U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: Standards for Specifying Construction of Airports	**Date:** 9/30/2008 **Initiated by:** AAS-100	**AC No.:** 150/5370-10D **Change:**

1. PURPOSE. This advisory circular (AC) provides standards for the construction of airports. Items covered in this AC include general provisions, earthwork, flexible base courses, rigid base courses, flexible surface courses, rigid pavement, miscellaneous, fencing, drainage, turfing, and lighting installation.

2. APPLICATION. The Federal Aviation Administration (FAA) recommends the guidelines and standards in this AC for materials and methods used in the construction of airports. This AC does not constitute a regulation and in general is not mandatory. However, use of these guidelines is mandatory for airport construction funded under the Airport Improvement Program (AIP) or Passenger Facility Charge (PFC) Program. Mandatory terms such as "must" used herein apply only to those who undertake construction projects using AIP or PFC funds.

3. CANCELLATION. This AC cancels AC 150/5370-10C, *Standards for Specifying Construction of Airports*, dated September 29, 2007.

4. BACKGROUND. This revised AC incorporates a new specification, P-632, and the errata sheet information for Items P-304, P-401, and P-501.

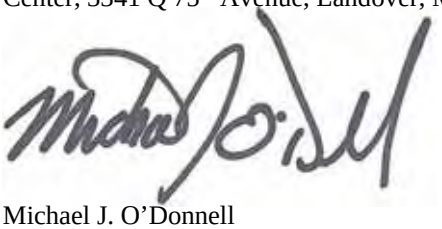
5. PRINCIPAL CHANGES. This AC adds item P-632, Bituminous Pavement Rejuvenation.

6. METRICS. To promote an orderly transition to metric units, this AC contains both English and metric dimensions. The metric conversions may not be exact metric equivalents, and until there is an official changeover to the metric system, the English dimensions will govern.

7. COMMENTS OR SUGGESTIONS. Send comments or suggestions for improving this AC to—

Manager, Airport Engineering Division
Federal Aviation Administration
ATTN: AAS-100
800 Independence Avenue SW
Washington DC 20591

8. COPIES OF THIS AC. The Office of Airport Safety and Standards is in the process of making ACs available to the public online. These ACs can be found on the Federal Aviation Administration (FAA) website at http://www.faa.gov/airports_airtraffic/airports/ resources/advisory_circulars/. A printed copy of this and other ACs can be ordered from the U.S. Department of Transportation, Subsequent Business Office, Annmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785.



Michael J. O'Donnell
Director of Airport Safety and Standards

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NOTICE TO USERS

Projects funded under the Airport Improvement Program (AIP) must be developed in accordance with the policies, standards, and specifications approved by the Secretary, Department of Transportation. The standards contained in this advisory circular (AC) relate to materials and methods used in the construction of airports.

To the Airport Owner—This AC is required as part of your grant agreement. The plans and specifications that will result from this AC will be part of the construction agreement.

To the Consultant—This AC is required for the project as part of the grant assurances. The plans and specifications that will result from this AC are part of the project and are also required for the grant assurances.

Since it is not feasible to provide construction specifications that can be applied to all geographical areas of the United States, its territories and possessions, the guide specifications in this AC should be used in developing project specifications. The verbatim incorporation of these standards in contract specifications is not practical because of the numerous decisions that must be made by the Engineer regarding local materials, methods, and requirements. For this reason, the notes (shown between lines of asterisks) elaborate on the options available to the Engineer when preparing a specification and to ensure that sound engineering judgment is applied.

Appropriate changes and additions required by the notes must be made. Where numbers, words, phrases or sentences are enclosed in brackets [ ], a choice or modification must be made. Where blank spaces [ ] occur in sentences, the appropriate data must be inserted. Where entire paragraphs are not applicable, they should be deleted. Additional sentences may be added if necessary. The final project specifications shall not include notes to the Engineer.

The standards should be used to develop construction specifications for either (1) a particular state, or (2) an individual project. They will not be made a part of a contract merely by reference. Pertinent portions should be copied verbatim into the contract documents.

For state specifications, the necessary choices and engineering judgments should be made to develop the standards into specifications for a particular state. On approval by the FAA, these state specifications may be incorporated in construction contracts by reference. The state specifications must be readily available to all parties interested in such contracts.

For individual projects, construction specifications may be produced by making the necessary choices and engineering judgments and developing the standards into specifications for a particular project.

FAA Airports field representatives, designated by regional offices, have the authority to approve modifications to standards contained in this AC if the modifications provide acceptable levels of safety, economy, durability, and workmanship and are necessary to meet local conditions. When preparing construction contracts for AIP projects, the user should contact these FAA representatives to obtain the mandatory provisions (wage, labor, EEO, etc.) that must be included in all AIP contract proposals. Additional contract clauses may be required to comply with local and state laws relating to advertising, awarding, and administrating construction contracts.

The Office of Airport Safety and Standards is in the process of making ACs available to the public through the Internet. These ACs may be found on the Federal Aviation Administration (FAA) website at **http://www.faa.gov/airports_airtraffic/airports/ resources/advisory_circulars/.** A printed copy of this and other ACs can be ordered from the U.S. Department of Transportation, Subsequent Business Office, Annmore East Business Center, 3341 Q 75th Avenue, Landover, Maryland, 20785.

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PART I – GENERAL PROVISIONS
SECTION 10
DEFINITION OF TERMS

Whenever the following terms are used in these specifications, in the contract, or in any documents or other instruments pertaining to construction where these specifications govern, the intent and meaning shall be interpreted as follows:

10-01 AASHTO. The American Association of State Highway and Transportation Officials, the successor association to AASHO.

10-02 ACCESS ROAD. The right-of-way, the roadway and all improvements constructed thereon connecting the airport to a public highway.

10-03 ADVERTISEMENT. A public announcement, as required by local law, inviting bids for work to be performed and materials to be furnished.

10-04 AIP. The Airport Improvement Program, a grant-in-aid program, administered by the Federal Aviation Administration.

10-05 AIR OPERATIONS AREA. For the purpose of these specifications, the term air operations area shall mean any area of the airport used or intended to be used for the landing, takeoff, or surface maneuvering of aircraft. An air operation area shall include such paved or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runway, taxiway, or apron.

10-06 AIRPORT. Airport means an area of land or water which is used or intended to be used for the landing and takeoff of aircraft; an appurtenant area used or intended to be used for airport buildings or other airport facilities or rights of way; and airport buildings and facilities located in any of these areas, and includes a heliport.

10-07 ASTM. The American Society for Testing and Materials.

10-08 AWARD. The acceptance, by the Owner, of the successful bidder's proposal.

10-09 BIDDER. Any individual, partnership, firm, or corporation, acting directly or through a duly authorized representative, who submits a proposal for the work contemplated.

10-10 BUILDING AREA. An area on the airport to be used, considered, or intended to be used for airport buildings or other airport facilities or rights-of-way together with all airport buildings and facilities located thereon.

10-11 CALENDAR DAY. Every day shown on the calendar.

10-12 CHANGE ORDER. A written order to the Contractor covering changes in the plans, specifications, or proposal quantities and establishing the basis of payment and contract time adjustment, if any, for the work affected by such changes. The work, covered by a change order, shall be within the scope of the contract.

10-13 CONTRACT. The written agreement covering the work to be performed. The awarded contract shall include, but is not limited to: The Advertisement; The Contract Form; The Proposal; The Performance Bond; The Payment Bond; any required insurance certificates; The Specifications; The Plans, and any addenda issued to bidders.

10-14 CONTRACT ITEM (PAY ITEM). A specific unit of work for which a price is provided in the contract.

10-15 CONTRACT TIME. The number of calendar days or working days, stated in the proposal, allowed for completion of the contract, including authorized time extensions. If a calendar date of completion is stated in the proposal, in lieu of a number of calendar or working days, the contract shall be completed by that date.

10-16 CONTRACTOR. The individual, partnership, firm, or corporation primarily liable for the acceptable performance of the work contracted and for the payment of all legal debts pertaining to the work who acts directly or through lawful agents or employees to complete the contract work.

10-17 DRAINAGE SYSTEM. The system of pipes, ditches, and structures by which surface or subsurface waters are collected and conducted from the airport area.

10-18 ENGINEER. The individual, partnership, firm, or corporation duly authorized by the Owner to be responsible for engineering inspection of the contract work and acting directly or through an authorized representative.

10-19 EQUIPMENT. All machinery, together with the necessary supplies for upkeep and maintenance, and also all tools and apparatus necessary for the proper construction and acceptable completion of the work.

10-20 EXTRA WORK. An item of work not provided for in the awarded contract as previously modified by change order or supplemental agreement, but which is found by the Engineer to be necessary to complete the work within the intended scope of the contract as previously modified.

10-21 FAA. The Federal Aviation Administration of the U.S. Department of Transportation. When used to designate a person, FAA shall mean the Administrator or his/her duly authorized representative.

10-22 FEDERAL SPECIFICATIONS. The Federal Specifications and Standards, Commercial Item Descriptions, and supplements, amendments, and indices thereto are prepared and issued by the General Services Administration of the Federal Government.

10-23 FORCE ACCOUNT. Force account construction work is construction that is accomplished through the use of material, equipment, labor, and supervision provided by the Owner or by another public agency pursuant to an agreement with the Owner.

10-24 INSPECTOR. An authorized representative of the Engineer assigned to make all necessary inspections and/or tests of the work performed or being performed, or of the materials furnished or being furnished by the Contractor.

10-25 INTENTION OF TERMS. Whenever, in these specifications or on the plans, the words ``directed," ``required," ``permitted," ``ordered," ``designated," ``prescribed," or words of like import are used, it shall be understood that the direction, requirement, permission, order, designation, or prescription of the Engineer is intended; and similarly, the words ``approved," ``acceptable," ``satisfactory," or words of like import, shall mean approved by, or acceptable to, or satisfactory to the Engineer, subject in each case to the final determination of the Owner.

Any reference to a specific requirement of a numbered paragraph of the contract specifications or a cited standard shall be interpreted to include all general requirements of the entire section, specification item, or cited standard that may be pertinent to such specific reference.

10-26 LABORATORY. The official testing laboratories of the Owner or such other laboratories as may be designated by the Engineer.

10-27 LIGHTING. A system of fixtures providing or controlling the light sources used on or near the airport or within the airport buildings. The field lighting includes all luminous signals, markers, floodlights, and illuminating devices used on or near the airport or to aid in the operation of aircraft landing at, taking off from, or taxiing on the airport surface.

10-28 MAJOR AND MINOR CONTRACT ITEMS. A major contract item shall be any item that is listed in the proposal, the total cost of which is equal to or greater than 20 percent of the total amount of the award contract. All other items shall be considered minor contract items.

10-29 MATERIALS. Any substance specified for use in the construction of the contract work.

10-30 NOTICE TO PROCEED. A written notice to the Contractor to begin the actual contract work on a previously agreed to date. If applicable, the Notice to Proceed shall state the date on which the contract time begins.

10-31 OWNER. The term "Owner" shall mean the party of the first part or the contracting agency signatory to the contract. For AIP contracts, the term "sponsor" shall have the same meaning as the term "Owner." Where the term "Owner" is capitalized in this document, it shall mean airport owner or sponsor only.

10-32 PAVEMENT. The combined surface course, base course, and subbase course, if any, considered as a single unit.

10-33 PAYMENT BOND. The approved form of security furnished by the Contractor and his/her surety as a guaranty that he will pay in full all bills and accounts for materials and labor used in the construction of the work.

10-34 PERFORMANCE BOND. The approved form of security furnished by the Contractor and his/her surety as a guaranty that the Contractor will complete the work in accordance with the terms of the contract.

10-35 PLANS. The official drawings or exact reproductions which show the location, character, dimensions and details of the airport and the work to be done and which are to be considered as a part of the contract, supplementary to the specifications.

10-36 PROJECT. The agreed scope of work for accomplishing specific airport development with respect to a particular airport.

10-37 PROPOSAL. The written offer of the bidder (when submitted on the approved proposal form) to perform the contemplated work and furnish the necessary materials in accordance with the provisions of the plans and specifications.

10-38 PROPOSAL GUARANTY. The security furnished with a proposal to guarantee that the bidder will enter into a contract if his/her proposal is accepted by the Owner.

10-39 RUNWAY. The area on the airport prepared for the landing and takeoff of aircraft.

10-40 SPECIFICATIONS. A part of the contract containing the written directions and requirements for completing the contract work. Standards for specifying materials or testing which are cited in the contract specifications by reference shall have the same force and effect as if included in the contract physically.

10-41 SPONSOR. See definition above of "Owner."

10-42 STRUCTURES. Airport facilities such as bridges; culverts; catch basins, inlets, retaining walls, cribbing; storm and sanitary sewer lines; water lines; underdrains; electrical ducts, manholes, handholes, lighting fixtures and bases; transformers; flexible and rigid pavements; navigational aids; buildings; vaults; and, other manmade features of the airport that may be encountered in the work and not otherwise classified herein.

10-43 SUBGRADE. The soil that forms the pavement foundation.

10-44 SUPERINTENDENT. The Contractor's executive representative who is present on the work during progress, authorized to receive and fulfill instructions from the Engineer, and who shall supervise and direct the construction.

10-45 SUPPLEMENTAL AGREEMENT. A written agreement between the Contractor and the Owner covering (1) work that would increase or decrease the total amount of the awarded contract, or any major contract item, by more than 25 percent, such increased or decreased work being within the scope of the originally awarded contract; or (2) work that is not within the scope of the originally awarded contract.

10-46 SURETY. The corporation, partnership, or individual, other than the Contractor, executing payment or performance bonds that are furnished to the Owner by the Contractor.

10-47 TAXIWAY. For the purpose of this document, the term taxiway means the portion of the air operations area of an airport that has been designated by competent airport authority for movement of aircraft to and from the airport's runways or aircraft parking areas.

10-48 WORK. The furnishing of all labor, materials, tools, equipment, and incidentals necessary or convenient to the Contractor's performance of all duties and obligations imposed by the contract, plans, and specifications.

10-49 WORKING DAY. A working day shall be any day other than a legal holiday, Saturday, or Sunday on which the normal working forces of the Contractor may proceed with regular work for at least 6 hours toward completion of the contract when work is suspended for causes beyond the Contractor's control, Saturdays, Sundays and holidays on which the Contractor's forces engage in regular work, requiring the presence of an inspector, will be considered as working days.

END OF SECTION 10

SECTION 20
PROPOSAL REQUIREMENTS AND CONDITIONS

20-01 ADVERTISEMENT (Notice to Bidders).

* * * *

For AIP contracts, the proposal shall conform to the requirements of local laws and ordinances pertaining to letting of contracts.

* * * *

for which a quantity is given. The bidder shall state the price (written in ink or typed) both in words and numerals for which he proposes to do each pay item furnished in the proposal. In case of conflict between words and numerals, the words, unless obviously incorrect, shall govern.

The bidder shall sign his/her proposal correctly and in ink. If the proposal is made by an individual, his/her name and post office address must be shown. If made by a partnership, the name and post office address of each member of the partnership must be shown. If made by a corporation, the person signing the proposal shall give the name of the state under the laws of which the corporation was chartered and the name, titles, and business address of the president, secretary, and the treasurer. Anyone signing a proposal as an agent shall file evidence of his/her authority to do so and that the signature is binding upon the firm or corporation.

20-08 IRREGULAR PROPOSALS. Proposals shall be considered irregular for the following reasons:

* * * *

additional envelope. No proposal will be considered unless received at the place specified in the advertisement before the time specified for opening all bids. Proposals received after the bid opening time shall be returned to the bidder unopened.

20-11 WITHDRAWAL OR REVISION OF PROPOSALS. A bidder may withdraw or revise (by withdrawal of one proposal and submission of another) a proposal provided that the bidder's request for withdrawal is received by the Owner in writing or by telegram before the time specified for opening bids. Revised proposals must be received at the place specified in the advertisement before the time specified for opening all bids.

20-12 PUBLIC OPENING OF PROPOSALS. Proposals shall be opened, and read, publicly at the time and place specified in the advertisement. Bidders, their authorized agents, and other interested persons are invited to attend. Proposals that have been withdrawn (by written or telegraphic request) or received after the time specified for opening bids shall be returned to the bidder unopened.

20-13 DISQUALIFICATION OF BIDDERS. A bidder shall be considered disqualified for any of the following reasons:

a. Submitting more than one proposal from the same partnership, firm, or corporation under the same or different name.

b. Evidence of collusion among bidders. Bidders participating in such collusion shall be disqualified as bidders for any future work of the Owner until any such participating bidder has been reinstated by the Owner as a qualified bidder.

c. If the bidder is considered to be in ``default'' for any reason specified in the subsection titled ISSUANCE OF PROPOSAL FORMS of this section.

END OF SECTION 20

SECTION 30
AWARD AND EXECUTION OF CONTRACT

30-01 CONSIDERATION OF PROPOSALS. After the proposals are publicly opened and read, they will be compared on the basis of the summation of the products obtained by multiplying the estimated quantities shown in the proposal by the unit bid prices. If a bidder's proposal contains a discrepancy between unit bid prices written in words and unit bid prices written in numbers, the unit price written in words shall govern.

Until the award of a contract is made, the Owner reserves the right to reject a bidder's proposal for any of the following reasons:

a. If the proposal is irregular as specified in the subsection titled IRREGULAR PROPOSALS of Section 20.

b. If the bidder is disqualified for any of the reasons specified in the subsection titled DISQUALIFICATION OF BIDDERS of Section 20.

In addition, until the award of a contract is made, the Owner reserves the right to reject any or all proposals, waive technicalities, if such waiver is in the best interest of the Owner and is in conformance with applicable state and local laws or regulations pertaining to the letting of construction contracts; advertise for new proposals; or proceed with the work otherwise. All such actions shall promote the Owner's best interests.

30-02 AWARD OF CONTRACT. The award of a contract, if it is to be awarded, shall be made within [ ] calendar days of the date specified for publicly opening proposals, unless otherwise specified herein.

* * * *

30-05 REQUIREMENTS OF CONTRACT BONDS. At the time of the execution of the contract, the successful bidder shall furnish the Owner a surety bond or bonds that have been fully executed by the bidder and the surety guaranteeing the performance of the work and the payment of all legal debts that may be incurred by reason of the Contractor's performance of the work. The surety and the form of the bond or bonds shall be acceptable to the Owner. Unless otherwise specified in this subsection, the surety bond or bonds shall be in a sum equal to the full amount of the contract.

* * * *

SECTION 40
SCOPE OF WORK

40-01 INTENT OF CONTRACT. The intent of the contract is to provide for construction and completion, in every detail, of the work described. It is further intended that the Contractor shall furnish all labor, materials, equipment, tools, transportation, and supplies required to complete the work in accordance with the plans, specifications, and terms of the contract.

40-02 ALTERATION OF WORK AND QUANTITIES. The owner reserves and shall have the right to make such alterations in the work as may be necessary or desirable to complete the work originally intended in an acceptable manner. Unless otherwise specified herein, the Engineer shall be and is hereby authorized to make such alterations in the work as may increase or decrease the originally awarded contract quantities, provided that the aggregate of such alterations does not change the total contract cost or the total cost of any major contract item by more than 25 percent (total cost being based on the unit prices and estimated quantities in the awarded contract). Alterations that do not exceed the 25 percent limitation shall not invalidate the contract nor release the surety, and the Contractor agrees to accept payment for such alterations as if the altered work had been a part of the original contract. These alterations that are for work within the general scope of the contract shall be covered by ``Change Orders" issued by the Engineer. Change orders for altered work shall include extensions of contract time where, in the Engineer's opinion, such extensions are commensurate with the amount and difficulty of added work.

Should the aggregate amount of altered work exceed the 25 percent limitation hereinbefore specified, such excess altered work shall be covered by supplemental agreement. If the owner and the Contractor are unable to agree on a unit adjustment for any contract item that requires a supplemental agreement, the owner reserves the right to terminate the contract with respect to the item and make other arrangements for its completion.

* * * *

When determined by the Engineer to be in the Owner's best interest, he may order the Contractor to proceed with Extra Work by force account as provided in the subsection titled PAYMENT FOR EXTRA AND FORCE ACCOUNT WORK of Section 90.

Extra Work that is necessary for acceptable completion of the project, but is not within the general scope of the work covered by the original contract shall be covered by a Supplemental Agreement as hereinbefore defined in the subsection titled SUPPLEMENTAL AGREEMENT of Section 10.

Any claim for payment of Extra Work that is not covered by written agreement (change order or supplemental agreement) shall be rejected by the Owner.

40-05 MAINTENANCE OF TRAFFIC. It is the explicit intention of the contract that the safety of aircraft, as well as the Contractor's equipment and personnel, is the most important consideration. It is understood and agreed that the Contractor shall provide for the free and unobstructed movement of aircraft in the air operations areas of the airport with respect to his/her own operations and the operations of all his/her subcontractors as specified in the subsection titled LIMITATION OF OPERATIONS of Section 80. It is further understood and agreed that the Contractor shall provide for the uninterrupted operation of visual and electronic signals (including power supplies thereto) used in the guidance of aircraft while operating to, from, and upon the airport as specified in the subsection titled CONTRACTOR'S RESPONSIBILITY FOR UTILITY SERVICE AND FACILITIES OF OTHERS in Section 70.

With respect to his/her own operations and the operations of all his/her subcontractors, the Contractor shall provide marking, lighting, and other acceptable means of identifying: personnel; equipment; vehicles; storage areas; and any work area or condition that may be hazardous to the operation of aircraft, fire-rescue equipment, or maintenance vehicles at the airport.

When the contract requires the maintenance of vehicular traffic on an existing road, street, or highway during the Contractor's performance of work that is otherwise provided for in the contract, plans, and specifications, the Contractor shall keep such road, street, or highway open to all traffic and shall provide such maintenance as may be required to accommodate traffic. The Contractor shall furnish erect, and maintain barricades, warning signs, flagperson, and other traffic control devices in reasonable conformity with the manual of Uniform Traffic Control Devices for Streets and Highways (published by the United States Government Printing Office), unless otherwise specified herein. The Contractor shall also construct and maintain in a safe condition any temporary connections necessary for ingress to and egress from abutting property or intersecting roads, streets or highways. Unless otherwise specified herein, the Contractor will not be required to furnish snow removal for such existing road, street, or highway.

The Contractor shall make his/her own estimate of all labor, materials, equipment, and incidentals necessary for providing the maintenance of aircraft and vehicular traffic as specified in this subsection.

The cost of maintaining the aircraft and vehicular traffic specified in this subsection shall not be measured or paid for directly, but shall be included in the various contract items.

40-06 REMOVAL OF EXISTING STRUCTURES. All existing structures encountered within the established lines, grades, or grading sections shall be removed by the Contractor, unless such existing structures are otherwise specified to be relocated, adjusted up or down, salvaged, abandoned in place, reused in the work or to remain in place. The cost of removing such existing structures shall not be measured or paid for directly, but shall be included in the various contract items.

Should the Contractor encounter an existing structure (above or below ground) in the work for which the disposition is not indicated on the plans, the Engineer shall be notified prior to disturbing such structure. The disposition of existing structures so encountered shall be immediately determined by the Engineer in accordance with the provisions of the contract.

Except as provided in the subsection titled RIGHTS IN AND USE OF MATERIALS FOUND IN THE WORK of this section, it is intended that all existing materials or structures that may be encountered (within the lines, grades, or grading sections established for completion of the work) shall be utilized in the work as otherwise provided for in the contract and shall remain the property of the Owner when so utilized in the work.

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40-09 FINAL CLEANING UP. Upon completion of the work and before acceptance and final payment will be made, the Contractor shall remove from the site all machinery, equipment, surplus and discarded materials, rubbish, temporary structures, and stumps or portions of trees. He shall cut all brush and woods within the limits indicated and shall leave the site in a neat and presentable condition. Material cleared from the site and deposited on adjacent property will not be considered as having been disposed of satisfactorily, unless the Contractor has obtained the written permission of such property owner.

END OF SECTION 40

SECTION 50
CONTROL OF WORK

50-01 AUTHORITY OF THE ENGINEER. The Engineer shall decide any and all questions which may arise as to the quality and acceptability of materials furnished, work performed, and as to the manner of performance and rate of progress of the work. The Engineer shall decide all questions that may arise as to the interpretation of the specifications or plans relating to the work. The Engineer shall determine the amount and quality of the several kinds of work performed and materials furnished which are to be paid for the under contract.

The Engineer does not have the authority to accept pavements that do not conform to FAA specification requirements.

50-02 CONFORMITY WITH PLANS AND SPECIFICATIONS. All work and all materials furnished shall be in reasonably close conformity with the lines, grades, grading sections, cross sections, dimensions, material requirements, and testing requirements that are specified (including specified tolerances) in the contract, plans or specifications.

If the Engineer finds the materials furnished, work performed, or the finished product not within reasonably close conformity with the plans and specifications but that the portion of the work affected will, in his/her opinion, result in a finished product having a level of safety, economy, durability, and workmanship acceptable to the Owner, he will advise the Owner of his/her determination that the affected work be accepted and remain in place. In this event, the Engineer will document his/her determination and recommend to the Owner a basis of acceptance that will provide for an adjustment in the contract price for the affected portion of the work. The Engineer's determination and recommended contract price adjustments will be based on good engineering judgment and such tests or retests of the affected work as are, in his/her opinion, needed. Changes in the contract price shall be covered by contract modifications (change order or supplemental agreement) as applicable.

If the Engineer finds the materials furnished, work performed, or the finished product are not in reasonably close conformity with the plans and specifications and have resulted in an unacceptable finished product, the affected work or materials shall be removed and replaced or otherwise corrected by and at the expense of the Contractor in accordance with the Engineer's written orders.

For the purpose of this subsection, the term ``reasonably close conformity'' shall not be construed as waiving the Contractor's responsibility to complete the work in accordance with the contract, plans, and specifications. The term shall not be construed as waiving the Engineer's responsibility to insist on strict compliance with the requirements of the contract, plans, and specifications during the Contractor's prosecution of the work, when, in the Engineer's opinion, such compliance is essential to provide an acceptable finished portion of the work.

For the purpose of this subsection, the term ``reasonably close conformity'' is also intended to provide the Engineer with the authority, after consultation with the FAA, to use good engineering judgment in his/her determinations as to acceptance of work that is not in strict conformity but will provide a finished product equal to or better than that intended by the requirements of the contract, plans and specifications.

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The Engineer will not be responsible for the Contractor's means, methods, techniques, sequences, or procedures of construction or the safety precautions incident thereto.

50-03 COORDINATION OF CONTRACT, PLANS, AND SPECIFICATIONS. The contract, plans, specifications, and all referenced standards cited are essential parts of the contract requirements. 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 case of discrepancy, calculated dimensions will govern over scaled dimensions; contract technical specifications shall govern over contract general provisions, plans, cited standards for materials or testing, and cited FAA advisory circulars; contract general provisions shall govern over plans, cited standards for materials or testing, and cited FAA advisory circulars; plans shall govern over cited standards for materials or testing and cited FAA advisory circulars. If any paragraphs contained in the Special Provisions conflict with General Provisions or Technical Specifications, the Special Provisions shall govern.

The Contractor shall not take advantage of any apparent error or omission on the plans or specifications. In the event the Contractor discovers any apparent error or discrepancy, he shall immediately call upon the Engineer for his/her interpretation and decision, and such decision shall be final.

LIST SPECIAL PROVISIONS

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markings, an amount equal to the cost of replacing the same may be deducted from subsequent estimates due the Contractor at the discretion of the Engineer.

The Contractor will be required to furnish all lines, grades and measurements from the control points necessary for the proper prosecution and control of the work contracted for under these specifications.

The Contractor must give weekly copies of the survey notes to the Engineer so that the Engineer may check them as to accuracy and method of staking. All areas that are staked by the Contractor must be checked by the Engineer prior to beginning any work in the area. The Engineer will make periodic checks of the grades and alignment set by the Contractor. In case of error on the part of the Contractor, or his/her employees, resulting in establishing grades and/or alignment that are not in accordance with the plans or established by the Engineer, all construction not in accordance with the established grades and/or alignment shall be replaced without additional cost to the Owner.

No direct payment will be made, unless otherwise specified in contract documents, for this labor, materials, or other expenses therewith. The cost thereof shall be included in the price of the bid for the various items of the Contract.

Construction Staking and Layout includes but is not limited to:

Clearing and Grubbing perimeter staking.
Rough Grade slope stakes at 100-foot stations.
Drainage Swales slope stakes and flow line blue tops at 50-foot stations.
Subgrade blue tops at 25 foot stations and 25 foot offset distance (max.) for the following section locations:
- a. Runway – minimum 5 per station
- b. Taxiways – minimum 3 per station
- c. Holding apron areas – minimum 3 per station
- d. Roadways – minimum 3 per station

Base Course blue tops at 25 foot stations and 25 foot offset distance (max.) for the following section locations:
- a. Runway – minimum 5 per station
- b. Taxiways – minimum 3 per station
- c. Holding apron areas – minimum 3 per station

Pavement areas:
- a. Edge of Pavement hubs and tacks (for stringline by Contractor) at 100 foot stations
- b. Between Lifts at 25 foot stations for the following section locations:
  - (1). Runways – each paving lane width
  - (2). Taxiways – each paving lane width
  - (3). Holding areas – each paving lane width
- c. After finish paving operations at 50 foot stations
  - (1). All paved areas – Edge of each paving lane prior to next paving lot
- d. Shoulder and safety area blue tops at 50 foot stations and at all break points with maximum of 50 foot offsets

Fence lines at 100 foot stations
Electrical and Communications System locations, lines and grades including but not limited to duct runs, connections, fixtures, signs, lights, VASI's, PAPI's, REIL's, Wind Cones, Distance Markers (signs), pull boxes and manholes.
Drain lines, cut stakes and alignment on 25-foot stations, inlet and manholes.
Painting and Striping layout (pinned with 1.5 inch PK nails) marked for paint Contractor. (All nails shall be removed after painting)
Laser, or other automatic control devices, shall be checked with temporary control point or grade hub at a minimum of once per 400 feet per pass (i.e. paving lane).

NOTE: Controls and stakes disturbed or suspect of having been disturbed shall be checked and/or reset as directed by the Engineer without additional cost to the Owner.

