.03 in (0.75 mm) per minute.
4. The marker fails if it breaks or deforms at a load less than	
2,000 lbs (8.9 kN)	4,000 lbs (17.8 kN)
Or if the shell and the filler material significantly delaminate, regardless of the load required to break the marker.	
5. If any of the 3 samples fail, the Department will test 6 additional samples.	
6. If any of the 6 additional samples fail, the Department will reject the entire lot.	

3. Impact Test

- a. Condition all prismatic reflective faces that meet the requirements of ASTM D 4280, designation H, before the impact test.
- b. Choose at random 20 markers for each test.
- c. Condition the markers in an oven at 130 °F (54° C) for one hour.
- d. While at this temperature, drop a 0.42 lb (0.2 kg) dart fitted with a 0.25 in (6 mm) radius spherical head from 18 in (450 mm) above the reflective face.
- e. Drop the dart perpendicularly onto the center of the reflective surface. The cracks in the impact area shall appear generally concentric.
- f. The Department will reject the marker if more than two radial cracks longer than 0.25 in (6 mm) appear, or if radial cracks extend to the edge of the reflective face.
- g. Use the following table to determine if the markers pass the tests.

Markers that Pass	Department Action
18 of 20	Accept the lot.
16 of 20	Reject the lot.
17 of 20	The Contractor may request a retest. The Department will test 20 additional lenses.
19 or less of 20 retested	Reject the lot.

Section 919—Raised Pavement Markers

4. Temperature Cycle
 - a. Subject the same markers used for impact testing to 3 cycles of 140 °F (60 °C) for 4 hours followed by 20 °F (–7 °C) for 4 hours.
 - b. The Department will reject the markers if they crack or delaminate after this test.
 - c. Use the following table to determine if the markers pass the tests.

Markers That Pass	Department Action
18 of 20	Accept the lot.
16 of 20	Reject the lot.
17 of 20	The Contractor may request a retest. The Department will test 20 additional lenses.
19 or less of 20 retested	Reject the lot.

5. Hardness (Type 14 or 15 only)
 - a. Select five random markers.
 - b. Use ASTM D 2240 to determine the Shore A hardness.
 - c. Measure the hardness. The Department will reject markers whose body and clear protective cover hardness is less than 80.

D. Materials Warranty

General Provisions 101 through 150.

919.2.02 Ceramic Pavement Markers

A. Requirements

Ceramic pavement markers are types 4, 5, 6, 7, and 8.

1. Use ceramic pavement markers made from a heat-fired, white, vitreous, ceramic base and a heat fired, opaque, glazed surface to produce the properties required in these Specifications.
 - a. Do not place glaze on the marker bottom where it connects to the road surface.
 - b. Thoroughly and evenly mature the markers. Ensure that they have no defects that affect appearance and serviceability.
 - c. Use reflective ceramic markers that meet the specific intensity of each reflective surface according to [Subsection 919.2.01.A.4.](#)
 - d. Ensure that the mean thickness of the glazed surface is at least 0.005 in (0.13 mm) when measured at least 0.25 in (6 mm) from the edge of the marker.
 - e. Ensure that the water absorption of the ceramic markers does not exceed 2 percent of the original dry weight when tested according to ASTM C 373.
 - f. Ensure that the glazed surface does not craze, spoil, or peel when passed through one cycle of the Autoclave test at 250 psi (1724 kPa) (ASTM C 424).

Section 919—Raised Pavement Markers

2. Use the designated colors for the white and yellow markers.
 - a. Ensure that the colors are uniform.
 - b. Ensure that black matches Federal Color No. 595-27038.
 - c. Determine the color by visually comparing each marker with calibrated standards having CIE Chromaticity Coordinate limits. Determine the limits with Federal methods of test TT-T-141, Method 4252, using a rectangle with the following corner points:

	1		2		3		4		(90MGO)
White	.290	.316	.310	.296	.330	.320	.310	.344	80 min.
Yellow	.435	.485	.445	.435	.544	.456	.516	.484	50 min.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

1. Use a random sample of five markers for each of the required tests in [Subsection 919.2.01.C.3](#) to [Subsection 919.2.01.C.4](#), and [Subsection 919.2.01.C.5](#). Use the Compressive Strength Test in [Subsection 919.2.02.C.3](#).
2. Use the following table to determine if the markers pass the tests.