50-07 AUTOMATICALLY CONTROLLED EQUIPMENT. Whenever batching or mixing plant equipment is required to be operated automatically under the contract and a breakdown or malfunction of the automatic controls occurs, the equipment may be operated manually or by other methods for a period 48 hours following the

breakdown or malfunction, provided this method of operations will produce results which conform to all other requirements of the contract.

50-08 AUTHORITY AND DUTIES OF INSPECTORS. Inspectors employed by the Owner shall be authorized to inspect all work done and all material 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. Inspectors are not authorized to revoke, alter, or waive any provision of the contract. Inspectors are not authorized to issue instructions contrary to the plans and specifications or to act as foreman for the Contractor.

Inspectors employed by the Owner are authorized to notify the Contractor or his/her representatives of any failure of the work or materials to conform to the requirements of the contract, plans, or specifications and to reject such nonconforming materials in question until such issues can be referred to the Engineer for his/her decision.

50-09 INSPECTION OF THE WORK. All materials and each part or 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.

If the Engineer requests it, 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 representative of the Owner may be ordered removed and replaced at the Contractor's expense unless the Owner's representative failed to inspect after having been given reasonable notice in writing that the work was to be performed.

Should the contract work include relocation, adjustment, or any other modification to existing facilities, not the property of the (contract) Owner, authorized representatives of the owners of such facilities shall have the right to inspect such work. Such inspection shall in no sense make any facility owner a party to the contract, and shall in no way interfere with the rights of the parties to this contract.

50-10 REMOVAL OF UNACCEPTABLE AND UNAUTHORIZED WORK. All work that does not conform to the requirements of the contract, plans, and specifications will be considered unacceptable, unless otherwise determined acceptable by the Engineer as provided in the subsection titled CONFORMITY WITH PLANS AND SPECIFICATIONS of this section.

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 in accordance with the provisions of the subsection titled CONTRACTOR'S RESPONSIBILITY FOR WORK of Section 70.

No removal work made under provision of this subsection 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 subsection, the Engineer will have authority to cause unacceptable work to be remedied or removed and replaced and unauthorized work to be removed and to deduct the costs (incurred by the Owner) from any monies due or to become due the Contractor.

50-11 LOAD RESTRICTIONS. The Contractor shall comply with all legal load restrictions in the hauling of materials on public roads beyond the limits of the work. A special permit will not relieve the Contractor of liability for damage that may result from the moving of material or equipment.

The operation of equipment of such weight or so loaded as to cause damage to structures or to any other type of construction will not be permitted. Hauling of materials over the base course or surface course under construction shall be limited as directed. No loads will be permitted on a concrete pavement, base, or structure before the expiration of the curing period. The Contractor shall be responsible for all damage done by his/her hauling equipment and shall correct such damage at his/her own expense.

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If, however, the inspection discloses any work, in whole or in part, as being unsatisfactory, the Engineer will give the Contractor the necessary instructions for correction of same and the Contractor shall immediately comply with and execute such instructions. Upon correction of the work, another inspection will be made which shall constitute the final inspection, provided the work has been satisfactorily completed. In such event, the Engineer will make the final acceptance and notify the Contractor in writing of this acceptance as of the date of final inspection.

50-16 CLAIMS FOR ADJUSTMENT AND DISPUTES. If for any reason the Contractor deems that additional compensation is due him for work or materials not clearly provided for in the contract, plans, or specifications or previously authorized as extra work, he shall notify the Engineer in writing of his/her intention to claim such additional compensation before he begins the work on which he bases the claim. If such notification is not given or the Engineer is not afforded proper opportunity by the Contractor for keeping strict account of actual cost as required, then the Contractor hereby agrees to waive any claim for such additional compensation. Such notice by the Contractor and the fact that the Engineer has kept account of the cost of the work shall not in any way be construed as proving or substantiating the validity of the claim. When the work on which the claim for additional compensation is based has been completed, the Contractor shall, within l0 calendar days, submit his/her written claim to the Engineer who will present it to the Owner for consideration in accordance with local laws or ordinances.

Nothing in this subsection shall be construed as a waiver of the Contractor's right to dispute final payment based on differences in measurements or computations.

50-17 COST REDUCTION INCENTIVE. The provisions of this subsection will apply only to contracts awarded to the lowest bidder pursuant to competitive bidding.

On projects with original contract amounts in excess of $100,000, the Contractor may submit to the Engineer, in writing, proposals for modifying the plans, specifications or other requirements of the contract for the sole purpose of reducing the cost of construction. The cost reduction proposal shall not impair, in any manner, the essential functions or characteristics of the project, including but not limited to service life, economy of operation, ease of maintenance, desired appearance, design and safety standards. This provision shall not apply unless the proposal submitted is specifically identified by the Contractor as being presented for consideration as a value engineering proposal.

Not eligible for cost reduction proposals are changes in the basic design of a pavement type, runway and taxiway lighting, visual aids, hydraulic capacity of drainage facilities, or changes in grade or alignment that reduce the geometric standards of the project.

As a minimum, the following information shall be submitted by the Contractor with each proposal:

a. A description of both existing contract requirements for performing the work and the proposed changes, with a discussion of the comparative advantages and disadvantages of each;

b. An itemization of the contract requirements that must be changed if the proposal is adopted;

c. A detailed estimate of the cost of performing the work under the existing contract and under the proposed changes;

d. A statement of the time by which a change order adopting the proposal must be issued;

e. A statement of the effect adoption of the proposal will have on the time for completion of the contract; and

f. The contract items of work affected by the proposed changes, including any quantity variation attributable to them.

The Contractor may withdraw, in whole or in part, any cost reduction proposal not accepted by the Engineer, within the period specified in the proposal. The provisions of this subsection shall not be construed to require the Engineer to consider any cost reduction proposal that may be submitted.

The Contractor shall continue to perform the work in accordance with the requirements of the contract until a change order incorporating the cost reduction proposal has been issued. If a change order has not been issued by the date upon which the Contractor's cost reduction proposal specifies that a decision should be made, or such other date as the Contractor may subsequently have requested in writing, such cost reduction proposal shall be deemed rejected.

The Engineer shall be the sole judge of the acceptability of a cost reduction proposal and of the estimated net savings from the adoption of all or any part of such proposal. In determining the estimated net savings, the Engineer may disregard the contract bid prices if, in the Engineer's judgment such prices do not represent a fair measure of the value of the work to be performed or deleted.

The Owner may require the Contractor to share in the Owner's costs of investigating a cost reduction proposal submitted by the Contractor as a condition of considering such proposal. Where such a condition is imposed, the Contractor shall acknowledge acceptance of it in writing. Such acceptance shall constitute full authority for the Owner to deduct the cost of investigating a cost reduction proposal from amounts payable to the Contractor under the contract.

If the Contractor's cost reduction proposal is accepted in whole or in part, such acceptance will be by a contract change order that shall specifically state that it is executed pursuant to this subsection. Such change order shall incorporate the changes in the plans and specifications which are necessary to permit the cost reduction proposal or such part of it as has been accepted and shall include any conditions upon which the Engineer's approval is based. The change order shall also set forth the estimated net savings attributable to the cost reduction proposal. The net savings shall be determined as the difference in costs between the original contract costs for the involved work items and the costs occurring as a result of the proposed change. The change order shall also establish the net savings agreed upon and shall provide for adjustment in the contract price that will divide the net savings equally between the Contractor and the Owner.

The Contractor's 50 percent share of the net savings shall constitute full compensation to the Contractor for the cost reduction proposal and the performance of the work.

Acceptance of the cost-reduction proposal and performance of the cost-reduction work shall not extend the time of completion of the contract unless specifically provided for in the contract change order.

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SECTION 60
CONTROL OF MATERIALS

60-01 SOURCE OF SUPPLY AND QUALITY REQUIREMENTS. The materials used on the work shall conform to the requirements of the contract, plans, and specifications. Unless otherwise specified, such materials that are manufactured or processed shall be new (as compared to used or reprocessed).

In order to expedite the inspection and testing of materials, the Contractor shall furnish complete statements to the Engineer as to the origin, composition, and manufacture of all materials to be used in the work. Such statements shall be furnished promptly after execution of the contract but, in all cases, prior to delivery of such materials.

At the Engineer's option, materials may be approved at the source of supply before delivery is stated. If it is found after trial that sources of supply for previously approved materials do not produce specified products, the Contractor shall furnish materials from other sources.

The Contractor shall furnish airport lighting equipment that conforms to the requirements of cited materials specifications. In addition, where an FAA specification for airport lighting equipment is cited in the plans or specifications, the Contractor shall furnish such equipment that is:

a. Listed in FAA Advisory Circular (AC) 150/5345-53, Airport Lighting Equipment Certification Program, that is in effect on the date of advertisement; and,

b. Produced by the manufacturer qualified (by FAA) to produce such specified and listed equipment.

The following airport lighting equipment is required for this contract and is to be furnished by the Contractor in accordance with the requirements of this subsection:

EQUIPMENT NAME
CITED FAA SPECIFICATIONS
EFFECTIVE FAA AC OR APPROVAL LETTER FOR EQUIPMENT AND MANUFACTURER

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The Contractor shall employ a testing organization to perform all Contractor required tests. The Contractor shall submit to the Engineer resumes on all testing organizations and individual persons who will be performing the tests. The Engineer will determine if such persons are qualified. All the test data shall be reported to the Engineer after the results are known. A legible, handwritten copy of all test data shall be given to the Engineer daily, along with printed reports, in an approved format, on a weekly basis. After completion of the project, and prior to final payment, the Contractor shall submit a final report to the Engineer showing all test data reports, plus an analysis of all results showing ranges, averages, and corrective action taken on all failing tests.

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Should the Engineer conduct plant inspections, the following conditions shall exist:

a. The Engineer shall have the cooperation and assistance of the Contractor and the producer with whom he has contracted for materials.

b. The Engineer shall have full entry at all reasonable times to such parts of the plant that concern the manufacture or production of the materials being furnished.

c. If required by the Engineer, the Contractor shall arrange for adequate office or working space that may be reasonably needed for conducting plant inspections. Office or working space should be conveniently located with respect to the plant.

It is understood and agreed that the Owner shall have the right to retest any material that has been tested and approved at the source of supply after it has been delivered to the site. The Engineer shall have the right to reject only material which, when retested, does not meet the requirements of the contract, plans, or specifications.

60-05 ENGINEER'S FIELD OFFICE. The Contractor shall furnish for the duration of the project one building for the use of the field engineers and inspectors, as a field office. This facility shall be an approved weatherproof building meeting the current State Highway Specifications (for example, Class I Field Office or Type C Structure). This building shall be located conveniently near to the construction and shall be separate from any building used by the Contractor. A land line telephone and answering machine shall be provided. The Contractor shall be responsible for payment of the basic monthly charge and local calls only. Any Long Distance Tolls shall be the responsibility of the caller. The Contractor shall furnish [FAX machine, photocopy machine, water, sanitary facilities, heat, air conditioning, and electricity]. No direct payment will be made for this building or labor, materials, ground rental, or other expense in connection therewith. The cost hereof shall be included in the price bid for the various items of the contract. The Contractor and his/her superintendent shall provide all reasonable facilities to enable to the Engineer to inspect the workmanship and materials entering into the work.

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Rejected material or assembly, the defects of which have been corrected by the Contractor, shall not be returned to the site of the work until such time as the Engineer has approved its used in the work.

60-08 OWNER FURNISHED MATERIALS. The Contractor shall furnish all materials required to complete the work, except those specified herein (if any) to be furnished by the Owner. Owner-furnished materials shall be made available to the Contractor at the location specified herein.

All costs of handling, transportation from the specified location to the site of work, storage, and installing Owner-furnished materials shall be included in the unit price bid for the contract item in which such Owner-furnished material is used.

After any Owner-furnished material has been delivered to the location specified, the Contractor shall be responsible for any demurrage, damage, loss, or other deficiencies that may occur during the Contractor's handling, storage, or use of such Owner-furnished material. The Owner will deduct from any monies due or to become due the Contractor any cost incurred by the Owner in making good such loss due to the Contractor's handling, storage, or use of Owner-furnished materials.

END OF SECTION 60

SECTION 70
LEGAL REGULATIONS AND RESPONSIBILITY TO PUBLIC

70-01 LAWS TO BE OBSERVED. The Contractor shall keep fully informed of all Federal and state laws, all local laws, ordinances, and regulations and all orders and decrees of bodies or tribunals having any jurisdiction or authority, which in any manner affect those engaged or employed on the work, or which in any way affect the conduct of the work. He shall at all times observe and comply with all such laws, ordinances, regulations, orders, and decrees; and shall protect and indemnify the Owner and all his/her officers, agents, or servants against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by himself or his/her employees.

70-02 PERMITS, LICENSES, AND TAXES. The Contractor shall procure all permits and licenses, pay all charges, fees, and taxes, and give all notices necessary and incidental to the due and lawful prosecution of the work.

70-03 PATENTED DEVICES, MATERIALS, AND PROCESSES. If the Contractor is required or desires to use any design, device, material, or process covered by letters of patent or copyright, he shall provide for such use by suitable legal agreement with the patentee or owner. The Contractor and the surety shall indemnify and save harmless the Owner, any third party, or political subdivision from any and all claims for infringement by reason of the use of any such patented design, device, material or process, or any trademark or copyright, and shall indemnify the Owner for any costs, expenses, and damages which it may be obliged to pay by reason of an infringement, at any time during the prosecution or after the completion of the work.

70-04 RESTORATION OF SURFACES DISTURBED BY OTHERS. The Owner reserves the right to authorize the construction, reconstruction, or maintenance of any public or private utility service, FAA or National Oceanic and Atmospheric Administration (NOAA) facility, or a utility service of another government agency at any time during the progress of the work. To the extent that such construction, reconstruction, or maintenance has been coordinated with the Owner, such authorized work (by others) is indicated as follows:

Owner (Utility or Other Facility)
Location (See Plan Sheet No.)
Person to Contact (Name, Title, Address and Phone)

Except as listed above, the Contractor shall not permit any individual, firm, or corporation to excavate or otherwise disturb such utility services or facilities located within the limits of the work without the written permission of the Engineer.

Should the owner of public or private utility service, FAA, or NOAA facility, or a utility service of another government agency be authorized to construct, reconstruct, or maintain such utility service or facility during the progress of the work, the Contractor shall cooperate with such owners by arranging and performing the work in this contract so as to facilitate such construction, reconstruction or maintenance by others whether or not such work by others is listed above. When ordered as extra work by the Engineer, the Contractor shall make all necessary repairs to the work which are due to such authorized work by others, unless otherwise provided for in the contract, plans, or specifications. It is understood and agreed that the Contractor shall not be entitled to make any claim for damages due to such authorized work by others or for any delay to the work resulting from such authorized work.

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subsection and provided for in the contract, plans and specifications. In addition, all known utility services or facilities that are within the limits of the proposed work should be shown on the plans (regardless of whether or not there is a conflict of work to be performed by the owner) with enough detailed information to indicate the lack of conflicts.

* * * *

emergency fire-rescue or maintenance vehicles on the airport in reasonable conformance to AC 150/5370-2, Operational Safety on Airports During Construction.

The Contractor shall identify each motorized vehicle or piece of construction equipment in reasonable conformance to AC 150/5370-2.

The Contractor shall furnish and erect all barricades, warning signs, and markings for hazards prior to commencing work that requires such erection and shall maintain the barricades, warning signs, and markings for hazards until their dismantling is directed by the Engineer.

Open-flame type lights shall not be permitted within the air operations areas of the airport.

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operations of the Contractor; or on account of or in consequence of any neglect in safeguarding the work; or through use of unacceptable materials in constructing the work; or because of any act or omission, neglect, or misconduct of said Contractor; or because of any claims or amounts recovered from any infringements of patent, trademark, or copyright; or from any claims or amounts arising or recovered under the ``Workmen's Compensation Act," or any other law, ordinance, order, or decree. Money due the Contractor under and by virtue of his/her contract as may be considered necessary by the Owner for such purpose may be retained for the use of the Owner or, in case no money is due, his/her surety may be held until such suit(s), action(s), or claim(s) for injuries or damages as aforesaid shall have been settled and suitable evidence to that effect furnished to the Owner, except that money due the Contractor will not be withheld when the Contractor produces satisfactory evidence that he is adequately protected by public liability and property damage insurance.

70-12 THIRD PARTY BENEFICIARY CLAUSE. It is specifically agreed between the parties executing the contract that it is not intended by any of the provisions of any part of the contract to create the public or any member thereof a third party beneficiary or to authorize anyone not a party to the contract to maintain a suit for personal injuries or property damage pursuant to the terms or provisions of the contract.

70-13 OPENING SECTIONS OF THE WORK TO TRAFFIC. Should it be necessary for the Contractor to complete portions of the contract work for the beneficial occupancy of the Owner prior to completion of the entire contract, such ``phasing" of the work shall be specified herein and indicated on the plans. When so specified, the Contractor shall complete such portions of the work on or before the date specified or as otherwise specified. The Contractor shall make his/her own estimate of the difficulties involved in arranging his/her work to permit such beneficial occupancy by the Owner as described below:

Phase or Description
Required Date or Sequence of Owner's Beneficial Occupancy
Work Shown on Plan Sheet

* * * *

Contractor shall be required to conform to safety standards contained AC 150/5370-2, Operational Safety on Airports During Construction (See Special Provisions.)

Contractor shall refer to the approved safety plan to identify barricade requirements and other safety requirements prior to opening up sections of work to traffic.

70-14 CONTRACTOR'S RESPONSIBILITY FOR WORK. Until the Engineer's final written acceptance of the entire completed work, excepting only those portions of the work accepted in accordance with the subsection titled PARTIAL ACCEPTANCE of Section 50, the Contractor shall have the charge and care thereof and shall take every precaution against injury or damage to any part due to the action of the elements or from any other cause, whether arising from the execution or from the non-execution of the work. The Contractor shall rebuild, repair, restore, and make good all injuries or damages to any portion of the work occasioned by any of the above causes before final acceptance and shall bear the expense thereof except damage to the work due to unforeseeable causes beyond the control of and without the fault or negligence of the Contractor, including but not restricted to acts of God such as earthquake, tidal wave, tornado, hurricane or other cataclysmic phenomenon of nature, or acts of the public enemy or of government authorities.

If the work is suspended for any cause whatever, the Contractor shall be responsible for the work and shall take such precautions necessary to prevent damage to the work. The Contractor shall provide for normal drainage and shall erect necessary temporary structures, signs, or other facilities at his/her expense. During such period of suspension of work, the Contractor shall properly and continuously maintain in an acceptable growing condition all living material in newly established planting, seedings, and soddings furnished under his/her contract, and shall take adequate precautions to protect new tree growth and other important vegetative growth against injury.

70-15 CONTRACTOR'S RESPONSIBILITY FOR UTILITY SERVICE AND FACILITIES OF OTHERS. As provided in the subsection titled RESTORATION OF SURFACES DISTURBED BY OTHERS of this section, the Contractor shall cooperate with the owner of any public or private utility service, FAA or NOAA, or a utility service of another government agency that may be authorized by the owner to construct, reconstruct or maintain such utility services or facilities during the progress of the work. In addition, the Contractor shall control his/her operations to prevent the unscheduled interruption of such utility services and facilities.

To the extent that such public or private utility services, FAA, or NOAA facilities, or utility services of another governmental agency are known to exist within the limits of the contract work, the approximate locations have been indicated on the plans and the owners are indicated as follows:

Utility Service or Facility
Person to Contract (Name, Title, Address, & Phone)
Owner's Emergency Contact (Phone)

* * * *

It is understood and agreed that the Owner does not guarantee the accuracy or the completeness of the location information relating to existing utility services, facilities, or structures that may be shown on the plans or encountered in the work. Any inaccuracy or omission in such information shall not relieve the Contractor of his/her responsibility to protect such existing features from damage or unscheduled interruption of service.

It is further understood and agreed that the Contractor shall, upon execution of the contract, notify the owners of all utility services or other facilities of his/her plan of operations. Such notification shall be in writing addressed to THE PERSON TO CONTACT as provided hereinbefore in this subsection and the subsection titled RESTORATION OF SURFACES DISTURBED BY OTHERS of this section. A copy of each notification shall be given to the Engineer.

In addition to the general written notification hereinbefore provided, it shall be the responsibility of the Contractor to keep such individual owners advised of changes in his/her plan of operations that would affect such owners.

Prior to commencing the work in the general vicinity of an existing utility service or facility, the Contractor shall again notify each such owner of his/her plan of operation. If, in the Contractor's opinion, the owner's assistance is needed to locate the utility service or facility or the presence of a representative of the owner is desirable to observe the work, such advice should be included in the notification. Such notification shall be given by the most expeditious means to reach the utility owner's PERSON TO CONTACT no later than two normal business days prior to the Contractor's commencement of operations in such general vicinity. The Contractor shall furnish a written summary of the notification to the Engineer.

The Contractor's failure to give the two day's notice hereinabove provided shall be cause for the Owner to suspend the Contractor's operations in the general vicinity of a utility service or facility.

Where the outside limits of an underground utility service have been located and staked on the ground, the Contractor shall be required to use excavation methods acceptable to the Engineer within 3 feet (90 cm) of such outside limits at such points as may be required to ensure protection from damage due to the Contractor's operations.

Should the Contractor damage or interrupt the operation of a utility service or facility by accident or otherwise, he shall immediately notify the proper authority and the Engineer and shall take all reasonable measures to prevent further damage or interruption of service. The Contractor, in such events, shall cooperate with the utility service or facility owner and the Engineer continuously until such damage has been repaired and service restored to the satisfaction of the utility or facility owner.

The Contractor shall bear all costs of damage and restoration of service to any utility service or facility due to his/her operations whether or not due to negligence or accident. The Owner reserves the right to deduct such costs from any monies due or which may become due the Contractor, or his/her surety.

70-15.1 FAA FACILITIES AND CABLE RUNS. The Contractor is hereby advised that the construction limits of the project include existing facilities and buried cable runs that are owned, operated and maintained by the FAA. The Contractor, during the prosecution of the project work, shall comply with the following:

a. The Contractor shall permit FAA maintenance personnel the right of access to the project work site for purposes of inspecting and maintaining all existing FAA owned facilities.

b. The Contractor shall notify the above named FAA Airway Facilities Point-of-Contact seven (7) calendar days prior to commencement of construction activities in order to permit sufficient time to locate and mark existing buried cables and to schedule any required facility outages.

c. If prosecution of the project work requires a facility outage, the Contractor shall contact the above named FAA Point-of-Contact a minimum of 48 hours prior to the time of the required outage.

d. If prosecution of the project work results in damages to existing FAA equipment or cables, the Contractor shall repair the damaged item in conformance with FAA Airway Facilities' standards to the satisfaction of the above named FAA Point-of-Contact.

e. If the project work requires the cutting or splicing of FAA owned cables, the above named FAA Point-of-Contact shall be contacted a minimum of 48 hours prior to the time the cable work commences. The FAA reserves the right to have a FAA Airway Facilities representative on site to observe the splicing of the cables as a condition of acceptance. All cable splices are to be accomplished in accordance with FAA Airway Facilities' specifications and require approval by the above named FAA Point-of-Contact as a condition of acceptance by the Owner. The Contractor is hereby advised that FAA Airway Facilities restricts the location of where splices may be installed. If a cable splice is required in a location that is not permitted by FAA Airway Facilities, the Contractor shall furnish and install a sufficient length of new cable that eliminates the need for any splice.

* * * *

The Engineer will immediately investigate the Contractor's finding and the Owner will direct the Contractor to either resume his/her operations or to suspend operations as directed.

Should the Owner order suspension of the Contractor's operations in order to protect an archaeological or historical finding, or order the Contractor to perform extra work, such shall be covered by an appropriate contract modification (change order or supplemental agreement) as provided in the subsection titled EXTRA WORK of Section 40 and the subsection titled PAYMENT FOR EXTRA WORK AND FORCE ACCOUNT WORK of Section 90. If appropriate, the contract modification shall include an extension of contract time in accordance with the subsection titled DETERMINATION AND EXTENSION OF CONTRACT TIME of Section 80.

* * * *

SECTION 80
PROSECUTION AND PROGRESS

80-01 SUBLETTING OF CONTRACT. The Owner will not recognize any subcontractor on the work. The Contractor shall at all times when work is in progress be represented either in person, by a qualified superintendent, or by other designated, qualified representative who is duly authorized to receive and execute orders of the Engineer.

Should the Contractor elect to assign his/her contract, said assignment shall be concurred in by the surety, shall be presented for the consideration and approval of the Owner, and shall be consummated only on the written approval of the Owner. In case of approval, the Contractor shall file copies of all subcontracts with the Engineer.

The Contractor shall perform, with his organization, an amount of work equal to at least [ ] percent of the total contract cost.

* * * *

When the work requires the Contractor to conduct his/her operations within an AIR OPERATIONS AREA of the airport, the work shall be coordinated with airport operations (through the Engineer) at least 48 hours prior to commencement of such work. The Contractor shall not close an AIR OPERATIONS AREA until so authorized by the Engineer and until the necessary temporary marking and associated lighting is in place as provided in the subsection titled BARRICADES, WARNING SIGNS, AND HAZARD MARKINGS of Section 70.

When the contract work requires the Contractor to work within an AIR OPERATIONS AREA (AOA) of the airport on an intermittent basis (intermittent opening and closing of the AIR OPERATIONS AREA), the Contractor shall maintain constant communications as hereinafter specified; immediately obey all instructions to vacate the AIR OPERATIONS AREA; immediately obey all instructions to resume work in such AIR OPERATIONS AREA. Failure to maintain the specified communications or to obey instructions shall be cause for suspension of the Contractor's operations in the AIR OPERATIONS AREA until the satisfactory conditions are provided. The following AIR OPERATIONS AREA cannot be closed to operating aircraft to permit the Contractor's operations on a continuous basis and will therefore be closed to aircraft operations intermittently as follows:

AOA
TIME PERIODS AOA CAN BE CLOSED
TYPE OF COMMUNICATIONS REQUIRED WHEN WORKING IN AN AOA
CONTROL AUTHORITY

* * * *

80-05 CHARACTER OF WORKERS, METHODS, AND EQUIPMENT. The Contractor shall, at all times, employ sufficient labor and equipment for prosecuting the work to full completion in the manner and time required by the contract, plans, and specifications.

All workers shall have sufficient skill and experience to perform properly the work assigned to them. Workers engaged in special work or skilled work shall have sufficient experience in such work and in the operation of the equipment required to perform the work satisfactorily.

Any person employed by the Contractor or by any subcontractor who violates any operational regulations and, in the opinion of the Engineer, does not perform his work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the Engineer, be removed forthwith by the Contractor or subcontractor employing such person, and shall not be employed again in any portion of the work without approval of the Engineer.

Should the Contractor fail to remove such persons or person, or fail to furnish suitable and sufficient personnel for the proper prosecution of the work, the Engineer may suspend the work by written notice until compliance with such orders.

All equipment that is proposed to be used on the work shall be of sufficient size and in such mechanical condition as to met requirements of the work and to produce a satisfactory quality of work. Equipment used on any portion of the work shall be such that no injury to previously completed work, adjacent property, or existing airport facilities will result from its use.

When the methods and equipment to be used by the Contractor in accomplishing the work are not prescribed in the contract, the Contractor is free to use any methods or equipment that will accomplish the work in conformity with the requirements of the contract, plans, and specifications.

When the contract specifies the use of certain methods and equipment, such methods and equipment shall be used unless others are authorized by the Engineer. If the Contractor desires to use a method or type of equipment other than specified in the contract, he may request authority from the Engineer to do so. The request shall be in writing and shall include a full description of the methods and equipment proposed and of the reasons for desiring to make the change. If approval is given, it will be on the condition that the Contractor will be fully responsible for producing work in conformity with contract requirements. If, after trial use of the substituted methods or equipment, the Engineer determines that the work produced does not meet contract requirements, the Contractor shall discontinue the use of the substitute method or equipment and shall complete the remaining work with the specified methods and equipment. The Contractor shall remove any deficient work and replace it with work of specified quality, or take such other corrective action as the Engineer may direct. No change will be made in basis of payment for the contract items involved nor in contract time as a result of authorizing a change in methods or equipment under this subsection.

80-06 TEMPORARY SUSPENSION OF THE WORK. The Owner shall have the authority to suspend the work wholly, or in part, for such period or periods as he may deem necessary, due to unsuitable weather, or such other conditions as are considered unfavorable for the prosecution of the work, or for such time as is necessary due to the failure on the part of the Contractor to carry out orders given or perform any or all provisions of the contract.

In the event that the Contractor is ordered by the Owner, in writing, to suspend work for some unforeseen cause not otherwise provided for in the contract and over which the Contractor has no control, the Contractor may be reimbursed for actual money expended on the work during the period of shutdown. No allowance will be made for anticipated profits. The period of shutdown shall be computed from the effective date of the Engineer's order to suspend work to the effective date of the Engineer's order to resume the work. Claims for such compensation shall be filed with the Engineer within the time period stated in the Engineer's order to resume work. The Contractor shall submit with his/her claim information substantiating the amount shown on the claim. The Engineer will forward the Contractor's claim to the Owner for consideration in accordance with local laws or ordinances. No provision of this article shall be construed as entitling the Contractor to compensation for delays due to inclement weather, for suspensions made at the request of the Owner, or for any other delay provided for in the contract, plans, or specifications.

If it should become necessary to suspend work for an indefinite period, the Contractor shall store all materials in such manner that they will not become an obstruction nor become damaged in any way. He shall take every precaution to prevent damage or deterioration of the work performed and provide for normal drainage of the work. The Contractor shall erect temporary structures where necessary to provide for traffic on, to, or from the airport.

80-07 DETERMINATION AND EXTENSION OF CONTRACT TIME. The number of calendar or working days allowed for completion of the work shall be stated in the proposal and contract and shall be known as the CONTRACT TIME.

Should the contract time require extension for reasons beyond the Contractor's control, it shall be adjusted as follows:

a. CONTRACT TIME based on WORKING DAYS shall be calculated weekly by the Engineer. The Engineer will furnish the Contractor a copy of his/her weekly statement of the number of working days charged against the contract time during the week and the number of working days currently specified for completion of the contract (the original contract time plus the number of working days, if any, that have been included in approved CHANGE ORDERS or SUPPLEMENTAL AGREEMENTS covering EXTRA WORK).

The Engineer shall base his/her weekly statement of contract time charged on the following considerations:

(1) No time shall be charged for days on which the Contractor is unable to proceed with the principal item of work under construction at the time for at least 6 hours with the normal work force employed on such principal item. Should the normal work force be on a double-shift, 12 hours shall be used. Should the normal work force be on a triple-shift, 18 hours shall apply. Conditions beyond the Contractor's control such as strikes, lockouts, unusual delays in transportation, temporary suspension of the principal item of work under construction or temporary suspension of the entire work which have been ordered by the Owner for reasons not the fault of the Contractor, shall not be charged against the contract time.

(2) The Engineer will not make charges against the contract time prior to the effective date of the notice to proceed.

(3) The Engineer will begin charges against the contract time on the first working day after the effective date of the notice to proceed.

(4) The Engineer will not make charges against the contract time after the date of final acceptance as defined in the subsection titled FINAL ACCEPTANCE of Section 50.

(5) The Contractor will be allowed 1 week in which to file a written protest setting forth his/her objections to the Engineer's weekly statement. If no objection is filed within such specified time, the weekly statement shall be considered as acceptable to the Contractor.

The contract time (stated in the proposal) is based on the originally estimated quantities as described in the subsection titled INTERPRETATION OF ESTIMATED PROPOSAL QUANTITIES of Section 20. Should the satisfactory completion of the contract require performance of work in greater quantities than those estimated in the proposal, the contract time shall be increased in the same proportion as the cost of the actually completed quantities bears to the cost of the originally estimated quantities in the proposal. Such increase in contract time shall not consider either the cost of work or the extension of contract time that has been covered by change order or supplemental agreement and shall be made at the time of final payment.

b. CONTRACT TIME based on CALENDAR DAYS shall consist of the number of calendar days stated in the contract counting from the effective date of the notice to proceed and including all Saturdays, Sundays, holidays, and nonwork days. All calendar days elapsing between the effective dates of the Owner's orders to suspend and resume all work, due to causes not the fault of the Contractor, shall be excluded.

At the time of final payment, the contract time shall be increased in the same proportion as the cost of the actually completed quantities bears to the cost of the originally estimated quantities in the proposal. Such increase in the

contract time shall not consider either cost of work or the extension of contract time that has been covered by a change order or supplemental agreement. Charges against the contract time will cease as of the date of final acceptance.

c. When the contract time is a specified completion date, it shall be the date on which all contract work shall be substantially completed.

If the Contractor finds it impossible for reasons beyond his/her control to complete the work within the contract time as specified, or as extended in accordance with the provisions of this subsection, he may, at any time prior to the expiration of the contract time as extended, make a written request to the Engineer for an extension of time setting forth the reasons which he believes will justify the granting of his/her request. Requests for extension of time on calendar day projects, caused by inclement weather, shall be supported with National Weather Bureau data showing the actual amount of inclement weather exceeded which could normally be expected during the contract period. The Contractor's plea that insufficient time was specified is not a valid reason for extension of time. If the Engineer finds that the work was delayed because of conditions beyond the control and without the fault of the Contractor, he may extend the time for completion in such amount as the conditions justify. The extended time for completion shall then be in full force and effect, the same as though it were the original time for completion.

80-08 FAILURE TO COMPLETE ON TIME. For each calendar day or working day, as specified in the contract, that any work remains uncompleted after the contract time (including all extensions and adjustments as provided in the subsection titled DETERMINATION AND EXTENSION OF CONTRACT TIME of this Section) the sum specified in the contract and proposal as liquidated damages will be deducted from any money due or to become due the Contractor or his/her surety. Such deducted sums shall not be deducted as a penalty but shall be considered as liquidation of a reasonable portion of damages including but not limited to additional engineering services that will be incurred by the Owner should the Contractor fail to complete the work in the time provided in his/her contract.

SCHEDULE	LIQUIDATED DAMAGES COST	ALLOWED CONSTRUCTION TIME

* * * *

AC 150/5300-9, Predesign, Prebid, and Preconstruction Conferences for Airport Grant Projects.

The amount of liquidated damages to be specified should be tailored to each contract and should be based on the cost per day incurred by the Owner should the Contractor overrun the contract time. For large airports (where the impact on airport operations may be great), it is not practical for the Owner to attempt to recover all loss of revenue through liquidated damages. Consequently, the amount of liquidated damages specified must be balanced somewhere between the cost per day incurred for a time overrun and the cost that bidders would have to add to their bids to cover the contingency of a time overrun.

Generally speaking, contract time is based on working days when completion is not critical to operation of the airport. As the impact on airport operations increases, the use of calendar days will give more control. Use of a specified completion date should be used only in cases where the construction operations require long-range rescheduling of airport operations. Also, generally speaking, the amount of liquidated damages would be greater for a calendar day contract than for a working day contract and would be greatest for a specified completion date contract.

* * * *

methods as in the opinion of the Engineer will be required for the completion of said contract in an acceptable manner.

All costs and charges incurred by the Owner, together with the cost of completing the work under contract, will be deducted from any monies due or which may become due the Contractor. If such expense exceeds the sum which would have been payable under the contract, then the Contractor and the surety shall be liable and shall pay to the Owner the amount of such excess.

80-10 TERMINATION FOR NATIONAL EMERGENCIES. The Owner shall terminate the contract or portion thereof by written notice when the Contractor is prevented from proceeding with the construction contract as a direct result of an Executive Order of the President with respect to the prosecution of war or in the interest of national defense.

When the contract, or any portion thereof, is terminated before completion of all items of work in the contract, payment will be made for the actual number of units or items of work completed at the contract price or as mutually agreed for items of work partially completed or not started. No claims or loss of anticipated profits shall be considered.

Reimbursement for organization of the work, and other overhead expenses, (when not otherwise included in the contract) and moving equipment and materials to and from the job will be considered, the intent being that an equitable settlement will be made with the Contractor.

Acceptable materials, obtained or ordered by the Contractor for the work and that are not incorporated in the work shall, at the option of the Contractor, be purchased from the Contractor at actual cost as shown by receipted bills and actual cost records at such points of delivery as may be designated by the Engineer.

Termination of the contract or a portion thereof shall neither relieve the Contractor of his/her responsibilities for the completed work nor shall it relieve his/her surety of its obligation for and concerning any just claim arising out of the work performed.

80-11 WORK AREA, STORAGE AREA AND SEQUENCE OF OPERATIONS. The Contractor shall obtain approval from the Engineer prior to beginning any work in all areas of the airport. No operating runway, taxiway, or Air Operations Area (AOA) shall be crossed, entered, or obstructed while it is operational. The Contractor shall plan and coordinate his/her work in such a manner as to insure safety and a minimum of hindrance to flight operations. All Contractor equipment and material stockpiles shall be stored a minimum or [ ] feet from the centerline of an active runway. No equipment will be allowed to park within the approach area of an active runway at any time. No equipment shall be within [ ] feet of an active runway at any time.

END OF SECTION 80

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SECTION 90
MEASUREMENT AND PAYMENT

90-01 MEASUREMENT OF QUANTITIES. All work completed under the contract will be measured by the Engineer, or his/her authorized representatives, using United States Customary Units of Measurement or the International System of Units.

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 horizontally, and no deductions will be made for individual fixtures (or leave-outs) having an area of 9 square feet (0.8 square meter) 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.

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

Unless otherwise specified, all contract items which are measured by the linear foot such as electrical ducts, conduits, pipe culverts, underdrains, and similar items shall be measured parallel to the base or foundation upon which such items are placed.

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

The thickness of plates and galvanized sheet used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing will be specified and measured in decimal fraction of inches.

The term ``ton" will mean the short ton consisting of 2,000 pounds (907 kilograms) avoirdupois. All materials that are measured or proportioned by weights shall be weighed on accurate, approved scales by competent, qualified personnel at locations designed by the Engineer. If material is shipped by rail, the car weight may be accepted provided that only the actual weight of material is paid for. However, car weights will not be acceptable for material to be passed through mixing plants. Trucks used to haul material being paid for by weight shall be weighed empty daily at such times as the Engineer directs, and each truck shall bear a plainly legible identification mark.

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 at least their water level capacity, and all loads shall be leveled when the vehicles arrive at the point of delivery.

When requested by the Contractor and approved by the Engineer in writing, material specified to be measured by the cubic yard (cubic meter) may be weighed, and such weights will be converted to cubic yards (cubic meters) for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the Engineer and shall be agreed to by the Contractor before such method of measurement of pay quantities is used.

Bituminous materials will be measured by the gallon (liter) or ton (kilogram). When measured by volume, such volumes will be measured at 60 F (15 C) or will be corrected to the volume at 60 F (15 C) using ASTM D 1250 for asphalts or ASTM D 633 for tars.

Net certified scale weights or weights based on certified volumes in the case of rail shipments will be used as a basis of measurement, subject to correction when bituminous material has been lost from the car or the distributor, wasted, or otherwise not incorporated in the work.

When bituminous materials are shipped by truck or transport, net certified weights by volume, subject to correction for loss or foaming, may be used for computing quantities.

Cement will be measured by the ton (kilogram) or hundredweight (kilogram).

Timber will be measured by the thousand feet board measure (M.F.B.M.) actually incorporated in the structure. Measurement will be based on nominal widths and thicknesses and the extreme length of each piece.

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 measurement, the unit will be construed to include all necessary fittings and accessories.

Rental of equipment will be measured by time in hours of actual working time and necessary traveling time of the equipment within the limits of the work. Special equipment ordered by the Engineer in connection with force account work will be measured as agreed in the change order or supplemental agreement authorizing such force account work as provided in the subsection titled PAYMENT FOR EXTRA AND FORCE ACCOUNT WORK of this section.

When standard manufactured items are specified such as fence, wire, plates, rolled shapes, pipe conduit, 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 tolerances in cited specifications, manufacturing tolerances established by the industries involved will be accepted.

Scales for weighing materials which are required to be proportioned or measured and paid for by weight shall be furnished, erected, and maintained by the Contractor, or be certified permanently installed commercial scales.

Scales shall be accurate within one-half percent of the correct weight throughout the range of use. The Contractor shall have the scales checked under the observation of the inspector before beginning work and at such other times as requested. The intervals shall be uniform in spacing throughout the graduated or marked length of the beam or dial and shall not exceed one-tenth of 1 percent of the nominal rated capacity of the scale, but not less than 1 pound (454 grams). The use of spring balances will not be permitted.

Beams, dials, platforms, and other scale equipment shall be so arranged that the operator and the inspector can safely and conveniently view them.

Scale installations shall have available ten standard 50-pound (2.3 kilogram) weights for testing the weighing equipment or suitable weights and devices for other approved equipment.

Scales must be tested for accuracy and serviced before use at a new site. Platform scales shall be installed and maintained with the platform level and rigid bulkheads at each end.

Scales ``overweighing'' (indicating more than correct weight) will not be permitted to operate, and all materials received subsequent to the last previous correct weighting-accuracy test will be reduced by the percentage of error in excess of one-half of 1 percent.

In the event inspection reveals the scales have been ``underweighing'' (indicating less than correct weight), they shall be adjusted, and no additional payment to the Contractor will be allowed for materials previously weighed and recorded.

All costs in connection with furnishing, installing, certifying, testing, and maintaining scales; for furnishing check weights and scale house; and for all other items specified in this subsection, for the weighing of materials for proportioning or payment, shall be included in the unit contract prices for the various items of the project.

When the estimated quantities for a specific portion of the work are designated as the pay quantities in the contract, they shall be the final quantities for which payment for such specific portion of the work will be made, unless the dimensions of said portions of the work shown on the plans are revised by the Engineer. If revised dimensions

result in an increase or decrease in the quantities of such work, the final quantities for payment will be revised in the amount represented by the authorized changes in the dimensions.

90-02 SCOPE OF PAYMENT. The Contractor shall receive and accept compensation provided for in the contract as full payment for furnishing all materials, for performing all work under the contract in a complete and acceptable manner, and for all risk, loss, damage, or expense of whatever character arising out of the nature of the work or the prosecution thereof, subject to the provisions of the subsection titled NO WAIVER OF LEGAL RIGHTS of Section 70.

When the ``basis of payment'' subsection of a technical specification requires that the contract price (price bid) include compensation for certain work or material essential to the item, this same work or material will not also be measured for payment under any other contract item which may appear elsewhere in the contract, plans, or specifications.

90-03 COMPENSATION FOR ALTERED QUANTITIES. When the accepted quantities of work vary from the quantities in the proposal, the Contractor shall accept as payment in full, so far as contract items are concerned, payment at the original contract price for the accepted quantities of work actually completed and accepted. No allowance, except as provided for in the subsection titled ALTERATION OF WORK AND QUANTITIES of Section 40 will be made for any increased expense, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor which results directly from such alterations or indirectly from his/her unbalanced allocation of overhead and profit among the contract items, or from any other cause.

90-04 PAYMENT FOR OMITTED ITEMS. As specified in the subsection titled OMITTED ITEMS of Section 40, the Engineer shall have the right to omit from the work (order nonperformance) any contract item, except major contract items, in the best interest of the Owner.

Should the Engineer omit or order nonperformance of a contract item or portion of such item from the work, the Contractor shall accept payment in full at the contract prices for any work actually completed and acceptable prior to the Engineer's order to omit or nonperform such contract item.

Acceptable materials ordered by the Contractor or delivered on the work prior to the date of the Engineer's order will be paid for at the actual cost to the Contractor and shall thereupon become the property of the Owner.

In addition to the reimbursement hereinbefore provided, the Contractor shall be reimbursed for all actual costs incurred for the purpose of performing the omitted contract item prior to the date of the Engineer's order. Such additional costs incurred by the Contractor must be directly related to the deleted contract item and shall be supported by certified statements by the Contractor as to the nature the amount of such costs.

90-05 PAYMENT FOR EXTRA AND FORCE ACCOUNT WORK. Extra work, performed in accordance with the subsection titled EXTRA WORK of Section 40, will be paid for at the contract prices or agreed prices specified in the change order or supplemental agreement authorizing the extra work. When the change order or supplemental agreement authorizing the extra work requires that it be done by force account, such force account shall be measured and paid for based on expended labor, equipment, and materials plus a negotiated and agreed upon allowance for overhead and profit.

a. Miscellaneous. No additional allowance will be made for general superintendence, the use of small tools, or other costs for which no specific allowance is herein provided.

b. Comparison of Record. The Contractor and the Engineer shall compare records of the cost of force account work at the end of each day. Agreement shall be indicated by signature of the Contractor and the Engineer or their duly authorized representatives.

c. Statement. No payment will be made for work performed on a force account basis until the Contractor has furnished the Engineer with duplicate itemized statements of the cost of such force account work detailed as follows:

(1) Name, classification, date, daily hours, total hours, rate and extension for each laborer and foreman.

(2) Designation, dates, daily hours, total hours, rental rate, and extension for each unit of machinery and equipment.

(3) Quantities of materials, prices, and extensions.

(4) Transportation of materials.

(5) Cost of property damage, liability and workman's compensation insurance premiums, unemployment insurance contributions, and social security tax.

Statements shall be accompanied and supported by a receipted invoice for all materials used and transportation charges. However, if materials used on the force account work are not specifically purchased for such work but are taken from the Contractor's stock, then in lieu of the invoices the Contractor shall furnish an affidavit certifying that such materials were taken from his/her stock, that the quantity claimed was actually used, and that the price and transportation claimed represent the actual cost to the Contractor.

90-06 PARTIAL PAYMENTS. Partial payments will be made at least once each month as the work progresses. Said payments will be based upon estimates prepared by the Engineer of the value of the work performed and materials complete in place in accordance with the contract, plans, and specifications. Such partial payments may also include the delivered actual cost of those materials stockpiled and stored in accordance with the subsection titled PAYMENT FOR MATERIALS ON HAND of this section.

No partial payment will be made when the amount due the Contractor since the last estimate amounts to less than five hundred dollars.

From the total of the amount determined to be payable on a partial payment, 10 percent of such total amount will be deducted and retained by the Owner until the final payment is made, except as may be provided (at the Contractor's option) in the subsection titled PAYMENT OF WITHHELD FUNDS of this section. The balance (90 percent) of the amount payable, less all previous payments, shall be certified for payment. Should the Contractor exercise his/her option, as provided in the subsection titled PAYMENT OF WITHHELD FUNDS of this section, no such 10 percent retainage shall be deducted.

When not less than 95 percent of the work has been completed, the Engineer may, at the Owner's discretion and with the consent of the surety, prepare an estimate from which will be retained an amount not less than twice the contract value or estimated cost, whichever is greater, of the work remaining to be done. The remainder, less all previous payments and deductions, will then be certified for payment to the Contractor.

It is understood and agreed that the Contractor shall not be entitled to demand or receive partial payment based on quantities of work in excess of those provided in the proposal or covered by approved change orders or supplemental agreements, except when such excess quantities have been determined by the Engineer to be a part of the final quantity for the item of work in question.

No partial payment shall bind the Owner to the acceptance of any materials or work in place as to quality or quantity. All partial payments are subject to correction at the time of final payment as provided in the subsection titled ACCEPTANCE AND FINAL PAYMENT of this section.

The Contractor shall deliver to the Owner a complete release of all claims for labor and material arising out of this contract before the final retained percentage or final payment is made. If any subcontractor or supplier fails to furnish such a release in full, the Contractor may furnish a bond or other collateral satisfactory to the Owner to indemnify the Owner against any potential lien or other such claim. The bond or collateral shall include all costs, expenses, and attorney fees the Owner may be compelled to pay in discharging any such lien or claim.

* *

In some areas, release of liens prior to paying the full amount to the prime contractor may void the contract. In those areas, revise the previous paragraph as required to meet all state and local regulations.

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90-07 PAYMENT FOR MATERIALS ON HAND. Partial payments may be made to the extent of the delivered cost of materials to be incorporated in the work, provided that such materials meet the requirements of the contract, plans, and specifications and are delivered to acceptable sites on the airport property or at other sites in the vicinity that are acceptable to the Owner. Such delivered costs of stored or stockpiled materials may be included in the next partial payment after the following conditions are met:

a. The material has been stored or stockpiled in a manner acceptable to the Engineer at or on an approved site.

b. The Contractor has furnished the Engineer with acceptable evidence of the quantity and quality of such stored or stockpiled materials.

c. The Contractor has furnished the Engineer with satisfactory evidence that the material and transportation costs have been paid.

d. The Contractor has furnished the Owner legal title (free of liens or encumbrances of any kind) to the material so stored or stockpiled.

e. The Contractor has furnished the Owner evidence that the material so stored or stockpiled is insured against loss by damage to or disappearance of such materials at anytime prior to use in the work.

It is understood and agreed that the transfer of title and the Owner's payment for such stored or stockpiled materials shall in no way relieve the Contractor of his/her responsibility for furnishing and placing such materials in accordance with the requirements of the contract, plans, and specifications.

In no case will the amount of partial payments for materials on hand exceed the contract price for such materials or the contract price for the contract item in which the material is intended to be used.

No partial payment will be made for stored or stockpiled living or perishable plant materials.

The Contractor shall bear all costs associated with the partial payment of stored or stockpiled materials in accordance with the provisions of this subsection.

90-08 PAYMENT OF WITHHELD FUNDS. At the Contractor's option, he/she may request that the Owner accept (in lieu of the 10 percent retainage on partial payments described in the subsection titled PARTIAL PAYMENTS of this section) the Contractor's deposits in escrow under the following conditions.

a. The Contractor shall bear all expenses of establishing and maintaining an escrow account and escrow agreement acceptable to the Owner.

b. The Contractor shall deposit to and maintain in such escrow only those securities or bank certificates of deposit as are acceptable to the Owner and having a value not less than the 10 percent retainage that would otherwise be withheld from partial payment.

c. The Contractor shall enter into an escrow agreement satisfactory to the Owner.

d. The Contractor shall obtain the written consent of the surety to such agreement.

90-09 ACCEPTANCE AND FINAL PAYMENT. When the contract work has been accepted in accordance with the requirements of the subsection titled FINAL ACCEPTANCE of Section 50, the Engineer will prepare the final estimate of the items of work actually performed. The Contractor shall approve the Engineer's final estimate or advise the Engineer of his/her objections to the final estimate which are based on disputes in measurements or computations of the final quantities to be paid under the contract as amended by change order or supplemental agreement. The Contractor and the Engineer shall resolve all disputes (if any) in the measurement and computation of final quantities to be paid within 30 calendar days of the Contractor's receipt of the Engineer's final estimate. If, after such 30-day period, a dispute still exists, the Contractor may approve the Engineer's estimate under protest of the quantities in dispute, and such disputed quantities shall be considered by the Owner as a claim in accordance with the subsection titled CLAIMS FOR ADJUSTMENT AND DISPUTES of Section 50.

After the Contractor has approved, or approved under protest, the Engineer's final estimate, final payment will be processed based on the entire sum, or the undisputed sum in case of approval under protest, determined to be due the Contractor less all previous payments and all amounts to be deducted under the provisions of the contract. All prior partial estimates and payments shall be subject to correction in the final estimate and payment.

If the Contractor has filed a claim for additional compensation under the provisions of the subsection titled CLAIMS FOR ADJUSTMENTS AND DISPUTES of Section 50 or under the provisions of this subsection, such claims will be considered by the Owner in accordance with local laws or ordinances. Upon final adjudication of such claims, any additional payment determined to be due the Contractor will be paid pursuant to a supplemental final estimate.

END OF SECTION 90

SECTION 100
CONTRACTOR QUALITY CONTROL PROGRAM

100-01 GENERAL. When the specification requires a Contractor Quality Control Program, the Contractor shall establish, provide, and maintain an effective Quality Control Program that details the methods and procedures that will be taken to assure that all materials and completed construction required by this contract conform to contract plans, technical specifications and other requirements, whether manufactured by the Contractor, or procured from subcontractors or vendors. Although guidelines are established and certain minimum requirements are specified herein and elsewhere in the contract technical specifications, the Contractor shall assume full responsibility for accomplishing the stated purpose.

The intent of this section is to enable the Contractor to establish a necessary level of control that will:

a. Adequately provide for the production of acceptable quality materials.

b. Provide sufficient information to assure both the Contractor and the Engineer that the specification requirements can be met.

c. Allow the Contractor as much latitude as possible to develop his or her own standard of control.

The Contractor shall be prepared to discuss and present, at the preconstruction conference, his/her understanding of the quality control requirements. The Contractor shall not begin any construction or production of materials to be incorporated into the completed work until the Quality Control Program has been reviewed by the Engineer. No partial payment will be made for materials subject to specific quality control requirements until the Quality Control Program has been reviewed.

The quality control requirements contained in this section and elsewhere in the contract technical specifications are in addition to and separate from the acceptance testing requirements. Acceptance testing requirements are the responsibility of the Engineer.

100-02 DESCRIPTION OF PROGRAM.

a. General Description. The Contractor shall establish a Quality Control Program to perform inspection and testing of all items of work required by the technical specifications, including those performed by subcontractors. This Quality Control Program shall ensure conformance to applicable specifications and plans with respect to materials, workmanship, construction, finish, and functional performance. The Quality Control Program shall be effective for control of all construction work performed under this Contract and shall specifically include surveillance and tests required by the technical specifications, in addition to other requirements of this section and any other activities deemed necessary by the Contractor to establish an effective level of quality control.

b. Quality Control Program. The Contractor shall describe the Quality Control Program in a written document that shall be reviewed by the Engineer prior to the start of any production, construction, or off-site fabrication. The written Quality Control Program shall be submitted to the Engineer for review at least **[ ]** calendar days before
the **[ ]**.

* * * *

Submittal of the written Quality Control Program prior to the start of work will allow for detailed discussion of the requirements at the preconstruction meeting. This will give the Contractor a better understanding of the requirements before developing the Quality Control Program.

When selecting the required days for the contractor to submit the Quality Control program, adequate time should be allowed for the Quality Control Program to be a supplement to the Owner's Construction Management Plan.

* * * *

(3) An individual with 3 years of highway and/or airport paving experience acceptable to the Engineer, with a Bachelor of Science Degree in Civil Engineering, Civil Engineering Technology or Construction.

(4) Construction materials technician certified at Level III by the National Institute for Certification in Engineering Technologies (NICET).

(5) Highway materials technician certified at Level III by NICET.

(6) Highway construction technician certified at Level III by NICET.

(7) A NICET certified engineering technician in Civil Engineering Technology with 5 years of highway and/or airport paving experience acceptable to the Engineer.

The Program Administrator shall have full authority to institute any and all actions necessary for the successful implementation of the Quality Control Program to ensure compliance with the contract plans and technical specifications. The Program Administrator shall report directly to a responsible officer of the construction firm. The Program Administrator may supervise the Quality Control Program on more than one project provided that person can be at the job site within 2 hours after being notified of a problem.

* * * *

Contractor of overall responsibility for scheduling, sequencing, and coordinating all work to comply with the requirements of the contract.

100-05 SUBMITTALS SCHEDULE. The Contractor shall submit a detailed listing of all submittals (e.g., mix designs, material certifications) and shop drawings required by the technical specifications. The listing can be developed in a spreadsheet format and shall include:

a. Specification item number;
b. Item description;
c. Description of submittal;
d. Specification paragraph requiring submittal; and
e. Scheduled date of submittal.

100-06 INSPECTION REQUIREMENTS. Quality control inspection functions shall be organized to provide inspections for all definable features of work, as detailed below. All inspections shall be documented by the Contractor as specified by Section 100-07.

Inspections shall be performed daily to ensure continuing compliance with contract requirements until completion of the particular feature of work. These shall include the following minimum requirements:

a. During plant operation for material production, quality control test results and periodic inspections shall be utilized to ensure the quality of aggregates and other mix components, and to adjust and control mix proportioning to meet the approved mix design and other requirements of the technical specifications. All equipment utilized in proportioning and mixing shall be inspected to ensure its proper operating condition. The Quality Control Program shall detail how these and other quality control functions will be accomplished and utilized.

b. During field operations, quality control test results and periodic inspections shall be utilized to ensure the quality of all materials and workmanship. All equipment utilized in placing, finishing, and compacting shall be inspected to ensure its proper operating condition and to ensure that all such operations are in conformance to the technical specifications and are within the plan dimensions, lines, grades, and tolerances specified. The Program shall document how these and other quality control functions will be accomplished and utilized.

100-07 QUALITY CONTROL TESTING PLAN. As a part of the overall Quality Control Program, the Contractor shall implement a quality control testing plan, as required by the technical specifications. The testing plan shall include the minimum tests and test frequencies required by each technical specification Item, as well as any additional quality control tests that the Contractor deems necessary to adequately control production and/or construction processes.
The testing plan can be developed in a spreadsheet fashion and shall, as a minimum, include the following:

a. Specification item number (e.g., P-401);
b. Item description (e.g., Plant Mix Bituminous Pavements);
c. Test type (e.g., gradation, grade, asphalt content);
d. Test standard (e.g., ASTM or AASHTO test number, as applicable);
e. Test frequency (e.g., as required by technical specifications or minimum frequency when requirements are not stated);
f. Responsibility (e.g., plant technician); and
g. Control requirements (e.g., target, permissible deviations).

The testing plan shall contain a statistically-based procedure of random sampling for acquiring test samples in accordance with ASTM D 3665. The Engineer shall be provided the opportunity to witness quality control sampling and testing.

All quality control test results shall be documented by the Contractor as required by Section 100-08.

100-08 DOCUMENTATION. The Contractor shall maintain current quality control records of all inspections and tests performed. These records shall include factual evidence that the required inspections or tests have been

performed, including type and number of inspections or tests involved; results of inspections or tests; nature of defects, deviations, causes for rejection, etc.; proposed remedial action; and corrective actions taken.

These records must cover both conforming and defective or deficient features, and must include a statement that all supplies and materials incorporated in the work are in full compliance with the terms of the contract. Legible copies of these records shall be furnished to the Engineer daily. The records shall cover all work placed subsequent to the previously furnished records and shall be verified and signed by the Contractor's Program Administrator.

Specific Contractor quality control records required for the contract shall include, but are not necessarily limited to, the following records:

a. Daily Inspection Reports. Each Contractor quality control technician shall maintain a daily log of all inspections performed for both Contractor and subcontractor operations on a form acceptable to the Engineer. These technician's daily reports shall provide factual evidence that continuous quality control inspections have been performed and shall, as a minimum, include the following:

(1) Technical specification item number and description;
(2) Compliance with approved submittals;
(3) Proper storage of materials and equipment;
(4) Proper operation of all equipment;
(5) Adherence to plans and technical specifications;
(6) Review of quality control tests; and
(7) Safety inspection.

The daily inspection reports shall identify inspections conducted, results of inspections, location and nature of defects found, causes for rejection, and remedial or corrective actions taken or proposed.

The daily inspection reports shall be signed by the responsible quality control technician and the Program Administrator. The Engineer shall be provided at least one copy of each daily inspection report on the work day following the day of record.

b. Daily Test Reports. The Contractor shall be responsible for establishing a system that will record all quality control test results. Daily test reports shall document the following information:

(1) Technical specification item number and description;
(2) Test designation;
(3) Location;
(4) Date of test;
(5) Control requirements;
(6) Test results;
(7) Causes for rejection;
(8) Recommended remedial actions; and
(9) Retests.

Test results from each day's work period shall be submitted to the Engineer prior to the start of the next day's work period. When required by the technical specifications, the Contractor shall maintain statistical quality control charts. The daily test reports shall be signed by the responsible quality control technician and the Program Administrator.

100-09 CORRECTIVE ACTION REQUIREMENTS. The Quality Control Program shall indicate the appropriate action to be taken when a process is deemed, or believed, to be out of control (out of tolerance) and detail what action will be taken to bring the process into control. The requirements for corrective action shall include both general requirements for operation of the Quality Control Program as a whole, and for individual items of work contained in the technical specifications.

The Quality Control Program shall detail how the results of quality control inspections and tests will be used for determining the need for corrective action and shall contain clear sets of rules to gauge when a process is out of control and the type of correction to be taken to regain process control.

When applicable or required by the technical specifications, the Contractor shall establish and utilize statistical quality control charts for individual quality control tests. The requirements for corrective action shall be linked to the control charts.