Markers that Pass	Department Action
5 of 5	Accept the lot.
3 or less of 5	Reject the lot; no resample allowed.
4 of 5	The Contractor may request a retest. The Department will retest an additional 25 random markers in the test or tests where the original sample failed.
20 of 25 retested	Accept the lot.
19 or less of 25 retested	Reject the lot; no resample allowed.

3. Compressive Strength Test
 - a. Center the markers with the base down over the open end of a vertically positioned hollow metal cylinder. Use a cylinder 1 in (25 mm) high with an internal diameter of 3 in (75 mm) and a wall thickness of 0.25 in (6 mm).
 - b. Apply a load at 0.2 in (5 mm) per minute to the top of the markers through a 1 in (25 mm) diameter solid metal cylinder centered on the top of the markers.
 - c. Apply the load until the marker breaks.
 - d. The markers pass if the average compressive load of all five markers is at least 1,500 psi (6.7 kN). No individual marker shall be less than 1,200 psi (5.3 kN).

D. Materials Warranty

General Provisions 101 through 150.

Section 919—Raised Pavement Markers

919.2.03 Channel Pavement Markers

A. Requirements

Channel pavement markers are type 9 and 10 markers only.

1. Use channel pavement markers made of either a heat-fired, white, vitreous, ceramic base with a heat-fired, opaque, glazed surface, or a 9 gauge (3.9 mm) steel body with a heat-fired porcelain finish.
 - a. Ensure both ceramic and steel channel markers have no defects that affect appearance and serviceability.
 - b. Ensure that the mean thickness of the glazed surface of ceramic channel markers is at least 0.005 in (0.13 mm) when measured at least 0.25 in (6 mm) from the edge of the marker.
 - c. Ensure that mean thickness of the porcelain finish on the steel channel markers is at least 0.030 in (0.76 mm).
 - d. Ensure that the water absorption of the ceramic markers does not exceed 2.0 percent of the original dry weight when tested according to ASTM C 373.
 - e. Ensure that the surface of the markers do not craze, spoil, or peel when passed through one cycle of the Autoclave test at 250 psi (1724 kPa) (ASTM C 424).
2. Use the designated colors for the white and yellow markers.
 - a. Ensure that the colors are uniform.
 - b. Determine the color by visually comparing them with calibrated standards having CIE Chromaticity Coordinate limits. Determine the limits with Federal methods of test TT-T-141, Method 4252, using a rectangle with the following corner points:

	1		2		3		4		(90MGO)
White	.290	.316	.310	.296	.330	.320	.310	.344	80 min.
Yellow	.435	.485	.445	.435	.544	.456	.516	.484	50 min.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

1. Ensure that Type 10 markers meet the specific intensity of each reflective surface according to [Subsection 919.2.01.A.4](#)
2. Use a random sample of five markers for each of the required tests in [Subsection 919.2.01.C.2](#), [Subsection 919.2.01.C.3](#), [Subsection 919.2.01.C.4](#), and [Subsection 919.2.01.C.5](#).
3. Select two of the five markers and subject them to all the required tests.
4. Use the following table to determine if the markers pass the tests.

Markers that Pass	Department Action
2 of 2	Accept the lot.
0 of 2	Reject the lot; no resample allowed.

Section 919—Raised Pavement Markers

1 of 2	Retest the three remaining markers.
3 of 3 retested	Accept the lot.
2 or less of 3 retested	Reject the lot; no resample allowed

D. Materials Warranty

General Provisions 101 through 150.