100-10 SURVEILLANCE BY THE ENGINEER. All items of material and equipment shall be subject to surveillance by the Engineer at the point of production, manufacture or shipment to determine if the Contractor, producer, manufacturer or shipper maintains an adequate quality control system in conformance with the requirements detailed herein and the applicable technical specifications and plans. In addition, all items of materials, equipment and work in place shall be subject to surveillance by the Engineer at the site for the same purpose.

Surveillance by the Engineer does not relieve the Contractor of performing quality control inspections of either on-site or off-site Contractor's or subcontractor's work.

100-11 NONCOMPLIANCE.

a. The Engineer will notify the Contractor of any noncompliance with any of the foregoing requirements. The Contractor shall, after receipt of such notice, immediately take corrective action. Any notice, when delivered by the Engineer or his/her authorized representative to the Contractor or his/her authorized representative at the site of the work, shall be considered sufficient notice.

b. In cases where quality control activities do not comply with either the Contractor Quality Control Program or the contract provisions, or where the Contractor fails to properly operate and maintain an effective Quality Control Program, as determined by the Engineer, the Engineer may:

(1) Order the Contractor to replace ineffective or unqualified quality control personnel or subcontractors.

(2) Order the Contractor to stop operations until appropriate corrective actions are taken.

END OF SECTION 100

SECTION 110
METHOD OF ESTIMATING PERCENTAGE OF MATERIAL WITHIN SPECIFICATION LIMITS (PWL)

110-01 GENERAL. When the specifications provide for acceptance of material based on the method of estimating percentage of material within specification limits (PWL), the PWL will be determined in accordance with this section. All test results for a lot will be analyzed statistically to determine the total estimated percent of the lot that is within specification limits. The PWL is computed using the sample average (X) and sample standard deviation (S_n) of the specified number (n) of sublots for the lot and the specification tolerance limits, L for lower and U for upper, for the particular acceptance parameter. From these values, the respective Quality index(s), Q_L for Lower Quality Index and/or Q_U for Upper Quality Index, is computed and the PWL for the lot for the specified n is determined from Table 1. All specification limits specified in the technical sections shall be absolute values. Test results used in the calculations shall be to the significant figure given in the test procedure.

There is some degree of uncertainty (risk) in the measurement for acceptance because only a small fraction of production material (the population) is sampled and tested. This uncertainty exists because all portions of the production material have the same probability to be randomly sampled. The Contractor's risk is the probability that material produced at the acceptable quality level is rejected or subjected to a pay adjustment. The Owner's risk is the probability that material produced at the rejectable quality level is accepted.

IT IS THE INTENT OF THIS SECTION TO INFORM THE CONTRACTOR THAT, IN ORDER TO CONSISTENTLY OFFSET THE CONTRACTOR'S RISK FOR MATERIAL EVALUATED, PRODUCTION QUALITY (USING POPULATION AVERAGE AND POPULATION STANDARD DEVIATION) MUST BE MAINTAINED AT THE ACCEPTABLE QUALITY SPECIFIED OR HIGHER. IN ALL CASES, IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO PRODUCE AT QUALITY LEVELS THAT WILL MEET THE SPECIFIED ACCEPTANCE CRITERIA WHEN SAMPLED AND TESTED AT THE FREQUENCIES SPECIFIED.

* *

Paragraph 110-01 shall be included verbatim in all projects.

* *

110-02 METHOD FOR COMPUTING PWL. The computational sequence for computing PWL is as follows:

a. Divide the lot into n sublots in accordance with the acceptance requirements of the specification.

b. Locate the random sampling position within the sublot in accordance with the requirements of the specification.

c. Make a measurement at each location, or take a test portion and make the measurement on the test portion in accordance with the testing requirements of the specification.

d. Find the sample average (X) for all sublot values within the lot by using the following formula:

$$X = (x_1 + x_2 + x_3 + \ldots x_n) / n$$

Where: X = Sample average of all sublot values within a lot
x_1, x_2 = Individual sublot values
n = Number of sublots

e. Find the sample standard deviation (S_n) by use of the following formula:

$$S_n = [(d_1^2 + d_2^2 + d_3^2 + \ldots d_n^2)/(n-1)]^{1/2}$$

Where: S_n = Sample standard deviation of the number of sublot values in the set
$d_1, d_2,$ = Deviations of the individual sublot values $x_1, x_2, \ldots$ from the average value X

that is: $d_1 = (x_1 - X)$, $d_2 = (x_2 - X)$ … $d_n = (x_n - X)$

n = Number of sublots

f. For single sided specification limits (i.e., L only), compute the Lower Quality Index Q_L by use of the following formula:

$Q_L = (X - L) / S_n$

Where: L = specification lower tolerance limit

Estimate the percentage of material within limits (PWL) by entering Table 1 with Q_L, using the column appropriate to the total number (n) of measurements. If the value of Q_L falls between values shown on the table, use the next higher value of PWL.

g. For double-sided specification limits (i.e. L and U), compute the Quality Indexes Q_L and Q_U by use of the following formulas:

$Q_L = (X - L) / Sn$ and $Q_U = (U - X) / Sn$

Where: L and U = specification lower and upper tolerance limits

Estimate the percentage of material between the lower (L) and upper (U) tolerance limits (PWL) by entering Table 1 separately with Q_L and Q_U, using the column appropriate to the total number (n) of measurements, and determining the percent of material above P_L and percent of material below P_U for each tolerance limit. If the values of Q_L fall between values shown on the table, use the next higher value of P_L or P_U. Determine the PWL by use of the following formula:

$PWL = (P_U + P_L) - 100$

Where: P_L = percent within lower specification limit
P_U = percent within upper specification limit

EXAMPLE OF PWL CALCULATION

Project: Example Project
Test Item: Item P-401, Lot A.

A. PWL Determination for Mat Density.

1. Density of four random cores taken from Lot A.

A-1 96.60
A-2 97.55
A-3 99.30
A-4 98.35
n = 4

2. Calculate average density for the lot.

X = (x1 + x2 + x3 + . . .xn) / n
X = (96.60 + 97.55 + 99.30 + 98.35) / 4
X = 97.95 percent density

3. Calculate the standard deviation for the lot.

$Sn = [((96.60 - 97.95)^2 + (97.55 - 97.95)^2 + (99.30 - 97.95)^2 + (98.35 - 97.95)^2)) / (4 - 1)]^{1/2}$
$Sn = [(1.82 + 0.16 + 1.82 + 0.16) / 3]^{1/2}$
$Sn = 1.15$

4. Calculate the Lower Quality Index Q_L for the lot. (L=96.3)

$Q_L = (X - L) / Sn$
$Q_L = (97.95 - 96.30) / 1.15$
$Q_L = 1.4348$

5. Determine PWL by entering Table 1 with $Q_L = 1.44$ and n= 4.

PWL = 98

B. PWL Determination for Air Voids.

1. Air Voids of four random samples taken from Lot A.

A-1	5.00
A-2	3.74
A-3	2.30
A-4	3.25

2. Calculate the average air voids for the lot.

$X = (x1 + x + x3 . . .n) / n$

$X = (5.00 + 3.74 + 2.30 + 3.25) / 4$

$X = 3.57$ percent

3. Calculate the standard deviation Sn for the lot.

$Sn = [((3.57 - 5.00)^2 + (3.57 - 3.74)^2 + (3.57 - 2.30)^2 + (3.57 - 3.25)^2) / (4 - 1)]^{1/2}$

$Sn = [(2.04 + 0.03 + 1.62 + 0.10) / 3]^{1/2}$

$Sn = 1.12$

4. Calculate the Lower Quality Index Q_L for the lot. (L= 2.0)

$Q_L = (X - L) / Sn$

$Q_L = (3.57 - 2.00) / 1.12$

$Q_L = 1.3992$

5. Determine P_L by entering Table 1 with $Q_L = 1.41$ and n = 4.

PL = 97

6. Calculate the Upper Quality Index Q_U for the lot. (U= 5.0)

$Q_U = (U - X) / Sn$

$Q_U = (5.00 - 3.57) / 1.12$

$Q_U = 1.2702$

7. Determine P_U by entering Table 1 with $Q_U = 1.29$ and n = 4.

$P_U = 93$

8. Calculate Air Voids PWL

$PWL = (P_L + P_U) - 100$

$PWL = (97 + 93) - 100 = 90$

EXAMPLE OF OUTLIER CALCULATION (Reference ASTM E 178)

Project: Example Project
Test Item: Item P-401, Lot A.

A. Outlier Determination for Mat Density.

1. Density of four random cores taken from Lot A. arranged in descending order.

A-3 99.30
A-4 98.35
A-2 97.55
A-1 96.60

2. Use n=4 and upper 5 percent significance level of to find the critical value for test criterion = 1.463.

3. Use average density, standard deviation, and test criterion value to evaluate density measurements.

a. For measurements greater than the average:
If: (measurement - average)/(standard deviation) is less than test criterion,
Then: the measurement is not considered an outlier

for A-3 Check if (99.30 - 97.95) / 1.15 greater than 1.463
1.174 is less than 1.463, the value is not an outlier

b. For measurements less than the average:
If (average - measurement)/(standard deviation) is less than test criterion,
the measurement is not considered an outlier

for A-1 Check if (97.95 - 96.60) / 1.15 greater than 1.463
1.0 is less than 1.463, the value is not an outlier

NOTE: In this example, a measurement would be considered an outlier if the density was:
greater than (97.95+1.463x1.15) = 99.63 percent or,
less than (97.95-1.463x1.15) = 96.27 percent

TABLE 1. TABLE FOR ESTIMATING PERCENT OF LOT WITHIN LIMITS (PWL)

Percent Within Limits (P_L and P_U)	Positive Values of Q (Q_L and Q_U)							
	n=3	n=4	n=5	n=6	n=7	n=8	n=9	n=10
99	1.1541	1.4700	1.6714	1.8008	1.8888	1.9520	1.9994	2.0362
98	1.1524	1.4400	1.6016	1.6982	1.7612	1.8053	1.8379	1.8630
97	1.1496	1.4100	1.5427	1.6181	1.6661	1.6993	1.7235	1.7420
96	1.1456	1.3800	1.4897	1.5497	1.5871	1.6127	1.6313	1.6454
95	1.1405	1.3500	1.4407	1.4887	1.5181	1.5381	1.5525	1.5635
94	1.1342	1.3200	1.3946	1.4329	1.4561	1.4717	1.4829	1.4914
93	1.1269	1.2900	1.3508	1.3810	1.3991	1.4112	1.4199	1.4265
92	1.1184	1.2600	1.3088	1.3323	1.3461	1.3554	1.3620	1.3670
91	1.1089	1.2300	1.2683	1.2860	1.2964	1.3032	1.3081	1.3118
90	1.0982	1.2000	1.2290	1.2419	1.2492	1.2541	1.2576	1.2602
89	1.0864	1.1700	1.1909	1.1995	1.2043	1.2075	1.2098	1.2115
88	1.0736	1.1400	1.1537	1.1587	1.1613	1.1630	1.1643	1.1653
87	1.0597	1.1100	1.1173	1.1192	1.1199	1.1204	1.1208	1.1212
86	1.0448	1.0800	1.0817	1.0808	1.0800	1.0794	1.0791	1.0789
85	1.0288	1.0500	1.0467	1.0435	1.0413	1.0399	1.0389	1.0382
84	1.0119	1.0200	1.0124	1.0071	1.0037	1.0015	1.0000	0.9990
83	0.9939	0.9900	0.9785	0.9715	0.9671	0.9643	0.9624	0.9610
82	0.9749	0.9600	0.9452	0.9367	0.9315	0.9281	0.9258	0.9241
81	0.9550	0.9300	0.9123	0.9025	0.8966	0.8928	0.8901	0.8882
80	0.9342	0.9000	0.8799	0.8690	0.8625	0.8583	0.8554	0.8533
79	0.9124	0.8700	0.8478	0.8360	0.8291	0.8245	0.8214	0.8192
78	0.8897	0.8400	0.8160	0.8036	0.7962	0.7915	0.7882	0.7858
77	0.8662	0.8100	0.7846	0.7716	0.7640	0.7590	0.7556	0.7531
76	0.8417	0.7800	0.7535	0.7401	0.7322	0.7271	0.7236	0.7211
75	0.8165	0.7500	0.7226	0.7089	0.7009	0.6958	0.6922	0.6896
74	0.7904	0.7200	0.6921	0.6781	0.6701	0.6649	0.6613	0.6587
73	0.7636	0.6900	0.6617	0.6477	0.6396	0.6344	0.6308	0.6282
72	0.7360	0.6600	0.6316	0.6176	0.6095	0.6044	0.6008	0.5982
71	0.7077	0.6300	0.6016	0.5878	0.5798	0.5747	0.5712	0.5686
70	0.6787	0.6000	0.5719	0.5582	0.5504	0.5454	0.5419	0.5394
69	0.6490	0.5700	0.5423	0.5290	0.5213	0.5164	0.5130	0.5105
68	0.6187	0.5400	0.5129	0.4999	0.4924	0.4877	0.4844	0.4820
67	0.5878	0.5100	0.4836	0.4710	0.4638	0.4592	0.4560	0.4537
66	0.5563	0.4800	0.4545	0.4424	0.4355	0.4310	0.4280	0.4257
65	0.5242	0.4500	0.4255	0.4139	0.4073	0.4030	0.4001	0.3980
64	0.4916	0.4200	0.3967	0.3856	0.3793	0.3753	0.3725	0.3705
63	0.4586	0.3900	0.3679	0.3575	0.3515	0.3477	0.3451	0.3432
62	0.4251	0.3600	0.3392	0.3295	0.3239	0.3203	0.3179	0.3161
61	0.3911	0.3300	0.3107	0.3016	0.2964	0.2931	0.2908	0.2892
60	0.3568	0.3000	0.2822	0.2738	0.2691	0.2660	0.2639	0.2624
59	0.3222	0.2700	0.2537	0.2461	0.2418	0.2391	0.2372	0.2358
58	0.2872	0.2400	0.2254	0.2186	0.2147	0.2122	0.2105	0.2093
57	0.2519	0.2100	0.1971	0.1911	0.1877	0.1855	0.1840	0.1829
56	0.2164	0.1800	0.1688	0.1636	0.1607	0.1588	0.1575	0.1566
55	0.1806	0.1500	0.1406	0.1363	0.1338	0.1322	0.1312	0.1304
54	0.1447	0.1200	0.1125	0.1090	0.1070	0.1057	0.1049	0.1042
53	0.1087	0.0900	0.0843	0.0817	0.0802	0.0793	0.0786	0.0781
52	0.0725	0.0600	0.0562	0.0544	0.0534	0.0528	0.0524	0.0521
51	0.0363	0.0300	0.0281	0.0272	0.0267	0.0264	0.0262	0.0260
50	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

TABLE 1. TABLE FOR ESTIMATING PERCENT OF LOT WITHIN LIMITS (PWL)

Percent Within Limits (P_L and P_U)	Negative Values of Q (Q_L and Q_U)							
	n=3	n=4	n=5	n=6	n=7	n=8	n=9	n=10
49	-0.0363	-0.0300	-0.0281	-0.0272	-0.0267	-0.0264	-0.0262	-0.0260
48	-0.0725	-0.0600	-0.0562	-0.0544	-0.0534	-0.0528	-0.0524	-0.0521
47	-0.1087	-0.0900	-0.0843	-0.0817	-0.0802	-0.0793	-0.0786	-0.0781
46	-0.1447	-0.1200	-0.1125	-0.1090	-0.1070	-0.1057	-0.1049	-0.1042
45	-0.1806	-0.1500	-0.1406	-0.1363	-0.1338	-0.1322	-0.1312	-0.1304
44	-0.2164	-0.1800	-0.1688	-0.1636	-0.1607	-0.1588	-0.1575	-0.1566
43	-0.2519	-0.2100	-0.1971	-0.1911	-0.1877	-0.1855	-0.1840	-0.1829
42	-0.2872	-0.2400	-0.2254	-0.2186	-0.2147	-0.2122	-0.2105	-0.2093
41	-0.3222	-0.2700	-0.2537	-0.2461	-0.2418	-0.2391	-0.2372	-0.2358
40	-0.3568	-0.3000	-0.2822	-0.2738	-0.2691	-0.2660	-0.2639	-0.2624
39	-0.3911	-0.3300	-0.3107	-0.3016	-0.2964	-0.2931	-0.2908	-0.2892
38	-0.4251	-0.3600	-0.3392	-0.3295	-0.3239	-0.3203	-0.3179	-0.3161
37	-0.4586	-0.3900	-0.3679	-0.3575	-0.3515	-0.3477	-0.3451	-0.3432
36	-0.4916	-0.4200	-0.3967	-0.3856	-0.3793	-0.3753	-0.3725	-0.3705
35	-0.5242	-0.4500	-0.4255	-0.4139	-0.4073	-0.4030	-0.4001	-0.3980
34	-0.5563	-0.4800	-0.4545	-0.4424	-0.4355	-0.4310	-0.4280	-0.4257
33	-0.5878	-0.5100	-0.4836	-0.4710	-0.4638	-0.4592	-0.4560	-0.4537
32	-0.6187	-0.5400	-0.5129	-0.4999	-0.4924	-0.4877	-0.4844	-0.4820
31	-0.6490	-0.5700	-0.5423	-0.5290	-0.5213	-0.5164	-0.5130	-0.5105
30	-0.6787	-0.6000	-0.5719	-0.5582	-0.5504	-0.5454	-0.5419	-0.5394
29	-0.7077	-0.6300	-0.6016	-0.5878	-0.5798	-0.5747	-0.5712	-0.5686
28	-0.7360	-0.6600	-0.6316	-0.6176	-0.6095	-0.6044	-0.6008	-0.5982
27	-0.7636	-0.6900	-0.6617	-0.6477	-0.6396	-0.6344	-0.6308	-0.6282
26	-0.7904	-0.7200	-0.6921	-0.6781	-0.6701	-0.6649	-0.6613	-0.6587
25	-0.8165	-0.7500	-0.7226	-0.7089	-0.7009	-0.6958	-0.6922	-0.6896
24	-0.8417	-0.7800	-0.7535	-0.7401	-0.7322	-0.7271	-0.7236	-0.7211
23	-0.8662	-0.8100	-0.7846	-0.7716	-0.7640	-0.7590	-0.7556	-0.7531
22	-0.8897	-0.8400	-0.8160	-0.8036	-0.7962	-0.7915	-0.7882	-0.7858
21	-0.9124	-0.8700	-0.8478	-0.8360	-0.8291	-0.8245	-0.8214	-0.8192
20	-0.9342	-0.9000	-0.8799	-0.8690	-0.8625	-0.8583	-0.8554	-0.8533
19	-0.9550	-0.9300	-0.9123	-0.9025	-0.8966	-0.8928	-0.8901	-0.8882
18	-0.9749	-0.9600	-0.9452	-0.9367	-0.9315	-0.9281	-0.9258	-0.9241
17	-0.9939	-0.9900	-0.9785	-0.9715	-0.9671	-0.9643	-0.9624	-0.9610
16	-1.0119	-1.0200	-1.0124	-1.0071	-1.0037	-1.0015	-1.0000	-0.9990
15	-1.0288	-1.0500	-1.0467	-1.0435	-1.0413	-1.0399	-1.0389	-1.0382
14	-1.0448	-1.0800	-1.0817	-1.0808	-1.0800	-1.0794	-1.0791	-1.0789
13	-1.0597	-1.1100	-1.1173	-1.1192	-1.1199	-1.1204	-1.1208	-1.1212
12	-1.0736	-1.1400	-1.1537	-1.1587	-1.1613	-1.1630	-1.1643	-1.1653
11	-1.0864	-1.1700	-1.1909	-1.1995	-1.2043	-1.2075	-1.2098	-1.2115
10	-1.0982	-1.2000	-1.2290	-1.2419	-1.2492	-1.2541	-1.2576	-1.2602
9	-1.1089	-1.2300	-1.2683	-1.2860	-1.2964	-1.3032	-1.3081	-1.3118
8	-1.1184	-1.2600	-1.3088	-1.3323	-1.3461	-1.3554	-1.3620	-1.3670
7	-1.1269	-1.2900	-1.3508	-1.3810	-1.3991	-1.4112	-1.4199	-1.4265
6	-1.1342	-1.3200	-1.3946	-1.4329	-1.4561	-1.4717	-1.4829	-1.4914
5	-1.1405	-1.3500	-1.4407	-1.4887	-1.5181	-1.5381	-1.5525	-1.5635
4	-1.1456	-1.3800	-1.4897	-1.5497	-1.5871	-1.6127	-1.6313	-1.6454
3	-1.1496	-1.4100	-1.5427	-1.6181	-1.6661	-1.6993	-1.7235	-1.7420
2	-1.1524	-1.4400	-1.6016	-1.6982	-1.7612	-1.8053	-1.8379	-1.8630
1	-1.1541	-1.4700	-1.6714	-1.8008	-1.8888	-1.9520	-1.9994	-2.0362

END OF SECTION 110

SECTION 120
NUCLEAR GAGES

120-01 TESTING. When the specifications provide for nuclear gage acceptance testing of material for Items P-152, P-154, P-208, and P-209, the testing shall be performed in accordance with this section. At each sampling location, the field density shall be determined in accordance with ASTM D 2922 using the Direct Transmission Method. The nuclear gage shall be calibrated in accordance with Annex A1. Calibration and operation of the gage shall be in accordance with the requirements of the manufacturer. The operator of the nuclear gage must show evidence of training and experience in the use of the instrument. The gage shall be standardized daily in accordance with ASTM D 2922, paragraph 8.

Use of ASTM D 2922 results in a wet unit weight, and when using this method, ASTM D 3017 shall be used to determine the moisture content of the material. The moisture gage shall be standardized daily in accordance with ASTM D 3017, paragraph 7.

The material shall be accepted on a lot basis. Each Lot shall be divided into eight (8) sublots when ASTM D 2922 is used.

120-02. When PWL concepts are incorporated, compaction shall continue until a PWL of 90 percent or more is achieved using the lower specification tolerance limits (L) below.

The percentage of material within specification limits (PWL) shall be determined in accordance with the procedures specified in Section 110 of the General Provisions.

The lower specification tolerance limit (L) for density shall be:

Specification Item Number	Specification Tolerance (L) for Density, (percent of laboratory maximum)	
Item P-152	90.5 for cohesive material,	95.5 for non-cohesive
Item P-154	95.5	
Item P-208	97.0	
Item P-209	97.0	

If the PWL is less than 90 percent, the lot shall be reworked and recompacted by the Contractor at the Contractor's expense. After reworking and recompaction, the lot shall be resampled and retested. Retest results for the lot shall be reevaluated for acceptance. This procedure shall continue until the PWL is 90 percent or greater.

120-03 VERIFICATION TESTING. (For Items P-152 and P-154 only.) The Engineer will verify the maximum laboratory density of material placed in the field for each lot. A minimum of one test will be made for each lot of material at the site. The verification process will consist of; (1) compacting the material and determining the dry density and moisture-density in accordance with [ASTM D 698 for aircraft gross weights less than 60,0000 pounds] [ASTM D 1557 for aircraft gross weights 60,000 pounds or more], and (2) comparing the result with the laboratory moisture-density curves for the material being placed. This verification process is commonly referred to as a "one-point Proctor". If the material does not conform to the existing moisture-density curves, the Engineer will establish the laboratory maximum density and optimum moisture content for the material in accordance with [ASTM D 698 for aircraft gross weights less than 60,0000 pounds] [ASTM D 1557 for aircraft gross weights 60,000 pounds or more].

Additional verification tests will be made, if necessary, to properly classify all materials placed in the lot.

The percent compaction of each sampling location will be determined by dividing the field density of each sublot by the laboratory maximum density for the lot.

END OF SECTION 120

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PART II – EARTHWORK
ITEM P-101 SURFACE PREPARATION

DESCRIPTION

101-1.1. This item shall consist of preparation of existing pavement surfaces for overlay, removal of existing pavement, and other miscellaneous items. The work shall be accomplished in accordance with these specifications and the applicable drawings.

* *

For projects that involve preparing and repairing the existing pavement to accommodate an overlay, add the following ITEM P-101: SURFACE PREPARATION.

* *

EQUIPMENT

101-2.1. All equipment shall be specified hereinafter or as approved by the Engineer. The equipment shall not cause damage to the pavement to remain in place.

CONSTRUCTION

101-3.1. REMOVAL OF EXISTING PAVEMENT

a. Concrete: The existing concrete to be removed shall be freed from the pavement to remain unless jackhammers are used for the complete removal. This shall be accomplished by line drilling or sawing through the complete depth of the slab one foot inside the perimeter of the final removal limits or outside the load transfer devices, whichever is greater. In this case, the limits of removal would be located on joints. If line drilling is used, the distance between holes shall not exceed the diameter of the hole. The pavement between the perimeter of the pavement removal and the saw cut or line-drilled holes shall be removed with a jackhammer. Where the perimeter of the removal limits is not located on the joint, the perimeter shall be saw cut 2 inches in depth or 1/4 the slab thickness, whichever is less. Again, the concrete shall be line drilled or saw cut the full depth of the pavement 6 inches inside the removal limits. The pavement inside the saw cut or line shall be broken by methods suitable to the Contractor; however, if the material is to be wasted on the airport site, it shall be reduced to a maximum size designated by the airport owner. The Contractor's removal operation shall not cause damage to cables, utility ducts, pipelines, or drainage structures under the pavement. Any damage shall be repaired by the Contractor at no expense to the airport owner.

b. Asphaltic Concrete: Asphaltic concrete pavement to be removed shall be cut to the full depth of the bituminous material around the perimeter of the area to be removed. The pavement shall be removed in such a manner that the joint for each layer of pavement replacement is offset one foot from the joint in the preceding layer. This does not apply if the removed pavement is to be replaced with concrete or soil. If the material is to be wasted on the airport site, it shall be broken to a maximum size as designated by the airport owner.

101-3.2. PREPARATION OF JOINTS AND CRACKS. All joints and cracks in bituminous and concrete pavements to be overlaid with asphaltic concrete shall be cleaned of joint and crack sealer, debris, and vegetation. Any excess joint or crack sealer on the surface of the pavement shall also be removed from the pavement surface. If vegetation is a problem a soil sterilant shall be applied. Cracks and joints wider than 3/8 inch shall be filled with a mixture of emulsified asphalt and aggregate. The aggregate shall consist of limestone, volcanic ash, sand, or other material that will cure to form a hard substance. The combined gradation shall be as shown in Table 1.

TABLE 1

Sieve Size	Percent Passing
No. 4	100
No. 8	90-100
No. 16	65-90
No. 30	40-60
No. 50	25-42
No. 100	15-30
No. 200	10-20

Up to 3% cement can be added to accelerate the set time. The mixture shall not contain more than 20% natural sand without approval in writing from the Engineer.

The proportions of asphalt emulsion and aggregate shall be determined in the field and may be varied to facilitate construction requirements. Normally, these proportions will be approximately one part asphalt emulsion to five parts aggregate by volume. The material shall be poured into the joints or cracks or shall be placed in the joint or crack and compacted to form a voidless mass. The joint or crack shall be filled within 0 to 1/8 inch of the surface. Any material spilled outside the width of the joint shall be removed from the surface prior to constructing the overlay. Where concrete overlays are to be constructed, only the excess joint material on the surface and vegetation in the joints need to be removed.

101-3.3. REMOVAL OF PAINT AND RUBBER. All paint and rubber over one foot wide that will affect the bond of the new overlay shall be removed from the surface of the existing pavement. Chemicals, high-pressure water, heater scarifier (asphaltic concrete only), cold milling, or sandblasting may be used. Any methods used shall not cause major damage to the pavement. Major damage is defined as changing the properties of the pavement or removing pavement over 1/8 inch deep. If chemicals are used, they shall comply with the state's environmental protection regulations. No material shall be deposited on the runway shoulders. All wastes shall be disposed of in areas indicated in this specification or shown on the plans. This specification shall not be used for removal of rubber deposits to improve skid resistance or obliterate traffic markings where a new overlay is not to be constructed.

101-3.4. CONCRETE SPALL OR FAILED ASPHALTIC CONCRETE PAVEMENT REPAIR.

a. Repair of Concrete Spalls in Areas to be overlaid with Asphalt: The Contractors shall repair all spalled concrete as shown on the plans or as directed by the Resident Engineer. The perimeter of the repair shall be sawed a minimum of 1 inch deep or shall be cut with approved tools to this depth. The deteriorated material shall be removed to a depth where the existing material is firm or cannot be easily removed with a geologist pick. The removed area shall be filled with asphaltic concrete with a minimum Marshal stability of 1,200 lbs. and maximum flow of 20. The material shall be compacted with equipment approved by the Resident Engineer until the material is dense and no movement or marks can be noted. The material shall not be placed in lifts over 4 inches in depth. This method of repair applies only to pavement to be overlaid.

b. Asphaltic Concrete Pavement Repair: The failed areas shall be removed as specified in paragraph 101-3.1b. All failed material including surface, base course, subbase course, and subgrade shall be removed. The base course and subbase shall be replaced if it has been infiltrated with clay, silt, or other material affecting the load-bearing capacity. Materials and methods of construction shall comply with the other applicable sections of this specification.

101-3.5: COLD PLANING.

a. Patching: The machine shall be capable of cutting a vertical edge without chipping or spalling the edges of the pavement to remain. The machine shall have a positive method of controlling the depth of cut. The Engineer shall layout the area to be milled. The area shall be laid out with straightedges in increments of 1-foot widths. The area to be milled shall cover only the failed area. Any excessive area that is milled because the Contractor doesn't have the appropriate machine, or areas that are damaged because of his negligence, shall not be included in the measurement for payment.

b. Profiling, Grade Correction, or Surface Correction: The machine shall have a minimum width of 10 feet. It shall be equipped with electronic grade control devices on both sides that will cut the surface to the grade and tolerances specified. The machine shall cut vertical edges. A positive method of dust control shall be provided. The machine shall be capable of discharging the millings in a truck or leaving them in a defined windrow.

METHOD OF MEASUREMENT

101-4.1. MEASUREMENT.

a. General: If there is no quantity shown in the bidding schedule, the work covered by this section shall be considered as a subsidiary obligation of the Contractor covered under the other contract items. Only accepted work will be measured.

b. Pavement Removal: The unit of measurement for pavement removal shall be the number of square yards removed by the Contractor. Any pavement removed outside the limits of removal because the pavement was damaged by negligence on the part of the Contractor shall not be included in the measurement for payment.

c. Joint and Crack Repair: The unit of measurement for joint and crack repair shall be the linear foot of joint.

d. Paint and Rubber Removal: The unit of measurement for paint and rubber removal shall be the square foot.

e. Spall and Failed Asphaltic Concrete Pavement Repair:

(1) The unit of measure for concrete spall repair shall be the number of square feet. The average depth of the patch shall be agreed upon by the Contractor and the Resident Engineer. The quantity shall be divided in the following categories:

(a) 0 to 4 inches in average depth.

(b) 4 to 8 inches in average depth.

(c) Greater than 8 inches in average depth.

(2) The unit of measure for failed asphaltic concrete pavement shall be as follow:

(a) Asphaltic Concrete Square Yards.

(b) Base Course Square Yards.

(c) Subbase Course Square Yards.

(d) Subgrade Square Yards.

f. Cold Planing: The unit of measure for cold planing shall be the number square yards. The average depth of the cold planing shall be determined by the Engineer and the Contractor prior to accomplishment of the work. When surface correction is required, if the initial cut doesn't correct the condition, the Contractor shall re-plane the area and will be paid only once for the total depth of planning. The quantity shall be divided into the following categories:

(a) 0 to 2 inches

(b) 0 to 3 inches

(c) 0 to 4 inches

(d) 0 to 5 inches

(e) 0 to 6 inches

BASIS OF PAYMENT

101-5.1 PAYMENT. Payment shall be made at contract unit price for the unit of measurement as specified hereinbefore. This price shall be full compensation for furnishing all materials and for all preparation, hauling, and placing of the material and for all labor, equipment, tools, and incidentals necessary to complete this item.

END OF ITEM P-101

ITEM P-151 CLEARING AND GRUBBING

DESCRIPTION

151-1.1 This item shall consist of clearing or clearing and grubbing, including the disposal of materials, for all areas within the limits designated on the plans or as required by the Engineer.

Clearing shall consist of the cutting and removal of all trees, stumps, brush, logs, hedges, the removal of fences and other loose or projecting material from the designated areas. The grubbing of stumps and roots will not be required.

Clearing, when so designated, shall consist of the cutting and removal of isolated single trees or isolated groups of trees. The cutting of all the trees of this classification shall be in accordance with the requirements for the particular area being cleared, or as shown on the plans, or as directed by the Engineer. The trees shall be considered isolated when they are 40 feet (12 m) or more apart, with the exception of a small clump of approximately five trees or less.

Clearing and grubbing shall consist of clearing the surface of the ground of the designated areas of all trees, stumps, down timber, logs, snags, brush, undergrowth, hedges, heavy growth of grass or weeds, fences, structures, debris, and rubbish of any nature, natural obstructions or such material which in the opinion of the Engineer is unsuitable for the foundation of strips, pavements, or other required structures, including the grubbing of stumps, roots, matted roots, foundations, and the disposal from the project of all spoil materials resulting from clearing and grubbing by burning or otherwise.

CONSTRUCTION METHODS

151-2.1 GENERAL. The areas denoted on the plans to be cleared or cleared and grubbed shall be staked on the ground by the Engineer. The clearing and grubbing shall be done at a satisfactory distance in advance of the grading operations.

All spoil materials removed by clearing or by clearing and grubbing shall be disposed of by burning, when permitted by local laws, or by removal to approved disposal areas. When burning of material is permitted, it shall be burned under the constant care of competent watchmen so that the surrounding vegetation and other adjacent property will not be jeopardized. Burning shall be done in accordance with all applicable laws, ordinances, and regulations. Before starting any burning operations, the Contractor shall notify the agency having jurisdiction.

As far as practicable, waste concrete and masonry shall be placed on slopes of embankments or channels. When embankments are constructed of such material, this material shall be placed in accordance with requirements for formation of embankments. Any broken concrete or masonry that cannot be used in construction, and all other materials not considered suitable for use elsewhere, shall be disposed of by the Contractor. In no case shall any discarded materials be left in windrows or piles adjacent to or within the airport limits. The manner and location of disposal of materials shall be subject to the approval of the Engineer and shall not create an unsightly or objectionable view. When the Contractor is required to locate a disposal area outside the airport property limits at his/her own expense, he shall obtain and file with the Engineer, permission in writing from the property owner for the use of private property for this purpose.

If the plans or the specifications require the saving of merchantable timber, the Contractor shall trim the limbs and tops from designated trees, saw them into suitable lengths, and make the material available for removal by other agencies.

Any blasting necessary shall be done at the Contractor's responsibility, and the utmost care shall be taken not to endanger life or property.

The removal of existing structure and utilities required to permit orderly progress of work shall be accomplished by local agencies, unless otherwise shown on the plans. Whenever a telephone or telegraph pole, pipeline, conduit, sewer, roadway, or other utility is encountered and must be removed or relocated, the Contractor shall advise the Engineer who will notify the proper local authority or owner and attempt to secure prompt action.

151-2.2 CLEARING. The Contractor shall clear the staked or indicated area of all objectionable materials. Trees unavoidably falling outside the specified limits must be cut up, removed, and disposed of in a satisfactory manner. In order to minimize damage to trees that are to be left standing, trees shall be felled toward the center of area being cleared. The Contractor shall preserve and protect from injury all trees not to be removed. The trees, stumps, and brush shall be cut to a height of not more than 12 inches (300 mm) above the ground. The grubbing of stumps and roots will not be required.

When isolated trees are designated for clearing, the trees shall be classed in accordance with the butt diameter size as measured at a point 18 inches (45 cm) above the ground level or at a designated height specified in the proposal.

Fences shall be removed and disposed of when directed by the Engineer. Fence wire shall be neatly rolled and the wire and posts stored on the airport if they are to be used again, or stored at a designated location if the fence is to remain the property of a local owner or of a civic authority.

151-2.3 CLEARING AND GRUBBING. In areas designated to be cleared and grubbed, all stumps, roots, buried logs, brush, grass, and other unsatisfactory materials shall be removed, except where embankments exceeding 3-1/2 feet (105 cm) in depth are to be made outside of paved areas. In cases where such depth of embankments is to be made, all unsatisfactory materials shall be removed, but sound trees, stumps, and brush can be cut off within 6 inches (150 mm) above the ground and allowed to remain. Tap roots and other projections over 1-1/2 inches (37 mm) in diameter shall be grubbed out to a depth of at least 18 inches (45 cm) below the finished subgrade or slope elevation.

Any buildings and miscellaneous structures that are shown on the plans to be removed shall be demolished or removed, and all materials there from shall be disposed of either by burning or otherwise removed from the site. The remaining or existing foundations, wells, cesspools, and all like structures shall be destroyed by breaking out or breaking down the materials of which the foundations, wells, cesspools, etc., are built to a depth at least 2 feet (60 cm) below the existing surrounding ground. Any broken concrete, blocks, or other objectionable material that cannot be used in backfill shall be removed and disposed of. The holes or openings shall be backfilled with acceptable material and properly compacted.

All holes remaining after the grubbing operation in embankment areas shall have the sides broken down to flatten out the slopes, and shall be filled with acceptable material, moistened and properly compacted in layers to the density required in Item P-152. The same construction procedure shall be applied to all holes remaining after grubbing in excavation areas where the depth of holes exceeds the depth of the proposed excavation.

METHOD OF MEASUREMENT

151-3.1 The quantities of clearing or clearing and grubbing as shown by the limits on the plans or as ordered by the Engineer shall be the number of acres (square meters) or fractions thereof, of land specifically cleared or cleared and grubbed.

When isolated trees are designated for clearing, the quantities of trees, as determined in accordance with ranges of butt diameter size, measured at a point 18 inches (45 cm) above the ground level at the tree, shall be paid for according to the schedule of sizes as follows:

The number of trees:

From 0 to 2-1/2 feet (75 cm), butt diameter
From 2-1/2 to 5 feet (75 to 150 cm), butt diameter
For 5 feet (150 cm) or more, butt diameter

BASIS OF PAYMENT

151-4.1 Payment shall be made at the contract unit price per acre (square meter) for clearing. This price shall be full compensation for furnishing all materials and for all labor, equipment, tools, and incidentals necessary to complete the item.

151-4.2 Payment shall be made at the contract unit price for clearing isolated trees. This price shall be full compensation for furnishing all materials and for all labor, equipment, tools, and incidentals necessary to complete the item.

151-4.3 Payment shall be made at the contract unit price per acre (square meter) for clearing and grubbing. This price shall be full compensation for furnishing all materials and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-151-4.1 Clearing—per acre (square meter)
Item P-151-4.2 Clearing for isolated trees:
From 0 to 2-1/2 feet (75 cm) butt diameter, per tree
From 2-1/2 to 5 feet (75 to 150 cm) butt diameter, per tree
For 5 feet (150 cm) or more butt diameter, per tree
Item P-151-4.3 Clearing and grubbing—per acre (square meter)

END OF ITEM P-151

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ITEM P-152 EXCAVATION AND EMBANKMENT

DESCRIPTION

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

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

a. Unclassified Excavation. Unclassified excavation shall consist of the excavation and disposal of all material, regardless of its nature, which is not otherwise classified and paid for under the following items.

b. Rock Excavation. Rock excavation shall include all solid rock in ledges, in bedded deposits, in unstratified masses, and conglomerate deposits which are so firmly cemented they cannot be removed without blasting or using rippers. All boulders containing a volume of more than 1/2 cubic yard (0.4 cubic meter) will be classified as ``rock excavation."

c. Muck Excavation. Muck excavation shall consist of the removal and disposal of deposits or mixtures of soils and organic matter not suitable for foundation material. Muck shall include materials that will decay or produce subsidence in the embankment. It may be made up of decaying stumps, roots, logs, humus, or other material not satisfactory for incorporation in the embankment.

d. Drainage Excavation. Drainage excavation shall consist of all excavation made for the primary purpose of drainage and includes drainage ditches, such as intercepting, inlet or outlet; temporary levee construction; or any other type as shown on the plans.

e. Borrow Excavation. Borrow excavation shall consist of approved material required for the construction of embankment or for other portions of the work in excess of the quantity of usable material available from required excavations. Borrow material shall be obtained from areas within the limits of the airport property but outside the normal limits of necessary grading, or from areas outside the airport.

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

Those areas outside of the pavement areas in which the top layer of soil material has become compacted, by hauling or other activities of the Contractor shall be scarified and disked to a depth of 4 inches (100 mm), in order to loosen and pulverize the soil.

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

152-2.2 EXCAVATION. No excavation shall be started until the work has been staked out by the Contractor and the Engineer has obtained elevations and measurements of the ground surface. All suitable excavated material shall be used in the formation of embankment, subgrade, or for other purposes shown on the plans. All unsuitable material shall be disposed of as shown on the plans.

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

The grade shall be maintained so that the surface is well drained at all times. When necessary, temporary drains and drainage ditches shall be installed to intercept or divert surface water that may affect the work.

a. Selective Grading. When selective grading is indicated on the plans, the more suitable material as designated by the Engineer shall be used in constructing the embankment or in capping the pavement subgrade. If, at the time of excavation, it is not possible to place this material in its final location, it shall be stockpiled in approved areas so that it can be measured for payment for rehandling as specified in paragraph 3.3.

b. Undercutting. Rock, shale, hardpan, loose rock, boulders, or other material unsatisfactory for safety areas, subgrades, roads, shoulders, or any areas intended for turfing shall be excavated to a minimum depth of 12 inches (300 mm), or to the depth specified by the Engineer, below the subgrade. Muck, peat, matted roots, or other yielding material, unsatisfactory for subgrade foundation, shall be removed to the depth specified. Unsuitable materials shall be disposed of at locations shown on the plans. This excavated material shall be paid for at the contract unit price per cubic yard (per cubic meter) for **[ ]**. The excavated area shall be refilled with suitable material obtained from the grading operations or borrow areas and compacted to specified densities. The necessary refilling will constitute a part of the embankment. Where rock cuts are made and refilled with selected material, any pockets created in the rock surface shall be drained in accordance with the details shown on the plans.

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material was unavoidable and his/her decision shall be final. All overbreak shall be graded or removed by the Contractor and disposed of as directed; however, payment will not be made for the removal and disposal of overbreak that the Engineer determines as avoidable. Unavoidable overbreak will be classified as ``Unclassified Excavation."

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

e. Compaction Requirements. The subgrade under areas to be paved shall be compacted to a depth of **[ ]** and to a density of not less than **[ ]** percent of the maximum density as determined by ASTM **[ ].** The material to be compacted shall be within +/- 2 percent of optimum moisture content before rolled to obtain the prescribed compaction (except for expansive soils).

* * * *

In cuts, all loose or protruding rocks on the back slopes shall be barred loose or otherwise removed to line of finished grade of slope. All cut-and-fill slopes shall be uniformly dressed to the slope, cross section, and alignment shown on the plans or as directed by the Engineer.

Blasting will be permitted only when proper precautions are taken for the safety of all persons, the work, and the property. All damage done to the work or property shall be repaired at the Contractor's expense. All operations of the Contractor in connection with the transportation, storage, and use of explosives shall conform to all state and local regulations and explosive manufacturers' instructions, with applicable approved permits reviewed by the Engineer. Any approval given, however, will not relieve the Contractor of his/her responsibility in blasting operations.

Where blasting is approved, the Contractor shall employ a vibration consultant, approved by the Engineer, to advise on explosive charge weights per delay and to analyze records from seismograph recordings. The seismograph shall be capable of producing a permanent record of the three components of the motion in terms of particle velocity, and in addition shall be capable of internal dynamic calibration.

In each distinct blasting area, where pertinent factors affecting blast vibrations and their effects in the area remain the same, the Contractor shall submit a blasting plan of the initial blasts to the Engineer for approval. This plan must consist of hole size, depth, spacing, burden, type of explosives, type of delay sequence, maximum amount of explosive on any one delay period, depth of rock, and depth of overburden if any. The maximum explosive charge weights per delay included in the plan shall not be increased without the approval of the engineering.

The Contractor shall keep a record of each blast fired—its date, time and location; the amount of explosives used, maximum explosive charge weight per delay period, and, where necessary, seismograph records identified by instrument number and location.

These records shall be made available to the Engineer on a monthly basis or in tabulated form at other times as required.

152-2.3 BORROW EXCAVATION. Borrow area(s) within the airport property are indicated on the plans. Borrow excavation shall be made only at these designated locations and within the horizontal and vertical limits as staked or as directed.

When borrow sources are outside the boundaries of the airport property, it shall be the Contractor's responsibility to locate and obtain the supply, subject to the approval of the Engineer. The Contractor shall notify the Engineer, at least 15 days prior to beginning the excavation, so necessary measurements and tests can be made. All unsuitable material shall be disposed of by the Contractor. All borrow pits shall be opened up to expose the vertical face of various strata of acceptable material to enable obtaining a uniform product. Borrow pits shall be excavated to regular lines to permit accurate measurements, and they shall be drained and left in a neat, presentable condition with all slopes dressed uniformly.

152-2.4 DRAINAGE EXCAVATION. Drainage excavation shall consist of excavating for drainage ditches such as intercepting; inlet or outlet, for temporary levee construction; or for any other type as designed or as shown on the plans. The work shall be performed in the proper sequence with the other construction. All satisfactory material shall be placed in fills; unsuitable material shall be placed in waste areas or as directed. Intercepting ditches shall be constructed prior to starting adjacent excavation operations. All necessary work shall be performed to secure a finish true to line, elevation, and cross section.

The Contractor shall maintain ditches constructed on the project to the required cross section and shall keep them free of debris or obstructions until the project is accepted.

152-2.5 PREPARATION OF EMBANKMENT AREA. Where an embankment is to be constructed to a height of 4 feet (120 cm) or less, all sod and vegetable matter shall be removed from the surface upon which the embankment is to be placed, and the cleared surface shall be completely broken up by plowing or scarifying to a minimum depth of 6 inches (150 mm). This area shall then be compacted as indicated in paragraph 2.6. When the

height of fill is greater than 4 feet (120 cm), sod not required to be removed shall be thoroughly disked and recompacted to the density of the surrounding ground before construction of embankment.

Where embankments are to be placed on natural slopes steeper than 3 to 1, horizontal benches shall be constructed as shown on the plans.

* * * *

Include testing frequencies per square yard for density & moisture acceptance tests.

AASHTO T99 or T-180 (Moisture-Density) should be specified for soils that are expected to have more than 30% retained on the 3/4-inch sieve. The moisture-density relationship test procedures ASTM D 698 and D1557 are not applicable for materials with greater than 30 retained on the 3/4-inch sieve. A replacement procedure (ASTM D 4718) for the coarse material (greater than 3/4-inch) is used with ASTM methods but only until up to 30 percent is retained. Maximum density testing (ASTM D 4253) may be used but it also limits the material retained on the 1-1/2-inch sieve to 30 percent. The AASHTO T-99 and T-180 are similar to ASTM D 698 and D 1557, except they do not limit the replacement of the coarse material.

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directed and every effort shall be exerted to fill the voids with the finer material forming a dense, compact mass. Rock or boulders shall not be disposed of outside the excavation or embankment areas, except at places and in the manner designated by the Engineer.

When the excavated material consists predominantly of rock fragments of such size that the material cannot be placed in layers of the prescribed thickness without crushing, pulverizing or further breaking down the pieces, such material may be placed in the embankment as directed in layers not exceeding 2 feet (60 cm) in thickness. Each layer shall be leveled and smoothed with suitable leveling equipment and by distribution of spalls and finer fragments of rock. These type lifts shall not be constructed above an elevation 4 feet (120 cm) below the finished subgrade.

Frozen material shall not be placed in the embankment nor shall embankment be placed upon frozen material.

There will be no separate measurement of payment for compacted embankment, and all costs incidental to placing in layers, compacting, disking, watering, mixing, sloping, and other necessary operations for construction of embankments will be included in the contract price for excavation, borrow, or other items.

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152-2.10 TOPSOIL. When topsoil is specified or required as shown on the plans or under Item T-905, it shall be salvaged from stripping or other grading operations. The topsoil shall meet the requirements of Item T-905. If, at the time of excavation or stripping, the topsoil cannot be placed in its proper and final section of finished construction, the material shall be stockpiled at approved locations. Stockpiles shall not be placed within **[ ]** feet of runway pavement or **[ ]** feet of taxiway pavement and shall not be placed on areas that subsequently will require any excavation or embankment. If, in the judgment of the Engineer, it is practical to place the salvaged topsoil at the time of excavation or stripping, the material shall be placed in its final position without stockpiling or further rehandling.

* * * *

Final field cross sections shall be employed if the following changes have been made:

a. Plan width of embankments or excavations are changed by more than plus or minus 1.0 foot (0.3 meter); or

b. Plan elevations of embankments or excavations are changed by more than plus or minus 0.5 foot (0.15 meter).

BASIS OF PAYMENT

152-4.1 For ``Unclassified excavation" payment shall be made at the contract unit price per cubic yard (cubic meter). This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

152-4.2 For ``Rock Excavation" payment shall be made at the contract unit price per cubic yard (cubic meter). This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

152-4.3 For ``Muck Excavation" payment shall be made at the contract unit price per cubic yard (cubic meter). This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

152-4.4 For ``Drainage Excavation" payment shall be made at the contract unit price per cubic yard (cubic meter). This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

152-4.5 For ``Borrow Excavation" payment shall be made at the contract unit price per cubic yard (cubic meter). This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

152-4.6 For ``Stockpiled Material" payment shall be made at the contract unit price per cubic yard (cubic meter). This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

152-4.7 For ``Embankment in Place" payment shall be made at the contract unit price per cubic yard (cubic meter). This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-152-4.1 Unclassified Excavation—per cubic yard (cubic meter)

Item P-152-4.2 Rock Excavation—per cubic yard (cubic meter)

Item P-152-4.3 Muck Excavation—per cubic yard (cubic meter)

Item P-152-4.4 Drainage Excavation—per cubic yard (cubic meter)

Item P-152-4.5 Borrow Excavation—per cubic yard (cubic meter)

Item P-152-4.6 Stockpiled material—per cubic yard (cubic meter)

Item P-152-4.7 Embankment in Place—per cubic yard (cubic meter)

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ITEM P-153 CONTROLLED LOW-STRENGTH MATERIAL (CLSM)

DESCRIPTION

153.1.1 This item shall consist of furnishing, transporting, and placing a controlled low-strength material (CLSM) as flowable backfill in trenches or at other locations shown on the plans or as directed by the Engineer.

MATERIALS

153-2.1 MATERIALS

a. Portland Cement. Portland cement shall conform to the requirements of ASTM **[ ]** Type **[ ]**. If for any reason, cement becomes partially set or contains lumps of caked cement, it shall be rejected. Cement salvaged from discarded or used bags shall not be used.

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The Engineer shall specify one of the following : ASTM C 150 - Type I, II.

ASTM C 595 - Type IP, IS, S, I(PM).

* *

b. Fly Ash. Fly Ash shall conform to ASTM C 618, Class C or F.

c. Fine Aggregate (Sand). Fine aggregate shall conform to the requirements of ASTM C 33 except for aggregate gradation. Any aggregate gradation which produces performance characteristics of the CLSM specified herein will be accepted, except as follows.

Sieve Size	Percent Passing by weight
3/4 inch (19.0 mm)	100
No. 200 (0.075 mm)	0 - 12

d. Water. Water used in mixing shall be free of oil, salt, acid, alkali, sugar, vegetable matter, or other substances injurious to the finished product.

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Dyes and other methods of coloring the backfill material may be incorporated if desired.

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MIX DESIGN

153-3.1 PROPORTIONS. The contractor shall submit, to the Engineer, a mix design including the proportions and source of materials, admixtures, and dry cubic yard (cubic meter) batch weights. The mix shall contain a minimum of 50 pounds of cement and 250 pounds fly ash per cubic yard (30 kg of cement and 148 kg of fly ash per cubic meter), with the remainder of the volume composed of sand, water, and any approved admixtures.

a. Compressive Strength. CLSM shall be designed to achieve a 28-day compressive strength of 100 to 200 psi (690 to 3 680 kPa)when tested in accordance with ASTM C 39. There should be no significant strength gain after 28 days. Test specimens shall be made in accordance with ASTM C 31 except that the samples will not be rodded or vibrated and shall be air cured in their molds for the duration of the cure period.

b. Consistency. Consistency of the fresh mixture shall be such that the mixture may be placed without segregation. A desired consistency may be approximated by filling an open-ended three-inch (75 mm) diameter cylinder, six inches (150 mm) high to the top, with the mixture and the cylinder immediately pulled straight up. The correct consistency of the mixture will produce an approximate eight-inch (205 mm) diameter circular-type spread without segregation. Adjustments of the proportions of materials should be made to achieve proper solid suspension and flowable characteristics, however the theoretical yield shall be maintained at one cubic yard (cubic meter) for the given batch weights.

CONSTRUCTION METHODS

153-4.1 PLACEMENT.

a. Placement. CLSM may be placed by any reasonable means from a mixing unit into the space to be filled. Agitation is required during transportation and waiting time. Placement shall be performed in such a manner that structures or pipes are not displaced from their desired final position and intrusion of CLSM into undesirable areas is avoided. The material shall be brought up uniformly to the fill line shown on the plans or as directed to the Engineer. Each placement of CLSM shall be as continuous an operation as possible. If CLSM is placed in more than one layer, the base layer shall be free of surface water and loose of foreign material prior to placement of the next layer.

b. Limitations of Placement. CLSM shall not be placed on frozen ground. Mixing and placing may begin when the air or ground temperature is at least 35 degrees F (2 degrees C) and rising. At the time of placement, CLSM shall have a temperature of at least 40 degrees F (4 degrees C). Mixing and placement shall stop when the air temperature is 40 degrees F (4 degrees C) and falling or when the anticipated air or ground temperature will be 35 degrees F (2 degrees C) or less in the 24 hour period following proposed placement.

153-4.2 CURING AND PROTECTION

a. Curing. The air in contact with the CLSM should be maintained at temperatures above freezing for a minimum of 72 hours. If the CLSM is subjected to temperatures below 32 degrees F (0 degrees C), the material may be rejected by the Engineer if damage to the material is observed.

b. Protection. The CLSM shall not be subject to loads and shall remain undisturbed by construction activities for a period of 48 hours or until a compressive strength of 15 psi (105 kPa) is obtained. The Contractor shall be responsible for providing evidence to the Engineer that the material has reached the desired strength. Acceptable evidence shall be based upon compressive tests made in accordance with paragraph 153-3.1a.

MATERIAL ACCEPTANCE

153-5.1 Acceptance. Acceptance of CLSM delivered and placed as shown on the plans or as directed by the Engineer shall be based upon mix design approval and batch tickets provided by the Contractor to confirm that the delivered material conforms to the mix design. The Contractor shall verify by additional testing, each 5,000 cubic yards (3,825 cubic meters) of material used. Verification shall include confirmation of material proportions and tests of compressive strength to confirm that the material meets the original mix design and the requirements of CLSM as defined in this specification. Adjustments shall be made as necessary to the proportions and materials prior to further production.

METHOD OF MEASUREMENT

153-6.1 Measurement. Controlled low strength material shall be measured by the number of **[cubic yards (cubic meters)]** as computed from the neatline plan and section, adjusted for the quantities for any embedments, and as specified, completed, and accepted..

BASIS OF PAYMENT

153-7.1 Payment. Accepted quantities of controlled low strength material shall be paid for at the contract unit price per **[cubic yard (cubic meter)]**. Payment shall be full compensation for all materials, equipment, labor, and incidentals required to complete the work as specified.

TESTING REQUIREMENTS

ASTM C 31	Making and Curing Concrete Test Specimens in the Field
ASTM C 39	Compressive Strength of Cylindrical Concrete

MATERIAL REQUIREMENTS

ASTM C 33	Specification for Concrete Aggregates
ASTM C 150	Specification for Portland Cement
ASTM C 618	Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 595	Specification for Blended Hydraulic Cements

END OF ITEM P-153

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ITEM P-154 SUBBASE COURSE

DESCRIPTION

154-1.1 This item shall consist of a subbase course composed of granular materials constructed on a prepared subgrade or underlying course in accordance with these specifications, and in conformity with the dimensions and typical cross section shown on the plans.

MATERIALS

154-2.1 MATERIALS. The subbase material shall consist of hard durable particles or fragments of granular aggregates. This material will be mixed or blended with fine sand, clay, stone dust, or other similar binding or filler materials produced from approved sources. This mixture must be uniform and shall comply with the requirements of these specifications as to gradation, soil constants, and shall be capable of being compacted into a dense and stable subbase. The material shall be free from vegetable matter, lumps or excessive amounts of clay, and other objectionable or foreign substances. Pit-run material may be used, provided the material meets the requirements specified.

TABLE 1. GRADATION REQUIREMENTS

Sieve designation (square openings) as per ASTM C 136 and ASTM D 422	**Percentage by weight passing sieves**
3 inch (75.0 mm)	100
No. 10 (2.0 mm)	20-100
No. 40 (0.450 mm)	5-60
No. 200 (0.075 mm)	0-8

The portion of the material passing the No. 40 (0.450 mm) sieve shall have a liquid limit of not more than 25 and a plasticity index of not more than 6 when tested in accordance with ASTM D 4318.

The maximum amount of material finer than 0.02 mm in diameter shall be less than 3%.

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154-3.3 PREPARING UNDERLYING COURSE. Before any subbase material is placed, the underlying course shall be prepared and conditioned as specified. The course shall be checked and accepted by the Engineer before placing and spreading operations are started.

To protect the subgrade and to ensure proper drainage, the spreading of the subbase shall begin along the centerline of the pavement on a crowned section or on the high side of pavements with a one-way slope.

154-3.4 MATERIALS ACCEPTANCE IN EXISTING CONDITION. When the entire subbase material is secured in a uniform and satisfactory condition and contains approximately the required moisture, such approved material may be moved directly to the spreading equipment for placing. The material may be obtained from gravel pits, stockpiles, or may be produced from a crushing and screening plant with the proper blending. The materials from these sources shall meet the requirements for gradation, quality, and consistency. It is the intent of this section of the specifications to secure materials that will not require further mixing. The moisture content of the material shall be approximately that required to obtain maximum density. Any minor deficiency or excess of moisture may be corrected by surface sprinkling or by aeration. In such instances, some mixing or manipulation may be required, immediately preceding the rolling, to obtain the required moisture content. The final operation shall be blading or dragging, if necessary, to obtain a smooth uniform surface true to line and grade.

154-3.5 PLANT MIXING. When materials from several sources are to be blended and mixed, the subbase material shall be processed in a central or travel mixing plant. The subbase material, together with any blended material, shall be thoroughly mixed with the required amount of water. After the mixing is complete, the material shall be transported to and spread on the underlying course without undue loss of the moisture content.

154-3.5.1 MIXED IN PLACE. When materials from different sources are to be proportioned and mixed or blended in place, the relative proportions of the components of the mixture shall be as designated by the Engineer.

The subbase material shall be deposited and spread evenly to a uniform thickness and width. Then the binder, filler or other material shall be deposited and spread evenly over the first layer. There shall be as many layers of materials added as the Engineer may direct to obtain the required subbase mixture.

When the required amount of materials have been placed, they shall be thoroughly mixed and blended by means of graders, discs, harrows, rotary tillers, supplemented by other suitable equipment if necessary. The mixing shall continue until the mixture is uniform throughout. Areas of segregated material shall be corrected by the addition of binder or filler material and by thorough remixing. Water in the amount and as directed by the Engineer shall be uniformly applied prior to and during the mixing operations, if necessary, to maintain the material at its required moisture content. When the mixing and blending has been completed, the material shall be spread in a uniform layer which, when compacted, will meet the requirements of thickness and typical cross section.

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During the placing and spreading, sufficient caution shall be exercised to prevent the incorporation of subgrade, shoulder, or foreign material in the subbase course mixture.

154-3.7 FINISHING AND COMPACTING. After spreading or mixing, the subbase material shall be thoroughly compacted by rolling and sprinkling, when necessary. Sufficient rollers shall be furnished to adequately handle the rate of placing and spreading of the subbase course.

The field density of the compacted material shall be at least 100 percent of the maximum density of laboratory specimens prepared from samples of the subbase material delivered to the jobsite. The laboratory specimens shall be compacted and tested in accordance with **[ ]**. The in-place field density shall be determined in accordance with ASTM D 1556 or ASTM D 2922. The moisture content of the material at the start of compaction shall not be below nor more than 2 percentage points above the optimum moisture content.

* * * *

required smoothness and accuracy re obtained. The finished surface shall not vary more than 1/2 inch (12 mm) when tested with a 16-foot (4.8 m) straightedge applied parallel with, and at right angles to, the centerline.

154-3.9 THICKNESS. The thickness of the completed subbase course shall be determined by depth tests or sample holes taken at intervals so each test shall represent no more than 500 square yards (420 square meters). When the deficiency in thickness is more than 1/2 inch (12 mm), the Contractor shall correct such areas by scarifying, adding satisfactory mixture, rolling, sprinkling, reshaping, and finishing in accordance with these specifications. The Contractor shall replace at his/her expense the subbase material where borings are taken for test purposes.

* * * *

ASTM D 1557	Test for Laboratory Compaction Characteristics of Soil Using Modified Effort
ASTM D 2922	Density of Soil in Place by the Nuclear Density Method
ASTM D 4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soils

END OF ITEM P-154

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ITEM P-155 LIME-TREATED SUBGRADE

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155-2.4 SOIL. The soil for this work shall consist of materials on the site or selected materials from other sources and shall be uniform in quality and gradation, and shall be approved by the Engineer. The soil shall be free of roots, sod, weeds, and stones larger than 2-1/2 inches (60 mm).

COMPOSITION

155-3.1 LIME. Lime shall be applied at the rate specified on the plans for the depth of subgrade treatment shown.

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secondary grade shall be corrected, as directed by the Engineer, by scarifying, adding lime, and compacting until it is of uniform stability. The excavated material shall then be spread to the desired cross section.

If the Contractor elects to use a cutting and pulverizing machine that will remove the subgrade material accurately to the secondary grade and pulverize the material at the same time, he will not be required to expose the secondary grade nor windrow the material. However, the Contractor shall be required to roll the subgrade, as directed by the Engineer, and correct any soft areas that this rolling may reveal before using the pulverizing machine. This method will be permitted only where a machine is provided which will ensure that the material is cut uniformly to the proper depth and which has cutters that will plane the secondary grade to a smooth surface over the entire width of the cut. The machine must give visible indication at all times that it is cutting to the proper depth.

155-6.2 APPLICATION. Lime shall be spread only on that area where the first mixing operations can be completed during the same working day. The application and mixing of lime with the soil shall be accomplished by the methods hereinafter described as ``Dry Placing" or ``Slurry Placing." When hydrated lime is specified, the Contractor may use either method.

a. Dry Placing. The lime shall be spread uniformly over the top of the subgrade by an approved screw-type spreader box or other approved spreading equipment. The amount of lime spread shall be the amount required for mixing to the specified depth that will result in the percentage determined in the job mix formula.

The lime shall be distributed in such manner that scattering by wind will be minimal. Lime shall not be applied when wind conditions, in the opinion of the Engineer, are detrimental to a proper application. A motor grader shall not be used to spread the lime. The material shall be sprinkled, as directed by the Engineer, until the proper moisture content has been reached.

b. Slurry Placing. The lime shall be mixed with water in trucks with approved distributors and applied as a thin water suspension or slurry. Commercial lime slurry shall be applied with a lime percentage not less than that applicable for the grade used. The distribution of lime shall be attained by successive passes over a measured section of subgrade until the proper amount of lime has been spread. The amount of lime spread shall be the amount required for mixing to the specified depth that will result in the percentage determined in the job mix formula. The distributor truck shall continually agitate the slurry to keep the mixture uniform.

155-6.3 MIXING. The mixing procedure shall be the same for ``Dry Placing" or ``Slurry Placing" as hereinafter described:

a. First Mixing. The full depth of the treated subgrade shall be mixed with an approved mixing machine. Lime shall not be left exposed for more than 6 hours. The mixing machine shall make two coverages. Water shall be added to the subgrade during mixing to provide a moisture content above the optimum moisture of the material and to ensure chemical action of the lime and subgrade. After mixing, the subgrade shall be lightly rolled to seal the surface and help prevent evaporation of moisture. The water content of the subgrade mixture shall be maintained at a moisture content above the optimum moisture content for a minimum of 48 hours or until the material becomes friable. During the curing period, the material shall be sprinkled as directed. During the interval of time between application and mixing, lime that has been exposed to the open air for 6 hours or more, or to excessive loss due to washing or blowing will not be accepted for payment.

b. Final Mixing. After the required curing time, the material shall be uniformly mixed by approved methods. If the mixture contains clods, they shall be reduced in size by blading, discing, harrowing, scarifying, or the use of other approved pulverization methods so that the remainder of the clods shall meet the following requirements when tested dry by laboratory sieves:

	Percent
Minimum of clods passing 1-1/2\ inch sieve	100
Minimum of clods passing No. 4 sieve	60

155-6.4 COMPACTION. Compaction of the mixture shall begin immediately after final mixing. The material shall be aerated or sprinkled as necessary to provide optimum moisture. The field density of the compacted mixture

shall be at least 93 percent of the maximum density of laboratory specimens prepared from samples taken from the material in place. The specimens shall be compacted and tested in accordance with ASTM D 698. The in-place field density shall be determined in accordance with ASTM D 1556 or ASTM D 2922. Any mixture that has not been compacted shall not be left undisturbed for more than 30 minutes. The moisture content of the mixture at the start of compaction shall not be below nor more than 2 percentage points above the optimum moisture content. The optimum moisture content shall be determined in accordance with ASTM D 698 and shall be less than that amount which will cause the mixture to become unstable during compaction and finishing.

The material shall be sprinkled and rolled as directed by the Engineer. All irregularities, depressions, or weak spots that develop shall be corrected immediately by scarifying the areas affected, adding or removing material as required, and reshaping and recompacting by sprinkling and rolling. The surface of the course shall be maintained in a smooth condition, free from undulations and ruts, until other work is placed thereon or the work is accepted.

In addition to the requirements specified for density, the full depth of the material shown on the plans shall be compacted to the extent necessary to remain firm and stable under construction equipment. After each section is completed, tests will be made by the Engineer. If the material fails to meet the density requirements, it shall be reworked to meet these requirements. Throughout this entire operation, the shape of the course shall be maintained by blading, and the surface upon completion shall be smooth and shall conform with the typical section shown on the plans and to the established lines and grades. Should the material, due to any reason or cause, lose the required stability, density, and finish before the next course is placed or the work is accepted, it shall be recompacted and refinished at the sole expense of the Contractor.

When nuclear gages are to be used for density determination, testing shall be done in accordance with Section 120.

155-6.5 FINISHING AND CURING. After the final layer or course of lime-treated subgrade has been compacted, it shall be brought to the required lines and grades in accordance with the typical sections. The completed section shall then be finished by rolling, as directed, with a pneumatic or other suitable roller sufficiently light to prevent hair cracking. The finished surface shall not vary more than 3/8 inch (9 mm) when tested with a 16-foot (4.8 meter) straightedge applied parallel with and at right angles to the pavement centerline. Any variations in excess of this tolerance shall be corrected by the Contractor, at his/her own expense, in a manner satisfactory to the Engineer.

The completed section shall be moist-cured for a minimum of 7 days before further courses are added or any traffic is permitted, unless otherwise directed by the Engineer. Subsequent courses shall be applied within 14 days after the lime-treated subgrade is cured.

155-6.6 THICKNESS. The thickness of the lime-treated subgrade shall be determined by depth tests or cores taken at intervals so that each test shall represent no more than 300 square yards (250 square meters). When the base deficiency is more than 1/2 inch (12 mm), the Contractor shall correct such areas in a manner satisfactory to the Engineer. The Contractor shall replace, at his/her expense, the base material where borings are taken for test purposes.

155-6.7 MAINTENANCE. The Contractor shall maintain, at his/her own expense, the entire lime-treated subgrade in good condition from the start of work until all the work has been completed, cured, and accepted by the Engineer.

METHOD OF MEASUREMENT

155-7.1 The yardage of lime-treated subgrade to be paid for shall be the number of square yards (square meters) completed and accepted.

155-7.2 The amount of lime to be paid for shall be the number of tons (kg) of Hydrated Lime, or the calculated equivalent thereof, used as authorized. "Calculated Equivalent" will be determined by the Engineer as follows:

a. Hydrated lime delivered to the project in dry form will be measured according to the actual tonnage either spread on the subgrade or batched on site into a slurry, whichever is applicable.

b. Lime delivered to the project in slurry form will be paid for on the basis of certified chemical composition tickets and batch weight tickets. The owner shall reserve the right to have the dry lime content verified by an independent testing laboratory. If the chemical composition is reported on the basis of Pebble Quicklime, the equivalent hydrated lime will be determined in accordance with paragraph c. below.

c. If Pebble Quicklime is delivered to the project in dry form it will be measured for payment on the basis of the following formula:

Total Quicklime (CaO)(Tons) x %Purity x 1.32 Factor + Total Quicklime (CaO)(Tons) x % Impurities x 1.00 Factor = Equivalent Hydrated Lime $Ca(OH)_2$(Tons).

The foregoing will apply whether the quicklime is spread dry (if allowed) or batched into a slurry.

BASIS OF PAYMENT

155-8.1 Payment shall be made at the contract unit price per square yard (square meter) for the lime-treated subgrade of the thickness specified. The price shall be full compensation for furnishing all material, except the lime, and for all preparation, delivering, placing and mixing these materials, and all labor, equipment, tools and incidentals necessary to complete this item.

155-8.2 Payment shall be made at the contract unit price per pound (kg) of lime. This price shall be full compensation for furnishing this material; for all delivery, placing and incorporation of this material; and for all labor, equipment, tools, and incidentals necessary to complete this item.

Payment will be made under:

Item P-155-8.1 Lime-treated subgrade—per square yard (square meter)

Item P-155-8.2 Lime—per pound (kg)

TESTING REQUIREMENTS

ASTM D 698 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb (2.49 kg) Rammer and 12-in. (305 mm) Drop

ASTM D 1556 Density of Soil in Place by the Sand-Cone Method

ASTM D 2922 Density of Soil in Place by the Nuclear Density Method

AASHTO T 26 Quality of Water to be Used in Concrete

MATERIAL REQUIREMENTS

ASTM C 977 Quicklime and Hydrated Lime for Soil Stabilization

END OF ITEM P-155

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ITEM P-156 TEMPORARY AIR AND WATER POLLUTION, SOIL EROSION, AND SILTATION CONTROL

DESCRIPTION

156-1.1 This item shall consist of temporary control measures as shown on the plans or as ordered by the Engineer during the life of a contract to control water pollution, soil erosion, and siltation through the use of berms, dikes, dams, sediment basins, fiber mats, gravel, mulches, grasses, slope drains, and other erosion control devices or methods.

The temporary erosion control measures contained herein shall be coordinated with the permanent erosion control measures specified as part of this contract to the extent practical to assure economical, effective, and continuous erosion control throughout the construction period.

Temporary control may include work outside the construction limits such as borrow pit operations, equipment and material storage sites, waste areas, and temporary plant sites.

MATERIALS

156-2.1 GRASS. Grass that will not compete with the grasses sown later for permanent cover shall be a quick-growing species (such as ryegrass, Italian ryegrass, or cereal grasses) suitable to the area providing a temporary cover.

156-2.2 MULCHES. Mulches may be hay, straw, fiber mats, netting, bark, wood chips, or other suitable material reasonably clean and free of noxious weeds and deleterious materials.

156-2.3 FERTILIZER. Fertilizer shall be a standard commercial grade and shall conform to all Federal and state regulations and to the standards of the Association of Official Agricultural Chemists.

156-2.4 SLOPE DRAINS. Slope drains may be constructed of pipe, fiber mats, rubble, portland cement concrete, bituminous concrete, or other materials that will adequately control erosion.

156-2.5 OTHER. All other materials shall meet commercial grade standards and shall be approved by the Engineer before being incorporated into the project.

CONSTRUCTION REQUIREMENTS

156-3.1 GENERAL. In the event of conflict between these requirements and pollution control laws, rules, or regulations of other Federal, state, or local agencies, the more restrictive laws, rules, or regulations shall apply.

The Engineer shall be responsible for assuring compliance to the extent that construction practices, construction operations, and construction work are involved.

* * * *

Open burning.

Erosion control measures.

* * * *

seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified.

In the event that temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of the work as scheduled or are ordered by the Engineer, such work shall be performed by the Contractor at his/her own expense.

The Engineer may increase or decrease the area of erodible earth material to be exposed at one time as determined by analysis of project conditions.

The erosion control features installed by the Contractor shall be acceptably maintained by the Contractor during the construction period.

Whenever construction equipment must cross watercourses at frequent intervals, and such crossings will adversely affect the sediment levels, temporary structures should be provided.

Pollutants such as fuels, lubricants, bitumen, raw sewage, wash water from concrete mixing operations, and other harmful materials shall not be discharged into or near rivers, streams, and impoundments or into natural or manmade channels leading thereto.

METHOD OF MEASUREMENT

156-4.1 Temporary erosion and pollution control work required which is not attributed to the Contractor's negligence, carelessness, or failure to install permanent controls will be performed as scheduled or ordered by the Engineer. Completed and accepted work will be measured as follows:

a. Temporary seeding and mulching will be measured by the square yard (square meter).

b. Temporary slope drains will be measured by the linear foot (meter).

c. Temporary benches, dikes, dams, and sediment basins will be measured by the cubic yard (cubic meter) of excavation performed, including necessary cleaning of sediment basins, and the cubic yard (cubic meter) of embankment placed at the direction of the Engineer, in excess of plan lines and elevations.

d. All fertilizing will be measured by the ton (kilogram).

156-4.2 Control work performed for protection of construction areas outside the construction limits, such as borrow and waste areas, haul roads, equipment and material storage sites, and temporary plant sites, will not be measured and paid for directly but shall be considered as a subsidiary obligation of the Contractor with costs included in the contract prices bid for the items to which they apply.

BASIS OF PAYMENT

156-5.1 Accepted quantities of temporary water pollution, soil erosion, and siltation control work ordered by the Engineer and measured as provided in paragraph 156-4.1 will be paid for under:

Item P-156-5.1 Temporary seeding and mulching—per square yard (square meter)

Item P-156-5.2 Temporary slope drains—per linear foot (meter)

Item P-156-5.3 Temporary benches, dikes, dams and sediment basins—per cubic yard (cubic meter)

Item P-156-5.4 Fertilizing—per ton (kilogram)

Where other directed work falls within the specifications for a work item that has a contract price, the units of work shall be measured and paid for at the contract unit price bid for the various items.

Temporary control features not covered by contract items that are ordered by the Engineer will be paid for in accordance with Section 90-05.

END OF ITEM P-156

ITEM P-157 CEMENT KILN DUST (CKD) TREATED SUBGRADE

DESCRIPTION

157-1.1 This item shall consist of constructing one or more courses of a mixture of soil, cement kiln dust, and water in accordance with this specification, and in conformity with the lines, grades, thickness, and typical cross sections shown on the plans.

MATERIALS

157-2.1 CEMENT KILN DUST. Cement kiln dust shall contain a minimum of 40% CaO and be capable of providing the soil modification specified for this project. Cement Kiln Dust from the (_____) Cement Plant(s) is(are) a pre-approved source for cement kiln dust for this project. All other sources shall be identified and approved in advance of stabilization operations in order that laboratory tests can be completed prior to commencing work.

* * * *

Material/Properties	Target	Tolerance	Specifications
Cement Kiln Dust	(____)%	0 to +2%	% Total Dry Materials
Moisture Content	Optimum	0% to 6%	ASTM D-1557
Plastic Index	< (____)	None	ASTM D-4318

* * * *

The full depth of the treated subgrade shall be mixed with a rotary pulvamixer, disc and field cultivator or, other suitable methods as approved by the Engineer. Cement kiln dust shall not be left exposed for more than 1 hour after distribution.

Required moisture contents shall be established by the Engineer based on laboratory tests with the site soils at the specified cement kiln dust percent to be used for soil modification. Final moisture content of the mix, immediately prior to compaction shall be determined in accordance with ASTM C-593 (Modified Proctor) and shall not be less than the optimum moisture content or more than 6 percent over optimum.

If the soil cement kiln dust mixture contains clods greater than 1-1/2 inch in size, they shall be reduced in size by additional pulverization.

As a minimum, one soil sample will be obtained and tested for each 25 tons of CKD incorporated. Testing shall include Plastic Index Determination (ASTM D-4318) and 7-day accelerated compressive strengths (Section 8 ASTM C-593).

Areas that fall below specified values will need to be reworked, as directed by the Engineer.

157-6.4 COMPACTION. Compaction of the soil/cement kiln dust mixture shall be delayed for a minimum of 24 hours after mixing the cement kiln dust into the subgrade. The field density of the compacted mixture shall be at least 90 percent of the maximum density as determined by ASTM D-1557. The in-place field density shall be determined in accordance with ASTM D-1556 or ASTM D 2167. Testing frequency shall be a minimum of 1 compaction test per 5000 square feet of stabilized base or as directed by the Engineer.

All irregularities, depressions, or weak spots that develop shall be corrected immediately by scarifying the areas affected, adding or removing material as required, and reshaping and recompacting. The surface of the course shall be maintained in a smooth condition, free from undulations and ruts, until other work is placed thereon or the work is accepted.

In addition to the requirements specified for density, the full depth of the material shown on the plans shall be compacted to the extent necessary to remain firm and stable under construction equipment. After each section is completed, tests will be made by the Engineer. If the material fails to meet the density requirements, it shall be reworked to meet these requirements. Throughout this entire operation, the shape of the course shall be maintained by blading, and the surface upon completion shall be smooth and shall conform with the typical section shown on the plans to the established lines and grades specified. Should the material, due to any reason or cause, lose the required stability, density, and finish before the next course is placed or the work is accepted, it shall be recompacted and refinished at the sole expense of the Contractor.

157-6.5 FINISHING AND CURING. After the final layer or course of cement kiln dust treated subgrade has been compacted, it shall be brought to the required lines and grades in accordance with the typical sections. The finished surface shall not vary more than 3/8 inch when tested with a 16-foot straightedge applied parallel with and at right angles to the pavement centerline. Any variations in excess of this tolerance shall be corrected by the Contractor, at his/her own expense, in a manner satisfactory to the Engineer.

After the cement kiln dust treated course has been finished as specified herein, the surface shall be protected against rapid drying by either of the following methods for a period of not less than three days or until the pavement section is placed.

a. Maintain in a thorough and continuously moist condition by sprinkling.

b. Apply a 2-inch layer of earth on the compacted course and maintain in a moist condition.

157-6.6 THICKNESS. The thickness of the cement kiln dust treated subgrade shall be determined by depth tests or cores taken at intervals so that each test shall represent no more than 300 square yards. When the base deficiency is more than 1/2 inch, the Contractor shall correct such areas in a manner satisfactory to the Engineer. The Contractor shall replace, at his/her expense, the base material where borings are taken for test purposes.

157-6.7 MAINTENANCE. The Contractor shall maintain, at his/her own expense, the entire cement kiln dust treated subgrade in good condition from the start of work until all the work has been completed, cured, and accepted by the Engineer.

157-6.8 HANDLING AND SAFETY. The Contractor shall obtain from the Supplier of the cement kiln dust the instructions for, proper safety and handling of the cement kiln dust.

METHOD OF MEASUREMENT

157-7.1 The amount of cement kiln dust treated subgrade to be paid for shall be based on the number of square yards completed and accepted.

The amount of cement kiln dust utilized is based upon an application rate of (___) percent (by dry weight of soil).

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ITEM P-158 FLY ASH TREATED SUBGRADE

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depth and which has cutters that will plane the secondary grade to a smooth surface over the entire width of the cut. The machine must give visible indication at all times that it is cutting to the proper depth.

158-6.2 APPLICATION. Fly ash shall be spread only on that area where the first mixing operations can be completed within 2 hours. The application and mixing of fly ash with the soil shall be accomplished by the methods hereinafter described as ``Dry Placing."

a. Dry Placing. The fly ash shall be spread uniformly over the top of the subgrade by an approved screw-type spreader box or other approved spreading equipment. The amount of fly ash spread shall be the amount required for mixing to the specified depth which will result in the percentage determined in the job mix formula.

The fly ash shall be distributed in such manner that scattering by wind will be minimal. Fly ash shall not be applied when wind conditions, in the opinion of the Engineer, are detrimental to a proper application. A motor grader shall not be used to spread the fly ash.

158-6.3 MIXING. The mixing procedure shall be the same for Dry Placing as hereinafter described. The full depth of the treated subgrade shall be mixed with a rotary pulvamixer that utilizes a direct hydraulic drive. Fly ash shall not be left exposed for more than 30 minutes after distribution. The mixing machine shall make two coverages. Water shall be added through use of a pulvamixer equipped with a spray bar in the mixing drum capable of applying sufficient quantities of water to achieve the required moisture content of the soil-fly ash mixture. The system shall be capable of being regulated to the degree as to maintain moisture contents within the recommended range.

Required moisture contents shall be established by the Engineer based on laboratory tests with the site soils and specific fly ash to be used for the treatment. Final moisture content of the mix, immediately prior to compaction shall be determined in accordance with ASTM D 698 and shall not be below nor more than 2 percent above the optimum moisture content for maximum density of the mix. If moisture contents exceed the specified limits, additional fly ash may be added to lower the moisture content to the required limits. Lowering moisture contents by aeration following addition of the fly ash will not be permitted.

If the soil fly ash mixture contains clods greater than 1-1/2 inch in size, they shall be reduced in size by additional pulverization.

158-6.4 COMPACTION. Compaction of the soil-fly ash mixture shall begin immediately after mixing of the fly ash and be completed within two hours following incorporation of the fly ash. The field density of the compacted mixture shall be at least 95 percent of the maximum density of laboratory specimens prepared from samples taken from the material in place. The specimens shall be compacted and tested in accordance with ASTM D 698. The in-place density shall be determined in accordance with ASTM D 1556, ASTM D 2167 or ASTM D 2922.

All irregularities, depressions, or weak spots, which develop, shall be corrected immediately by scarifying the areas affected, adding or removing material as required, and reshaping and re-compacting. The surface of the course shall be maintained in a smooth condition, free from undulations and ruts, until other work is placed thereon or the work is accepted.

In addition to the requirements specified for density, the full depth of the material shown on the plans shall be compacted to the extent necessary to remain firm and stable under construction equipment. After each section is completed, tests will be made by the Engineer. If the material fails to meet the density requirements, it shall be reworked to meet these requirements. Throughout this entire operation, the shape of the course shall be maintained by blading, and the surface upon completion shall be smooth and shall conform with the typical section shown on the plans and to the established lines and grades. Should the material, due to any reason or cause, lose the required stability, density, and finish before the next course is placed or the work is accepted, it shall be recompacted and refinished at the sole expense of the Contractor.

* * * *

TESTING REQUIREMENTS

ASTM D 698	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb (2.49 kg) Rammer and 12-in. (305 mm) Drop
ASTM D 1556	Density of Soil in Place by the Sand-Cone Method
ASTM D 2167	Density and Unit Weight of Soil in Place by the Rubber-Ballon Method
AASHTO T 26	Quality of Water to be Used in Concrete

MATERIAL REQUIREMENTS

ASTM C 618	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete

END OF ITEM P-158

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PART III – FLEXIBLE BASE COURSES

ITEM P-208 AGGREGATE BASE COURSE

208-1.1 This item shall consist of a base course composed of **[crushed] [uncrushed]** coarse aggregate bonded with either soil or fine aggregate or both. It shall be constructed on a prepared underlying course in accordance with these specifications and shall conform to the dimensions and typical cross section shown on the plans.

MATERIALS

208-2.1 UNCRUSHED COARSE AGGREGATE. The base course material shall consist of hard, durable particles or fragments of stone or gravel mixed or blended with sand, stone dust, or other similar binding or filler materials produced from approved sources. All oversized stones, rocks and boulders occurring in the pit or quarry material shall be wasted; those of acceptable quality may be crushed and become a part of the base material, provided the blend meets the specified gradations. The aggregate shall be free from vegetation, lumps, or excessive amounts of clay and other objectionable substances. The coarse aggregate shall have a percent of wear not more than 45 at 500 revolutions as determined by ASTM C 131.

208-2.2 CRUSHED COARSE AGGREGATE. The aggregates shall consist of both fine and coarse fragments of crushed stone, crushed slag, or crushed gravel mixed or blended with sand, screenings, or other similar approved materials. The crushed stone shall consist of hard, durable particles or fragments of stone and shall be free from excess flat, elongated, soft or disintegrated pieces, dirt, or other objectionable matter.

The crushed slag shall be air-cooled, blast furnace slag and shall consist of angular fragments reasonably uniform in density and quality and shall be reasonably free from thin, elongated, or soft pieces, dirt, and other objectionable matter. It shall weigh not less than 70 pounds per cubic foot (1.12 Mg/cubic meter) as determined by ASTM C 29.

The crushed gravel shall consist of hard, durable stones, rock, and boulders crushed to specified size and shall be free from excess flat, elongated, soft or disintegrated pieces, dirt, or other objectionable matter. The method used in production of crushed gravel shall be such that the fractured particles occurring in the finished product shall be as nearly constant and uniform as practicable and shall result in a minimum of 60% of the material retained on the No. 4 sieve having at least 2 fractured faces and 75% having at least 1 fractured face.

If necessary to meet this requirement or to eliminate an excess of fine, uncrushed particles, the gravel shall be screened before crushing. All stones, rocks, and boulders of inferior quality in the pit shall be wasted.

The crushed coarse aggregate shall have a percent of wear not more than 50 at 500 revolutions as determined by ASTM C 131.

All material passing the No. 4 mesh (4.75 mm) sieve produced in the crushing operation of either stone, slag, or gravel shall be incorporated in the base material to the extent permitted by the gradation requirements.

208-2.3 GRADATION. The gradation of the uncrushed or crushed material shall meet the requirements of one of the gradations given in Table 1 when tested in accordance with ASTM C 117, ASTM C 136, and ASTM D 422.

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TABLE 1. REQUIREMENTS FOR GRADATION OF AGGREGATE

Sieve Designation	Percentage by weight passing sieves		
	2'' maximum	**1 1/2'' maximum**	**1''maximum**
2 inch (50.0 mm)	100	--	--
1-1/2 inch (37.0 mm)	70-100	100	--
1 inch (25.0 mm)	55-85	70-100	100
3/4 inch (13.0 mm)	50-80	55-85	70-100
No. 4 (4.75 mm)	30-60	30-60	35-65
No. 40 (0.45 mm)	10-30	10-30	10-25
No. 200 (0.075 mm)	5-15	5-15	5-15

* * * *

drainage conditions, hauling, or any other cause, shall be corrected and rolled to the required density before the base course is placed thereon.

To protect the underlying course and to ensure proper drainage, the spreading of the base shall begin along the centerline of the pavement on a crowned section or on the high side of the pavement with a one-way slope.

208-3.3 METHODS OF PRODUCTION

a. Plant Mix. When provided in the proposal, or when selected by the Contractor and approved by the Engineer, the base material shall be uniformly blended or mixed in an approved plant. The mixing plant shall include bins for storage and batching of the aggregate, pump and tanks for water, and batch mixers of either the pugmill or drum type. All mineral aggregates shall be batched into the mixer by weight. The agitation shall be such that a thorough dispersion of moisture is obtained. The size of the batch and the time of mixing shall be fixed by the Engineer and shall produce the results and requirements specified. The base course material produced by combining two or more materials from different sources shall be mixed in a mixing plant described herein. The mixture material shall be at a satisfactory moisture content to obtain maximum density.

b. Travel Plant. When the use of a traveling plant is allowed, the plant shall blend and mix the materials to meet these specifications. It shall accomplish a thorough mixing in one trip. The agitation shall be such that the dispersion of the moisture is complete. The machine shall move at a uniform rate of speed and this speed shall be regulated to fix the mixing time. If a windrow-type of travel plant is employed for mixing, the aggregate shall be placed in windrows parallel to the pavement centerline.

The windrow volume shall be sufficient to cover exact areas as planned. The windrow contents shall produce a mixture of the required gradation and bonding qualities. If a travel plant is used which is of the type that mixes previously spread aggregates in-place, the material shall have been spread in such thickness and proportions as may be handled by the machine to develop a base course of the thickness of each layer and of the gradation required. With either type of equipment, the mixed material shall be at a satisfactory moisture content to obtain the maximum density.

c. Materials of Proper Gradation. When the entire base course material from coarse to fine is secured in a uniform and well-graded condition and contains approximately the proper moisture, such approved material may be handled directly to the spreading equipment. The material may be obtained from gravel pits, stockpiles, or produced from a crushing and screening plant with the proper blending. The materials from these sources shall meet the requirements for gradation, quality, and consistency. The intent of this section of these specifications is to secure materials that will not require further mixing. The base material shall be at a satisfactory moisture content to obtain maximum density. Any minor deficiency or excess of moisture may be corrected by surface sprinkling or by aeration. In such instances some mixing or manipulation may be required immediately preceding the rolling to obtain the required moisture content. The final operation shall be blading, if necessary, to obtain a smooth uniform surface true to line and grade.

208-3.4 PLACING.

a. The aggregate base material that is correctly proportioned, or has been processed in a plant, shall be placed on the prepared underlying course and compacted in layers of the thickness shown on the plans. The depositing and spreading of the material shall commence where designated and shall progress continuously without breaks. The material shall be deposited and spread in lanes in a uniform layer and without segregation of size to such loose depth that, when compacted, the layer shall have the required thickness. The base aggregate shall be spread by spreader boxes or other approved devices having positive thickness controls that shall spread the aggregate in the required amount to avoid or minimize the need for hand manipulation. Dumping from vehicles in piles that require rehandling shall not be permitted. Hauling over the uncompacted base course shall not be permitted.

b. The aggregate base material that has been processed in a traveling plant, or mixed and blended in-place, shall be spread in a uniform layer of required depth and width and to the typical cross section. The spreading shall be by a self-powered blade grader, mechanical spreader, or other approved method. In spreading, care shall be taken

to prevent cutting into the underlying layer. The material shall be bladed until a smooth, uniform surface is obtained, true to line and grade.

c. The base course shall be constructed in a layer not less than 3 inches (75 mm) nor more than 6 inches (150 mm) of compacted thickness. The aggregate as spread shall be of uniform grading with no pockets of fine or coarse materials. The aggregate, unless otherwise permitted by the Engineer, shall not be spread more than 2,000 square yards (1700 square meters) in advance of the rolling. Any necessary sprinkling shall be kept within these limits. No material shall be placed in snow or on a soft, muddy, or frozen course.

When more than one layer is required, the construction procedure described herein shall apply similarly to each layer.

During the mixing and spreading process, sufficient caution shall be exercised to prevent the incorporation of subgrade, subbase, or shoulder material in the base course mixture.

208-3.5 COMPACTION. Immediately upon completion of the spreading operations, the aggregate shall be thoroughly compacted. The number, type, and weight of rollers shall be sufficient to compact the material to the required density.

The moisture content of the material during placing operations shall not be below, nor more than 2 percentage points above, the optimum moisture content as determined by ASTM **[ ]**.

* * * *

using blocks of materials with densities that extend through a range representative of the density of the proposed base material. ASTM 3017 may be used to determine the moisture content of the material. (See Section 120 of the General Provisions for additional guidance)

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BASIS OF PAYMENT

208-5.1 Payment shall be made at the contract unit price per cubic yard (cubic meter) for aggregate base course. This price shall be full compensation for furnishing all materials and for all operations, hauling, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-208-5.1 **[Uncrushed][Crushed]** Aggregate Base Course—per cubic yard (cubic meter)

TESTING REQUIREMENTS

ASTM C 29	Unit Weight of Aggregate
ASTM C 117	Materials Finer than 75µm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 131	Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine
ASTM C 136	Sieve Analysis of Fine and Coarse Aggregates
ASTM D 422	Particle Size Analysis of Soils
ASTM D 698	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb (2.49 kg) Rammer and 12-in (305 mm) Drop
ASTM D 1556	Density of Soil in Place by the Sand-Cone Method
ASTM D 1557	Test for Laboratory Compaction Characteristics of Soil Using Modified Effort
ASTM D 2167	Density of Soil in Place by the Rubber-Ballon Method
ASTM D 3665	Random Sampling of Paving Materials
ASTM D 4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soils

END OF ITEM P-208

ITEM P-209 CRUSHED AGGREGATE BASE COURSE

DESCRIPTION

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

MATERIALS

209-2.1 AGGREGATE. Aggregates shall consist of clean, sound, durable particles of crushed stone, crushed gravel, or crushed slag and shall be free from coatings of clay, silt, vegetable matter, and other objectionable materials and shall contain no clay balls. Fine aggregate passing the No. 4 (4.75 mm) sieve shall consist of fines from the operation of crushing the coarse aggregate. If necessary, fine aggregate may be added to produce the correct gradation. The fine aggregate shall be produced by crushing stone, gravel, or slag that meet the requirements for wear and soundness specified for coarse aggregate.

The crushed slag shall be an air-cooled, blast furnace slag and shall have a unit weight of not less than 70 pounds per cubic foot (1.12 Mg/cubic meter) when tested in accordance with ASTM C 29.

The coarse aggregate portion, defined as the material retained on the No. 4 (4.75 mm) sieve and larger, shall contain not more than 15 percent, by weight, of flat or elongated pieces as defined in ASTM D 693 and shall have at least 90 percent by weight of particles with at least two fractured faces and 100 percent with at least one fractured face. The area of each face shall be equal to at least 75 percent of the smallest midsectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 to count as two fractured faces.

The percentage of wear shall not be greater than 45 percent when tested in accordance with ASTM C 131. The sodium sulfate soundness loss shall not exceed 12 percent, after 5 cycles, when tested in accordance with ASTM C 88.

The fraction passing the No. 40 (0.42 mm) sieve shall have a liquid limit no greater than 25 and a plasticity index of not more than 4 when tested in accordance with ASTM D 4318. The fine aggregate shall have a minimum sand equivalent value of 35 when tested in accordance with ASTM D 2419.

a. Sampling and Testing. Aggregates for preliminary testing shall be furnished by the Contractor prior to the start of production. All tests for initial aggregate submittals necessary to determine compliance with the specification requirements will be made by the Engineer at no expense to the Contractor.

Samples of aggregates shall be furnished by the Contractor at the start of production and at intervals during production. The sampling points and intervals will be designated by the Engineer. The samples will be the basis of approval of specific lots of aggregates from the standpoint of the quality requirements of this section.

In lieu of testing, the Engineer may accept certified state test results indicating that the aggregate meets specification requirements. Certified test results shall be less than 6 months old.

Samples of aggregates to check gradation shall be taken by the Engineer at least two per lot. The lot will be consistent with acceptable sampling for density. The samples shall be taken from the in-place, compacted material. Sampling shall be in accordance with ASTM D 75, and testing shall be in accordance with ASTM C 136 and ASTM C 117.

b. Gradation Requirements. The gradation (job mix) of the final mixture shall fall within the design range indicated in Table 1, when tested in accordance with ASTM C 117 and ASTM C 136. The final gradation shall be continuously well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on an adjacent sieve or vice versa.

TABLE 1. REQUIREMENTS FOR GRADATION OF AGGREGATE \1

Sieve Size	Design Range Percentage by Weight Percentage by Weight	Job Mix Tolerances Percent
2 in (50.0 mm)	100	0
1-1/2 (37.0 mm)	95-100	+/- 5
1 in (25.0 mm)	70-95	+/- 8
3/4 in (19.0 mm)	55-85	+/- 8
No. 4 (4.75 mm)	30-60	+/- 8
No. 30 (0.60 mm)	12-30	+/- 5
No. 200 (0.075 mm)	0-8	+/- 3

\1\ Where environmental conditions (temperature and availability of free moisture) indicate potential damage due to frost action, the maximum percent of material, by weight, of particles smaller than 0.02 mm shall be 3 percent when tested in accordance with ASTM D 422. It also may be necessary to have a lower percentage of material passing the No. 200 sieve to help control the percentage of particles smaller than 0.02 mm maximum limit of 5 percent is recommended).

The job mix tolerances in Table 1 shall be applied to the job mix gradation to establish a job control grading band. The full tolerance still will apply if application of the tolerances results in a job control grading band outside the design range.

The fraction of the final mixture that passes the No. 200 (0.075 mm) sieve shall not exceed 60 percent of the fraction passing the No. 30 (0.60 mm) sieve.

CONSTRUCTION METHODS

209-3.1 PREPARING UNDERLYING COURSE. The underlying course shall be checked and accepted by the Engineer before placing and spreading operations are started. Any ruts or soft yielding places caused by improper drainage conditions, hauling, or any other cause shall be corrected at the Contractor's expense before the base course is placed thereon. Material shall not be placed on frozen subgrade.

209-3.2 MIXING. The aggregate shall be uniformly blended during crushing operations or mixed in a plant. The plant shall blend and mix the materials to meet the specifications and to secure the proper moisture content for compaction.

209-3.3 PLACING. The crushed aggregate base material shall be placed on the moistened subgrade in layers of uniform thickness with a mechanical spreader.

The maximum depth of a compacted layer shall be 6 inches (150 mm). If the total depth of the compacted material is more than 6 inches (150 mm), it shall be constructed in two or more layers. In multi-layer construction, the base course shall be placed in approximately equal-depth layers.

The previously constructed layer should be cleaned of loose and foreign material prior to placing the next layer. The surface of the compacted material shall be kept moist until covered with the next layer.

209-3.4 COMPACTION. Immediately upon completion of the spreading operations, the crushed aggregate shall be thoroughly compacted. The number, type, and weight of rollers shall be sufficient to compact the material to the required density.

The moisture content of the material during placing operations shall not be below, nor more than 2 percentage points above, the optimum moisture content as determined by ASTM **[ ]**.

209-3.5 ACCEPTANCE SAMPLING AND TESTING FOR DENSITY. Aggregate base course shall be accepted for density on a lot basis. A lot will consist of one day's production where it is not expected to exceed

2400 square yards (2000 square meters). A lot will consist of one-half day's production where a day's production is expected to consist of between 2400 and 4800 square yards (2000 and 4000 square meters).

Each lot shall be divided into two equal sublots. One test shall be made for each sublot. Sampling locations will be determined by the Engineer on a random basis in accordance with statistical procedures contained in ASTM D 3665.

Each lot will be accepted for density when the field density is at least 100 percent of the maximum density of laboratory specimens prepared from samples of the base course material delivered to the job site. The specimens shall be compacted and tested in accordance with ASTM **[ ]**. The in-place field density shall be determined in accordance with ASTM D 1556 or D 2167. If the specified density is not attained, the entire lot shall be reworked and/or recompacted and two additional random tests made. This procedure shall be followed until the specified density is reached.

* * * *

The Contractor shall remove all survey and grade hubs from the base courses prior to placing any bituminous surface course.

METHOD OF MEASUREMENT

209-4.1 The quantity of crushed aggregate base course to be paid for will be determined by measurement of the number of **[square yards (square meters)][cubic yards (cubic meters)]** of material actually constructed and accepted by the Engineer as complying with the plans and specifications. **[On individual depth measurements, thicknesses more than 1/2 inch (12 mm) in excess of the design thickness shall be considered as the specified thickness, plus 1/2 inch (12 mm) in computing the number of cubic yards (cubic meters) for payment.]**

BASIS OF PAYMENT

209-5.1 Payment shall be made at the contract unit price per **[square yard (square meter)][cubic yard (cubic meter)]** for crushed aggregate base course. This price shall be full compensation for furnishing all materials, for preparing and placing these materials, and for all labor, equipment tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-209-5.1 Crushed Aggregate Base Course—per **[square yard (square meter][cubic yard (cubic meter)]**

TESTING REQUIREMENTS

ASTM C 29	Unit Weight of Aggregate
ASTM C 88	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 117	Materials Finer than 75µm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 131	Resistance to Degradation of Small-Size Coarse Aggregate by abrasion and impact in the Los Angeles Machine
ASTM C 136	Sieve Analysis of Fine and Coarse Aggregates
ASTM D 75	Sampling Aggregate
ASTM D 422	Particle Size Analysis of Soils
ASTM D 693	Crushed Aggregate for Macadam Pavements
ASTM D 698	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in (305mm) Drop
ASTM D 1556	Density of Soil in Place by the Sand-Cone Method
ASTM D 1557	Test for Laboratory Compaction Characteristics of Soil Using Modified Effort
ASTM D 2167	Density and Unit Weight of Soil in Place by the Rubber Ballon Method
ASTM D 2419	Sand Equivalent Value of Soils and Fine Aggregate
ASTM D 2922	Density of Soil and Soil-Aggregate in Place by Nuclear Methods

ASTM D 3017	Water Content of Soil and Rock in Place by Nuclear Methods
ASTM D 3665	Random Sampling of Construction Materials
ASTM D 4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soils

END OF P-209

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ITEM P-210 CALICHE BASE COURSE

DESCRIPTION

210-1.1 This item shall consist of a base course composed of caliche, caliche-gravel, caliche and limestone, or material of similar characteristics, constructed on the prepared underlying course in accordance with these specifications and in conformity to the dimensions and typical cross section shown on the plans.

MATERIALS

210-2.1 MATERIALS. The base course material shall consist of caliche, caliche-gravel, caliche limestone, or similar materials obtained from sources approved by the Engineer prior to use of the materials. All acceptable material shall be screened, and the oversize shall be crushed and returned to the screened material in such manner and proportions that will produce a uniform product.

The gradation of the material, as finally processed and blended, shall meet the following requirements when tested in accordance with ASTM C 136.

Sieve Designation (Square Openings)	Percentage by Weight Passing Sieves
2 inch (50.0 mm)	100
No. 40 (0.425 mm)	15-35
No. 200 (0.075 mm)	0-15

That portion of the material, including the blended filler, passing a No. 40 (0.425 mm) mesh sieve shall be known as soil binder and shall have a liquid limit of not more than 35 and a plasticity index of not more than 10 as determined as ASTM D 4318.

If necessary, the Contractor shall blend or combine materials so that the final processed material meets all of the requirements of these specifications. The Contractor shall make such modifications in materials and methods as are necessary to secure a material that is capable of being compacted into a dense and well-bonded base.

210-2.2 FILLER FOR BLENDING. If filler, in addition to that naturally present in the base course material, is necessary for satisfactory bonding of the material, for changing the soil constants of the material passing the No. 40 mesh sieve, or for correcting the gradation to the limitations of the specified gradation, it shall be uniformly blended with the base course material on the runway, at the crushing plant, or at the mixing plant. The material for such purpose shall be obtained from sources approved by the Engineer.

CONSTRUCTION METHODS

210-3.1 OPERATION IN PITS. All work involved in clearing and stripping pits, including the handling of unsuitable material, shall be performed by the Contractor at his/her own expense. The pits shall be operated in such a manner that a clean and uniform material will be secured. The base course material shall be obtained from approved sources.

210-3.2 EQUIPMENT. All equipment necessary for the proper construction of the work shall be on the project, in first-class working condition, and approved by the Engineer before construction is permitted to start.

210-3.3 PREPARING UNDERLYING COURSE. The underlying course shall be checked and accepted by the Engineer before placing and spreading operations are started. Any ruts or soft, yielding places caused by improper drainage conditions, hauling, or any other cause, shall be corrected at the Contractor's expense.

210-3.4 PLACING AND SPREADING

a. The aggregate base material that has proportioned or processed shall be placed on the prepared underlying course and compacted in layers to the thickness shown on the plans. The depositing and spreading of the material shall commence where designated and shall progress without breaks. The material shall be deposited and spread in lanes in a uniform layer and without segregation of size to such loose depth that, when compacted, the layer shall have the required thickness. The base aggregate shall be spread by spreader boxes or other approved devices that shall spread the aggregate in the required amount. The base material shall be spread and shaped the same day as placed.

b. If the travel plant method is used for mixing, the base material shall be placed on the underlying course in windrows parallel to the centerline of the runway. Sufficient quantity and proportions of materials shall be placed in the windrow to provide a base mixture conforming to the specified grading and compacted thickness. The windrow shall be shaped to a uniform section and left undisturbed until measuring and sampling are complete. After mixing and before spreading, the mixture shall be examined by the Engineer, who shall determine whether the mixing is complete and satisfactory and whether the proper moisture content is maintained for spreading. No spreading shall be done, except when authorized.

After the mixing has been completed, the base material shall be spread to the required depth and width by a self-powered blade grader, mechanical spreader, or other approved method. In spreading, care shall be taken to prevent cutting into the underlying layer. The material shall be bladed, disced, and dragged if necessary until a smooth, uniform surface is obtained true to line, grade, and cross section.

c. When the base materials are to be proportioned and mixed or blended in-place, the different layers shall be spread and placed as follows with the relative proportions of the components of the mixture designated by the Engineer.

The base aggregate shall be deposited and spread evenly to a uniform thickness and width. Then the binder or filler or other admixture shall be deposited and spread evenly over the first layer. As many layers of materials as the Engineer may direct shall be added to obtain the required base materials.

When the required materials have been placed, they shall be thoroughly mixed and blended by means of approved graders, discs, harrows, or rotary-tillers, supplemented by other suitable equipment, if necessary. The mixing shall continue until the mixture is uniform throughout. Areas of segregated material shall be corrected by the addition of binder or filler material and shall be uniformly applied, prior to and during the mixing operations if necessary, to maintain the material at the proper moisture content. When the mixing and blending have been completed, the material shall be spread in a uniform layer which, when compacted, will meet the requirements of thickness and typical cross section. Hauling over material that has not been mixed and shaped shall not be permitted, except when necessitated by the placing of successive layers of materials. Layers of base material allowed to become partially compacted shall be scarified and disced before placing binder material or before blading and shaping for rolling.

d. The base course shall be constructed in a layer not less than 3 inches (75 mm) nor more than 6 inches (150 mm) of compacted thickness. The aggregate, as spread, shall be of uniform grading with no pockets of fine or coarse materials. Unless otherwise permitted by the Engineer, the aggregate shall not be spread more than 2,000 square yards (1700 square meters) in advance of the rolling. Any necessary sprinkling shall be kept within these limits. No material shall be placed in snow or on a soft, muddy, or frozen course.

When more than one layer is required, the construction procedure described herein shall apply similarly to each layer.

During the placing and spreading, sufficient caution shall be exercised to prevent the incorporation of subgrade, subbase, or shoulder material in the base course mixture.

210-3.5 COMPACTION. Immediately after completion of the spreading operations, the mixture shall be thoroughly compacted. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density.

The field density of the compacted material shall be at least 100 percent of the maximum density of laboratory specimens prepared from samples of the material delivered to the jobsite. The laboratory specimens shall be compacted and tested in accordance with **[ ]**. The in-place field density shall be determined in accordance with ASTM D 1556 or ASTM D 2167. The moisture content of the material at the start of compaction shall not be below nor more than 1-1/2 percentage points above the optimum moisture content.

* * * *

Hauling equipment may be routed over completed portions of the base course, provided no damage results and provided that such equipment is routed over the full width of the base course to avoid rutting or uneven compaction. However, the Engineer in charge shall have full and specific authority to stop all hauling over completed or partially completed base course when, in his/her opinion, such hauling is causing damage. Any damage resulting to the base course from routing equipment over the base course shall be repaired by the Contractor at his/her own expense.

210-3.10 MAINTENANCE. Following the completion of the base course, the Contractor shall perform all maintenance work necessary to keep the base course in a condition satisfactory for priming. After priming, the surface shall be kept clean and free from foreign material. The base course shall be properly drained at all times. If cleaning is necessary, or if the prime coat becomes disturbed, any work or restitution necessary shall be performed at the expense of the Contractor.

METHOD OF MEASUREMENT

210-4.1 The quantity of caliche base course to be paid for shall be the number of cubic yards (cubic meters) of base course material placed, bonded, and accepted in the completed base course. The quantity of base course material shall be measured in final position, based upon depth tests or cores taken as directed by the Engineer, at the rate of 1 depth test for each 300 square yards (250 square meters) of base course, or by means of average end areas on the complete work computed from elevations to the nearest 0.01 foot (3 mm). On individual depth measurements, thickness more than 1/2 inch (12 mm) in excess of that shown on the plans shall be considered as specified thickness, plus 1/2 inch (12 mm) in computing the yardage for payment. Base material shall not be included in any other excavation quantities.

BASIS OF PAYMENT

210-5.1 Payment shall be made at the contract unit price per cubic yard (cubic meter) for caliche base course. This price shall be full compensation for furnishing all materials and for all preparation, hauling, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-210-5.1 Caliche Base Course—per cubic yard (cubic meter)

TESTING REQUIREMENTS

ASTM C 136 Sieve Analysis of Fine and Coarse Aggregates

ASTM D 698 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb (2.49 kg) Rammer and 12-in. (305 mm) Drop

ASTM D 1557 Test for Laboratory Compaction Characteristics of Soil Using Modified Effort

ASTM D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils

END OF ITEM P-210

ITEM P-211 LIME ROCK BASE COURSE

DESCRIPTION

211-1.1 This item shall consist of a base course composed of lime rock constructed on the prepared underlying course in accordance with these specifications and shall conform to the dimensions and typical cross section shown on the plans.

MATERIALS

211-2.1 MATERIALS. The lime rock base course material shall consist of fossiliferous limestone of uniform quality, and shall not contain hard or flinty pieces that will cause a rough surface containing pits and pockets. The rock shall show no tendency to ``air slake" or undergo chemical change when exposed to the weather. The material when watered and rolled shall be capable of being compacted into a dense and well-bonded base.

The oolitic type of lime rock shall meet the following requirements:

Carbonates of calcium and magnesium - not less than 70%.
Oxides of iron and aluminum - not more than 2%.
The combined amount of carbonates, oxides, and silica shall be at least 97%. The material shall be non-plastic.

All other types of lime rock shall contain not less than 95% of carbonates of calcium and magnesium. Liquid limit shall not exceed 35, plasticity index shall not exceed 6, as determined in accordance with ASTM D 4318.

The chemical analysis of lime rock shall consist of determining the insoluble silica, iron oxide, and alumina by solution of the sample in hydrochloric (HCl) acid, evaporating, dehydrating, redissolving the residue, and neutralizing with ammonium hydroxide, filtering, washing, and igniting the residue lime rock. The difference between the percentage of insoluble matter and 100% is reported as carbonates of calcium and magnesium.

The lime rock shall not contain more than 0.5% of roots, leaf mold, organic, or foreign matter and shall be obtained from pits from which all overburden has been removed previous to blasting and quarrying.

The gradation of the lime rock shall meet the following requirements:

Sieve Designation (square openings)	Percentage by Weight Passing Sieves
3-1/2 inch (90.mm)	100
3/4 inch (19.0 mm)	50-100

All fine material shall consist entirely of dust of fracture.

CONSTRUCTION METHODS

211-3.1 SOURCES OF SUPPLY. All work involved in cleaning and stripping pits, including the handling of unsuitable material shall be performed by the Contractor at his/her own expense. The lime rock shall be obtained from approved sources. The pits shall be operated in such a manner that a clean and uniform material will be secured.

211-3.2 EQUIPMENT. All equipment necessary for the proper construction of this work shall be on the project, in first-class working condition, and approved by the Engineer before construction is permitted to start.

211-3.3 PREPARING UNDERLYING COURSE. The underlying course shall be checked and accepted by the Engineer before placing and spreading operations are started. Any ruts or soft yielding places caused by improper

drainage conditions, hauling, or any other cause shall be corrected at the Contractor's expense before the base course is placed thereon. Material shall not be placed on frozen subgrade.

211-3.4 PLACING AND SPREADING. All base course material shall be placed on the prepared underlying course and compacted in layers to the thickness shown on the plans. The depositing and spreading of the material on the prepared course or on a completed layer shall commence where designated and shall progress without breaks. The material shall be deposited and spread in lanes in a uniform layer and without segregation of size to such loose depth that, when compacted, the layer shall have the required thickness. When more than one layer is required, the construction procedure described herein shall apply similarly to each layer, excepting the scarifying and rerolling of the surface which shall apply to only the top layer.

The rock shall be transported to locations where it is to be used over rock previously placed and dumped at the end of the preceding spread. It shall then be spread uniformly with shovels, forks, or approved mechanical spreaders especially constructed for this purpose. In no case shall rock be dumped directly onto the underlying course. Transporting over the underlying course will not be permitted, except as directed, in which case it must be protected by planking if rutting occurs. During the dumping and spreading operations, the rock shall be brought to the proper moisture content to obtain maximum density. If water is added, it shall be uniformly mixed to the full depth of the course by discing. All segregated areas of fine or coarse rock shall be removed and replaced with well-graded rock, and approved by the Engineer. Lime rock shall not be spread when the subgrade is in an unsuitable condition.

The lime rock base course shall be constructed in a layer not less than 4 inches (100 mm) nor more than 6 inches (150 mm) of compacted thickness. The base course shall be constructed in lanes or strips parallel with the centerline of the paved area.

During the placing operation, sufficient caution shall be exercised to prevent the incorporation of subgrade, subbase, or shoulder material in the lime rock.

211-3.5 ROLLING. Immediately after completion of the spreading operations, the base material shall be thoroughly compacted. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density.

The field density of the compacted material shall be at least 100 percent of the maximum density of laboratory specimens prepared from samples of the base material delivered to the jobsite. The laboratory specimens shall be compacted and tested in accordance with **[ ]**. The in-place field density shall be determined in accordance with ASTM D 1556. The moisture content of the material at the start of compaction shall not be below nor more than 1-1/2 percentage points above the optimum moisture content.

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surface is removed, leaving a granular or porous condition that will allow free penetration of the prime material. The material planed from the base shall be removed from the base area.

If at any time the underlying material becomes churned up and mixed with the base course material, the Contractor shall, without additional compensation, dig out and remove the mixture, reshape and compact the underlying course, and replace the materials removed with clean rock which shall be watered and rolled until satisfactorily compacted.

Where cracks, checks, or failures appear in the base, either before or after priming and before the surface course is laid, the Contractor shall remove such cracks, checks, or failures by rescarifying, reshaping, watering, rolling, and adding lime rock where necessary.

211-3.7 SURFACE TOLERANCE. After the course has been completely compacted, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified, reshaped, recompacted, and otherwise manipulated as the Engineer may direct until the required smoothness and accuracy are obtained. The finished surface shall not vary more than 3/8 inch (9 mm) from a 16-foot (4.8 mm) straightedge when applied to the surface parallel with, and at right angles to, the centerline. In testing surface of the harder lime rocks, measurement of clearances from the straightedge shall not include small holes caused by individual pieces being pulled out by the grader.

211-3.8 THICKNESS. The thickness of the base course shall be determined by depth tests or elevations taken at intervals in such a manner that each test shall represent 300 square yards (250 square meters), or it shall be as otherwise directed by the Engineer. The depth tests shall be made by test holes through the base at least 3 inches (75 mm) in diameter. Where the base deficiency is more than 1/2 inch (12 mm), the Contractor shall correct such areas by scarifying and adding rock. The base shall be scarified, rock added, and tapered a distance of 100 feet (30 m) in each direction from the edge of the deficient area for each inch of rock added. The affected area shall then be watered, bladed, rolled, and brought to a satisfactory state of compaction, required thickness, and cross section. The thickness of the base in the affected area shall be remeasured by depth tests or elevations. The operations of scarifying, adding rock, and rerolling shall continue until the base thickness is within the 1/2-inch (12 mm) tolerance of base thickness. The final base thickness of the reconditioned area shall be used to determine the average job thickness.

The average job thickness shall be the average of the depth measurement as above outlined and shall be within 1/4 inch (6 mm) of the thickness shown on the typical cross section. On individual depth measurements, thicknesses more than 1/2 inch (12 mm) in excess of that shown on the plans shall be considered as specified thickness plus 1/2 inch (12 mm) in computing the average job thickness. The Contractor shall replace, at his/her expense, the lime rock removed from test holes.

211-3.9 PROTECTION. Work on the base course shall not be accomplished during freezing temperatures nor when the subgrade is wet. When the aggregate contains frozen materials or the underlying course is frozen, the construction shall be stopped.

Hauling equipment may be routed over completed portions of the base course, provided no damage results and provided that such equipment is routed over the full width of the base course to avoid rutting or uneven compaction. However, the Engineer in charge shall have full and specific authority to stop all hauling over completed or partially completed base course when, in his/her opinion, such hauling is causing damage. Any damage resulting to the base course from routing equipment over the base course shall be repaired by the Contractor at his/her own expense.

211-3.10 MAINTENANCE. Following the completion of the base course, the Contractor shall perform all maintenance work necessary to keep the base course in a condition satisfactory for priming. After priming, the surface shall be kept clean and free from foreign material. The base course shall be properly drained at all times. If cleaning is necessary, or if the prime coat becomes disturbed, any work or restitution necessary shall be performed at the expense of the Contractor.

METHOD OF MEASUREMENT

211-4.1 The quantity of lime rock base course to be paid for shall be the number of cubic yards (cubic meters) of base material placed, bonded, and accepted in the completed base course. The quantity of base course material shall be measured in final position, based upon depth tests taken as directed by the Engineer, at the rate of 1 depth test for each 300 square yards (250 square meters) of base course, or by means of average end areas on the complete work computed from elevations to the nearest 0.01 foot (3 mm). On individual depth measurements, thicknesses more than 1/2 inch (12 mm) in excess of that shown on the plans shall be considered as the specified thickness plus 1/2 inch (12 mm) in computing the yardage for payment.

BASIS OF PAYMENT

211-5.1 Payment shall be made at the contract unit price per cubic yard (cubic meter) for lime rock base course. This price shall be full compensation for furnishing all materials and for all preparation, hauling, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

The cost of removing cracks and checks including the labor and material for repriming, and the additional lime rock necessary for crack elimination, will not be paid for separately but shall be included in the contract price per cubic yard (cubic meter) for lime rock base course.

Payment will be made under:

Item P-211-5.1	Lime rock base course per cubic yard (cubic meter)

TESTING REQUIREMENTS

ASTM C 136	Sieve Analysis of Fine and Coarse Aggregates
ASTM D 698	Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in (305 mm) Drop
ASTM D 1556	Density of Soil in Place by the Sand-Cone Method
ASTM D 1557	Test for Laboratory Compaction Characteristics of Soil Using Modified Effort
ASTM D 4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soils

END OF ITEM P-211

ITEM P-212 SHELL BASE COURSE

DESCRIPTION

212-1.1 This item shall consist of a base course composed of shell and binder constructed on a prepared underlying course in accordance with these specifications and shall conform to the dimensions and typical cross section shown on the plans.

MATERIALS

212-2.1 MATERIALS. The shell shall consist of durable particles of ``dead" oyster or clam shell. The base material shall consist of oyster shell, together with an approved binding or filler material, blended or processed to produce a uniform mixture complying with the specifications for gradation, soil constants, and compaction capability. Clam shell may be used only in combination with oyster shell in the proportion up to and including 50%.

The shell shall be reasonably clean and free from excess amounts of clay or organic matter such as leaves, grass, roots, and other objectionable and foreign material.

The gradation of the blended or processed material shall meet the requirements of the gradation given in the following table, when tested in accordance with ASTM C 136.

Sieve Designation (square openings)	Percentage by Weight Passing Sieves
3 inch (75.0 mm)	100
3/4 inch (19.0 mm)	60-90
No. 4 (4.75 mm)	15-55
No. 200 (0.075 mm)	0-15

That portion of the material, including the blended filler, passing a No. 40 (0.42 mm) mesh sieve shall be known as soil binder and shall have a liquid limit of not more than 25 and a plasticity index of not more than 8 as determined by ASTM D 4318.

If necessary, the Contractor shall blend or combine materials so that the final processed material meets all the specifications. The Contractor shall make such modifications in materials and methods as are necessary to secure a material that is capable of being compacted into a dense and well-bonded base without an excess of soil binder.

212-2.2 FILLER FOR BLENDING. If filler, in addition to that naturally present in the base course material, is necessary for satisfactory bonding of the material, or for changing the soil constants of the material passing the No. 40 (0.42 mm) mesh sieve, or for correcting the gradation to the limitations of the specified gradation, it shall be uniformly blended with the base course material on the pavement or at the plant. The material for such purpose shall be obtained from sources approved by the Engineer and shall be of a gradation necessary to accomplish the specified gradation in the final processed material.

CONSTRUCTION METHODS

212-3.1 SOURCES OF SUPPLY. The Contractor shall notify the Engineer, sufficiently in advance, of the intended source of supply of shell. the shell shall be obtained from approved sources. The material in the stockpile shall be handled in a manner that will secure a uniform and satisfactory product.

212-3.2 EQUIPMENT. All equipment necessary for the proper construction of this work shall be on the project, in first-class working condition, and approved by the Engineer before construction is permitted to start.

The processing plant shall be designed, constructed, operated, and capable of thoroughly mixing the shell, binder, and water in the directed proportions to produce base material of the gradation and consistency required.

212-3.3 PREPARING UNDERLYING COURSE. The underlying course shall be checked and accepted by the Engineer before placing and spreading operations are started. Any ruts or soft yielding places caused by improper drainage conditions, hauling, or any other cause shall be corrected at the Contractor's expense before the base course is placed thereon. Material shall not be placed on frozen subgrade or subbase.

212-3.4 PLANT MIXING. The base material shall be uniformly blended and mixed in an approved central or travel mixing plant. The shell, together with any blended material, shall be thoroughly mixed with the required amount of water. After the mixing is complete, the material shall be transported to, or spread on, the underlying course without undue loss of the moisture content.

212-3.5 PLACING AND SPREADING. The base course material that is correctly proportioned or that has been processed in a central plant shall be placed on the prepared underlying course and compacted in the thickness shown on the plans. The depositing and spreading of the material shall commence where designated and shall progress without breaks. The materials shall be deposited and spread in lanes in a uniform layer and without segregation of size to such loose depth that, when compacted, the layer shall have the required thickness. The material shall be spread by spreader boxes or other approved devices that shall distribute the material in a uniform layer. Dumping from vehicles in piles requiring rehandling will not be permitted. hauling over the uncompacted base course shall not be permitted.

212-3.6 TRAVEL PLANT MIX. When the use of a travel plant is approved, sufficient quantities and proportions of all material necessary shall be used to provide a base mixture that conforms to the specified gradation, quality, and thickness. If a windrow travel plant is employed for mixing, the aggregate shall be placed in windrows parallel to the pavement centerline. If a traveling plant is used which mixes previously spread aggregates in-place, the material shall be spread to a thickness that may be readily handled by the machine and that will develop the proper thickness for each layer. The base material shall be of satisfactory moisture content to obtain maximum density.

After the mixing has been completed, the base material shall be spread to the required depth and width by a self-powered blade grader, mechanical spreader, or other approved method. In spreading, care shall be taken to prevent cutting into the underlying layer. The material shall be bladed, disced, and dragged if necessary until a smooth, uniform surface is obtained true to line, grade, and cross section and in condition for compacting.

212-3.7 MIXED IN-PLACE. When specified or permitted, the base materials may be proportioned and mixed or blended in-place on the underlying course. the different layers shall be spread and placed in the following manner with the relative proportions of the components of the mixture designated by the Engineer.
The base aggregate shall be deposited and spread evenly on the subgrade to a uniform thickness and width. Then the binder or filler shall be deposited and spread evenly over the first layer. There shall be as many layers of materials added as the Engineer may direct to obtain the required base mixture.

After the required materials have been placed, they shall be thoroughly mixed and blended using approved graders, discs, harrows, or rotary-tillers, supplemented by other suitable equipment if necessary. The mixing shall continue until the mixture is uniform throughout. Areas of segregated material shall be corrected by the addition of binder or filler material and then thoroughly remixed. If necessary, water in the required amount shall be uniformly applied as directed by the Engineer prior to and during the mixing operations to maintain the material at the proper moisture content. When the mixing and blending has been completed, the material shall be spread in a uniform layer which, when compacted, will meet the requirements for thickness and typical cross section.

212-3.8 GENERAL METHODS FOR PLACING. The base course shall be constructed in layers not less than 4 inches (100 mm) nor more than 6 inches (150 mm) of compacted thickness. The aggregate, as spread, shall be of uniform gradation with no pockets of fine or coarse materials. Unless otherwise permitted by the Engineer, the aggregate shall not be spread more than 2,000 square yards (186 square meters) in advance of the rolling. Any necessary sprinkling shall be kept within this limit. No material shall be placed in snow or on a soft, muddy, or frozen course.

When more than one layer is required, the construction procedure described herein shall apply similarly to each layer.

The Engineer shall conduct tests to determine the maximum density and the proper moisture content of the base material, and this information will be available to the Contractor. The base material shall be brought to a satisfactory moisture content when rolling is started and any minor variations prior to or during rolling shall be corrected by sprinkling or aeration.

During placing and spreading operations, sufficient caution shall be exercised to prevent the incorporation of subgrade, subbase, or shoulder material into the base course mixture.

212-3.9 COMPACTION. Immediately after completion of the spreading operations, the base course shall be thoroughly compacted. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density.

The field density of the compacted material shall be at least 100 percent of the maximum density of laboratory specimens prepared from samples of the base material delivered to the jobsite. The laboratory specimens shall be compacted and tested in accordance with **[ ]**. The in-place field density shall be determined in accordance with ASTM D 1556. The moisture content of the material at the start of compaction shall not be below nor more than 1-1/2 percentage points above the optimum moisture content.

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METHOD OF MEASUREMENT

212-4.1 The quantity of shell base course to be paid for shall be the number of cubic yards (cubic meters) of base course material placed, bonded, and accepted in the completed base course. The quantity of base course material shall be measured in final position based upon depth tests or cores taken as directed by the Engineer, at the rate of 1 depth test for each 300 square yards (28 square meters) of base course, or by means of average end areas on the complete work computed from elevations to the nearest 0.01 foot (3 mm). On individual depth measurements, thicknesses more than 1/2 inch (12 mm) in excess of that shown on the plans shall be considered as specified thickness, plus 1/2 inch (12 mm) in computing the yardage for payment. Base materials shall not be included in any other excavation quantities.

BASIS OF PAYMENT

212-5.1 Payment shall be made at the contract unit price per cubic yard (cubic meter) for shell base course. This price shall be full compensation for furnishing all materials and for all preparation, hauling, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-212-5.1 Shell Base Course—per cubic yard (cubic meter)

TESTING REQUIREMENTS

ASTM C 136 Sieve Analysis of Fine and Coarse Aggregates

ASTM D 698 Moisture-Content Relations of Soils and Soil Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in (305 mm) Drop

ASTM D 1556 Density of Soil in Place by the Sand-Cone Method

ASTM D 1557 Test for Laboratory Compaction Characteristics of Soil Using Modified Effort

ASTM D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils

END OF ITEM P-212

ITEM P-213 SAND-CLAY BASE COURSE

DESCRIPTION

213-1.1 This item shall consist of a base course composed of approved selected material, constructed on a prepared underlying course in accordance with these specifications and shall conform to the dimensions and typical cross section shown on the plans.

MATERIALS

213-2.1 SAND-CLAY. The materials shall be a mixture of clay and mineral aggregate. This mixture shall consist of topsoil, sand-clay, sand-clay gravel, disintegrated granite, or other approved selected aggregate, and it shall contain sufficient binder material so blended or processed as to produce a uniform mixture complying with the requirements of these specifications.

The materials shall be uniform and free from excess amounts of clay or organic matter such as leaves, grass, roots, and other objectionable or foreign substances. The coarse aggregate (particles coarser than a No. 4 mesh (4.75 mm) sieve) shall consist of hard, durable pieces or fragments of stone or gravel.

The gradation of the blended or processed material shall meet the requirements of one of the gradations given in the following table, when tested in accordance with ASTM C 136.

	Percentage by Weight	
Sieve designation	Passing Sieves	
1-1/2 inch (38.5 mm)	100	100
1 inch (25.0 mm)	85-100	85-100
No. 4 (4.75 mm)	45-75	65-100
No. 10 (2.0 mm)	30-60	60-100
No. 40 (0.42 mm)	10-40	20-70
No. 200 (0.075 mm)	2-15	4-25

The fraction passing the No. 40 (0.42 mm) mesh sieve shall be referred to as binder. The fraction passing the No. 200 (0.075 mm) mesh sieve shall be less than one-half the fraction passing the No. 40 (0.42 mm) mesh sieve. The material passing the No. 40 mesh sieve shall have a plasticity index not to exceed 6 and have a liquid limit of not more than 25, when tested in accordance with ASTM D 4318, for gradation A; plasticity index shall not exceed 4 and the liquid limit shall not exceed 25 for gradation B.

213-2.2 FILLER FOR BLENDING. If filler, in addition to that naturally present in the base course material, is necessary for satisfactory bonding of the material, or for changing the soil constants of the material passing the No. 40 (0.42 mm) mesh sieve, or for correcting the gradation to the limitations of the specified gradation, it shall be uniformly blended with the base course material. The material for such purpose shall be obtained from sources approved by the Engineer and, when used, shall be of a gradation necessary to accomplish the specified gradation in the finally processed material.

CONSTRUCTION METHODS

213-3.1 OPERATION IN PITS. All work involved in clearing and stripping pits, including the handling of unsuitable material shall be performed by the Contractor at his/her expense. The base material shall be obtained from approved pits or other approved sources. The material in the pits shall be excavated and handled in a manner that assures a uniform and satisfactory product.

213-3.2 EQUIPMENT. All equipment necessary for the proper construction of this work shall be on the project, in first-class working condition, and approved by the Engineer before construction is permitted to start.

The processing equipment shall be designed, constructed, operated, and capable of thoroughly mixing all materials and water in the directed proportions to produce a base course of the gradation and consistency required.

213-3.3 PREPARING UNDERLYING COURSE. The underlying course shall be checked and accepted by the Engineer before placing and spreading operations are started. Any ruts or soft yielding places caused by improper drainage conditions, hauling, or any other cause shall be corrected at the Contractor's expense before the base course is placed thereon. Material shall not be placed on frozen subgrade or subbase.

213-3.4 PLANT MIXING. The base material shall be uniformly blended and mixed in an approved central or travel mixing plant. The sand-clay, together with any blended material, shall be thoroughly mixed with the required amount of water. After the mixing is complete, the base material shall be transported to, and spread on, the underlying course without undue loss of the moisture content.

213-3.5 PLACING AND SPREADING. The base course material that is correctly proportioned or that has been processed in a plant shall be placed on the prepared underlying course and compacted in the thickness shown on the plans. The depositing and spreading of the material shall commence where designated and shall progress without breaks. The material shall be deposited and spread in lanes in a uniform layer and without segregation of size to such loose depth that, when compacted, the layer shall have the required thickness. The material shall be spread by spreader boxes, or other approved devices, equipped to distribute the material in a uniform layer.

When approved, the material may be dumped in piles, but it shall be spread immediately. Hauling over the uncompacted base course shall not be permitted.

213-3.6 TRAVEL PLANT MIX. When the use of a travel plant is approved, sufficient quantities and proportions of all material necessary shall be used to provide a base mixture that conforms to the specified gradation, quality, and thickness. If a windrow travel plant is employed for mixing, the sand-clay shall be placed in windrows parallel to the pavement centerline. If a traveling plant is used which mixes previously spread material in-place, the sand-clay shall be spread to a thickness that may be readily handled by the machine and that will develop the proper thickness for each layer. The base material shall be of a satisfactory moisture content to obtain maximum density.

After mixing has been completed, the base material shall be spread to the required depth and width by a self-powered blade grader, mechanical spreader, or other approved method. In spreading, care shall be taken to prevent cutting into the underlying layer. The material shall be bladed, disced, and dragged if necessary until a smooth, uniform surface is obtained true to line, grade, and cross section and in condition for compacting.

213-3.7 MIXED IN-PLACE. When the base materials are to be proportioned and mixed or blended in-place, the different layers shall be spread and placed in the following manner with the relative proportions of the components of the mixture designated by the Engineer.

The base aggregate shall be deposited and spread evenly on the subgrade to a uniform thickness and width. Then the binder or filler shall be deposited and spread evenly over the first layer. There shall be as many layers of materials added as the Engineer may direct to obtain the required base mixture.

After the required materials have been placed, they shall be thoroughly mixed and blended using approved graders, discs, harrows, rotary-tillers, supplemented by other suitable equipment if necessary. The mixing shall continue until the mixture is uniform throughout. Areas of segregated material shall be corrected by the addition of binder or filler material and then thoroughly remixed. If necessary, water in the required amount shall be uniformly applied as directed by the Engineer prior to and during the mixing operation to maintain the material at the proper moisture content. When the mixing and blending has been completed, the material shall be spread in a uniform layer which, when compacted, will meet the requirements for thickness and typical cross section.

213-3.8 GENERAL METHODS FOR PLACING. The base course shall be constructed in layers not less than 4 inches (100 mm) nor more than 6 inches (150 mm) of compacted thickness. Each layer shall be measured for depth. The material, as spread, shall be of uniform gradation with no pockets of fine or coarse materials. Unless otherwise permitted by the Engineer, the base shall not be spread more than 2,000 square yards (186 square meters)

in advance of the rolling. Any necessary sprinkling shall be kept within this limit. No material shall be placed in snow or on a soft, muddy, or frozen course.

When more than one layer is required, the construction procedure described herein shall apply similarly to each layer.

During placing and spreading operations, sufficient caution shall be exercised to prevent the incorporation of subgrade, subbase, or shoulder material into the base course mixture.

213-3.9 COMPACTION. Immediately after completion of the spreading operations, the base material shall be thoroughly compacted. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density.

The field density of the compacted material shall be at least 100 percent of the maximum density of laboratory specimens prepared from samples of the base material delivered to the jobsite. The laboratory specimens shall be compacted and tested in accordance with **[ ]**. The in-place field density shall be determined in accordance with ASTM D 1556. The moisture content of the material at the start of compaction shall not be below nor more than 1-1/2 percentage points above the optimum moisture content.

* * * *

METHOD OF MEASUREMENT

213-4.1 The quantity of sand-clay base course to be paid for shall be the number of cubic yards (cubic meters) of base course material placed, bonded, and accepted in the completed base course. The quantity of base course material shall be measured in final position based upon depth tests or cores taken as directed by the Engineer, at the rate of 1 depth test for each 300 square yards (28 square meters) of base course, or by means of average end areas on the complete work computed from elevations to the nearest 0.01 foot (3 mm). On individual depth measurements, thicknesses more than 1/2 inch (12 mm) in excess of that shown on the plans shall be considered as the specified thickness, plus 1/2 inch (12 mm) in computing the yardage for payment. Base materials shall not be included in any other excavation quantities.

BASIS OF PAYMENT

213-5.1 Payment shall be made at the contract unit price per cubic yard (cubic meter) for sand-clay base course. This price shall be full compensation for furnishing all materials and for all preparation, hauling, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-213-5.1 Sand-Clay Base Course—per cubic yard (cubic meter)

TESTING REQUIREMENTS

ASTM C 136	Sieve Analysis of Fine and Coarse Aggregates
ASTM D 698	Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in (305 mm) Drop
ASTM D 1556	Density of Soil in Place by the Sand-Cone Method
ASTM D 1557	Test for Laboratory Compaction Characteristics of Soil Using Modified Effort
ASTM D 2167	Density and Unit Weight of Soil in Place by the Rubber Ballon Method
ASTM D 4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soils

END OF ITEM P-213

ITEM P-217 AGGREGATE-TURF PAVEMENT

DESCRIPTION

217-1.1 This item shall consist of an aggregate-turf pavement composed of a base course of soil-bound crushed stone, soil-bound gravel, or soil-bound sand, and a seedbed of suitable soil or combination of soil and aggregate, constructed on a prepared subgrade or a previously constructed underlying course in accordance with these specifications, and shall conform to the dimensions and typical cross section shown on the plans.

This item may include the furnishing and applying of fertilizer, lime, top-soil, or other plant nutrients; the furnishing and planting of seed; and the furnishing and spreading of mulch. When any of these turfing materials are required, the quality, quantity, and construction methods shall be in accordance with applicable FAA Turf Specifications. When turf is to be established, the seedbed soil or topsoil shall be a natural friable soil, possessing characteristics of the best locally obtainable soils, which can produce a fairly heavy growth of crops, grass, or other vegetation.

The prepared composite mixture of aggregates used for the base course shall be **[Type A, B, or C, of Table 1][stabilizer aggregate of Table 2 mixed with in-place materials]**.

MATERIALS

217-2.1 STABILIZED MIXES. The designated stabilized base course mixtures shall conform to the following requirements.

Type A – The materials shall be natural or artificial mixtures of clay or soil binder and gravel, stone or sand, as screenings proportioned to meet the requirements specified.

Type B or C – The materials shall be natural or artificial mixtures of gravel, stone, or slag and soil so proportioned as to meet the requirement specified. The aggregate shall consist of clean, hard durable particles of crushed or uncrushed gravel, stone, or slag, and shall be free from soft, thin, elongated, or laminated pieces, and vegetable or other deleterious substances.

The prepared composite mixture used shall meet one of the applicable gradation requirements as follows when tested in accordance with ASTM C 136.

TABLE 1. REQUIREMENTS FOR GRADATION OF MIXTURE

Sieve Designation	Percentage by weight passing sieves		
(square openings)	A	B	C
2 inch (50.0 mm)	0	0	100
1 inch (24.0 mm)	100	100	70-95
3/4 inch (19.0 mm)	0	70-100	
No. 4 (4.75 mm)	0	40-70	
No. 10 (2.00 mm)	60-100	40-70	32-60
No. 20 (.085 mm)	50-90	0	0
No. 40 (0.425 mm)	40-75	20-45	20-40
No. 200 (0.075 mm)	12-30	10-20	10-20

The fraction of the composite mixture passing the No. 200 (0.075 mm) mesh sieve shall be less than two-thirds of the fraction passing the No. 40 (0.425 mm) mesh sieve. the fraction passing the No. 40 (0.425 mm) mesh sieve shall have a liquid limit not greater than 30 and a plasticity index not greater than 8 when tested in accordance with ASTM D 4318.

217-2.2 STABILIZER AGGREGATE. Stabilizer aggregate conforming to one of the gradations specified in Table 2, when tested in accordance with ASTM C 136, shall be placed upon the existing soil or base course in the specified quantity per square yard (square meter). The aggregate shall be uniformly blended with the soil or base

course material to the depth required or as shown on the plans. The aggregate shall consist of crushed stone, crushed or uncrushed gravel, or crushed slag, and it shall have a percent of wear not more than 60 at 500 revolutions as determined by ASTM C 131. The aggregate shall be free from soft, thin, elongated, or laminated pieces, disintegrated material, or other deleterious substances.

Where sand, as existing subgrade or base, requires stabilization, it shall be secured by the addition of clay or lime rock. The operations of spreading and mixing shall be handled as stated under construction methods.

TABLE 2. REQUIREMENTS FOR GRADATION OF STABILIZER AGGREGATE

Sieve designation	**Percentage by weight passing sieves**		
(square openings)	**D**	**E**	**F**
2 inch (50.0 mm)		100	
1-1/2 inch (37.5 mm)	100		
1 inch (24.0 mm)	90-100		
1/2 inch (12.5 mm)		0-15	100
No. 4 (4.75 mm)	20-50		85-100
No. 10 (2.00 mm)	0-10		
No. 100 (0.150 mm)			0-30

CONSTRUCTION METHODS

217-3.1 OPERATION IN PITS. All work involved in clearing and stripping pits, including handling of unsuitable material, shall be performed by the Contractor at his/her own expense. The base or binder material shall be obtained from approved sources. The material in the pits shall be excavated and handled in a manner that will secure a uniform and satisfactory product.

217-3.2 EQUIPMENT. All equipment necessary for the proper construction of this work shall be on the project in first-class working condition and approved by the Engineer before construction is permitted to start.

217-3.3 PREPARING SUBGRADE. Before any base course material is placed, the subgrade or underlying course shall be prepared and conditioned as specified. The underlying course shall be checked and accepted by the Engineer before placing and spreading operations are started.

217-3.4 PLACING MATERIALS.

a. All new material shall be placed on the prepared course and compacted in layers of the thickness shown on the plans. The depositing and spreading of the material on the prepared and completed layer shall commence where designated and shall progress without breaks. The material shall be deposited and spread in lanes in a uniform layer and without segregation of size to such loose depth that, when compacted, the layer will have the required thickness. The material shall be spread with approved equipment. When it is necessary to combine materials from different sources, it may be done either at the pits, in a processing plant prior to delivery of the material, or on the course in the proper proportions and in successive spreadings that give the required gradation and thickness of layer. If the combining is done on the course, the mixing shall be as specified hereinafter.

b. When it is necessary to blend new material with material on the existing surface, the existing surface shall first be scarified lightly and bladed to uniform grade and cross section as shown on the plans. After blading, and when necessary, the existing surface shall be further scarified and/or pulverized to provide sufficient loose material of the required depth to be mixed with the added material.

217-3.5 SPREADING AND MIXING.

a. Materials that have been mixed and processed in a processing plant at the pits, or elsewhere, shall be delivered and spread to the required depth.

b. Following the placing of the required materials being combined on the base course, the total base material shall be thoroughly pulverized and mixed by approved rotary-pulverizing mixers. The moisture content of the aggregate and soil binder shall be as specified by the Engineer to secure thorough mixing and the required compaction. The mixing shall produce a homogeneous mass of the specified gradation and soil characteristics to form a base course of the desired qualities. When the mixing is completed, the material shall be spread in a uniform layer which, when compacted, shall meet the requirements for thickness and typical cross section.

217-3.6 ROLLING. Immediately after completion of the spreading operations, the material shall be thoroughly compacted. The number, type, and weight of rollers shall be sufficient to compact the material to the required density.

The field density of the compacted material shall be at least 90 percent of the maximum density of laboratory specimens prepared from samples of the subbase material taken from the material delivered to the jobsite. The laboratory specimens shall be compacted and tested in accordance with ASTM D 698. The in-place field density shall be determined in accordance with ASTM D 1556 or ASTM D 2167. The moisture content of the material at the start of compaction shall not be below nor more than 1-1/2 percentage points above the optimum moisture content.

217-3.7 SURFACE TEST, THICKNESS, AND MAINTENANCE. The surface shall not deviate more than 1/2 inch (12 mm) when tested with a 16-foot (4.8 m) straightedge applied parallel with, and at right angles to, the centerline. Any deviation in excess of this amount shall be corrected by loosening, adding, or removing material, reshaping, and recompacting.

The thickness of the base course shall be determined by depth tests or cores taken at intervals in such manner that each test shall represent not more than 500 square yards (418 square meters). When the base deficiency exceeds 1/2 inch (12 mm), it shall be corrected. The Contractor shall replace, at his/her expense, the base material where borings have been taken for test purposes.

The surface of the base course shall be maintained and kept in a well-drained condition until the construction of another course. Sprinkling, blading, and rolling shall be performed when necessary to prevent the base material from becoming unbonded.

217-3.8 TURF-SURFACING. Following the construction of the soil-aggregate base, the Contractor shall prepare the seedbed for the turf. If topsoil is to be placed, the surface of the base course shall be loosened slightly, as directed by the Engineer. If seeding is to be done without topsoiling, the surface of the base shall be loosened sufficiently to prepare a seedbed. This can be accomplished by discing, harrowing, rotary-tilling, or other approved methods, and should be to a depth not less than 1 inch (25 mm) nor greater than 3 inches (75 mm). Any topsoil shall be spread to the depth as required. The seedbed preparation, applying lime, fertilizer and water, seeding, rolling and mulching, shall be performed in accordance with the specification requirements.

METHOD OF MEASUREMENT

217-4.1. Soil-aggregate base course shall be measured by the number of cubic yards (cubic meters) of base course material placed, bonded, and accepted in the completed base course. The quantity shall be measured in final position based on depth tests or cores, or by means of average end areas on the completed work.

Stabilizer aggregate shall be measured by the number of cubic yards (cubic meters) of aggregate furnished, placed, and accepted in the completed base course.

When approved materials in-place are utilized in the base course, the preparation and incorporation of other materials in the base mixture shall be measured as a conditioning and mixing operation. Conditioning shall be measured by the number of square yards (square meters) of such material prepared and incorporated in the mix, completed, and accepted.

[Topsoil shall be measured by the number of cubic yards (cubic meters) of topsoil removed, placed, and spread in the accepted work.]

[Lime and fertilizer shall be measured by the number of tons (kg) or 100-pound (45.4 kg) sacks, of the quality specified in the bid schedule, furnished, incorporated, and accepted.]

[Seeding shall be measured by the number of acres seeded, and accepted.]

[Watering for planting shall be measured by the number of 1,000-gallon (4000 liters) units of water measured by an approved water meter or in the vehicle at the point of delivery, furnished and applied as specified or ordered.]

[Mulching shall be measured by the number of acres mulched, and accepted.]

BASIS OF PAYMENT

217-5.1 Payment shall be made at the contract unit price per cubic yard (cubic meter) for soil-aggregate base course; at the contract unit price per cubic yard (cubic meter) for stabilizer aggregate; at the contract unit price per square yard (cubic meter) for conditioning operation; at the contract unit price per cubic yard (square meter) for topsoil; at the contract unit price per ton (kg) for lime; at the contract unit price per ton (kg) for fertilizer; at the contract unit price per acre for seeding; at the contract unit price per 1,000-gallon (4000 liter) unit for watering; and at the contract unit price per acre for mulching. These prices shall be full compensation for furnishing all materials and for all preparation, hauling, and placing of these materials; and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-217-5.1 Soil Aggregate Base Course—per cubic yard (cubic meter)

Item P-217-5.2 Stabilizer Aggregate—per cubic yard (cubic meter)

Item P-217-5.3 Conditioning Operation—per square yard (cubic meter)

Item P-217-5.4 Topsoil—per cubic yard (cubic meter)

Item P-217-5.5 Lime—per ton (kg)

Item P-217-5.6 Fertilizer—per ton (kg)

Item P-217-5.7 Seeding—per acre

Item P-217-5.8 Watering—per 1,000-gallon (4000 liter) unit

Item P-217-5.9 Mulching—per acre

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ASTM D 698 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb (2.49 kg) Rammer and 12-inch (300 mm) Drop

ASTM D 1556 Density of Soil in Place by the Sand-Cone Method

END OF ITEM P-217

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ITEM P-219 RECYCLED CONCRETE AGGREGATE BASE COURSE

DESCRIPTION

219 -1.1 This item consists of a base course composed of recycled concrete aggregate, crushed to meet a particular gradation, constructed on a prepared course in accordance with these specifications and in conformity to the dimensions and typical cross sections shown on the plans.

MATERIALS

219-2.1 AGGREGATE. Recycled concrete aggregate shall consist of Portland cement concrete or other concrete containing pozzolanic binder material. The recycled concrete material shall be free of reinforcing steel, expansion material. Asphalt concrete overlays shall be removed from the PCC surface prior to pavement removal and crushing. Also, full-slab asphalt concrete panels (used as a replacement for a removed PCC slab) shall be removed. An incidental amount of recycled asphalt concrete pavement and other foreign material may be present in the recycled concrete aggregate.

Recycled concrete aggregate for base course shall consist of at least 90 percent, by weight, Portland cement concrete, with the following materials making up the remaining 10 percent:
Wood - 0.1 percent maximum
Brick, mica, schist, or other friable materials - 4 percent maximum
Asphalt concrete – 10 percent maximum

Virgin aggregates may be added to meet the 90 percent minimum concrete requirement

The percentage of wood, brick, mica, schist, other friable materials, and asphalt concrete shall be determined by weighing that material retained on the No. 4 sieve, and dividing by the total weight of recycled concrete aggregate material retained on the No. 4 sieve.

Fine aggregate passing the No.4 (4.75-mm) sieve shall consist of fines from the operation of crushing the recycled concrete aggregate. If necessary, fine aggregate may be added to produce the correct gradation. The fine aggregate shall be produced by crushing stone, gravel, slag, or recycled concrete that meet the requirements for wear and soundness specified for coarse aggregate.

* * * *

The amount of flat and elongated particles in recycled concrete aggregate shall not exceed 20 percent for the fraction retained on the 0.5 inch (13 mm) sieve nor 20 percent for the fraction passing the 0.5 inch (13 mm) sieve when tested in accordance with ASTM D 4791. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3.

* * * *

EQUIPMENT

219-3.1 GENERAL. All equipment necessary to mix, transport, place, compact, and finish the recycled concrete aggregate base course shall be furnished by the Contractor. The Contractor shall provide written certification to the Engineer that all equipment meets the requirements for this section. The equipment shall be inspected by the Engineer at the job site prior to the start of I construction operations.

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219-3.2 MIXING EQUIPMENT. Base course shall be thoroughly mixed in a plant suitable for recycled concrete aggregate. The mixer shall be a batch or continuous-flow type and shall be equipped with calibrated metering and feeding device that introduce the aggregate and water into the mixer in specified quantities. If necessary, a screening device shall be installed to remove oversized material greater than 2 in (50 mm) from the recycled concrete aggregate feed.

Free access to the plant shall be provided to the Engineer at all times for inspection of the plant's equipment and operation and for sampling the mixed recycled concrete aggregate
materials.

219-3.3 HAULING EQUIPMENT. The mixed recycled concrete aggregate base course shall be transported from the plant to the job site in hauling equipment having beds that are smooth, clean, and tight. Truck bed covers shall be provided and used to protect the mixed recycled concrete aggregate base course from rain during transport.

219-3.4 PLACING EQUIPMENT. Recycled concrete aggregate shall be placed using a mechanical spreader or machine capable of receiving, spreading, and shaping the material without segregation into uniform layer or lift. The placing equipment shall be equipped with a strike off plate that can be adjusted to the layer thickness. [**The placing equipment shall have two end gates or cut off plates, so that the recycled concrete aggregate may be spread up to a lane width.]**

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conditions, hauling, or any other cause shall be corrected at the Contractor's expense before the base course is placed thereon. Material shall not be placed on frozen material.

To protect the existing layers and to ensure proper drainage, the spreading of the recycled concrete aggregate base course shall begin along the centerline of the pavement on a crowned section or on the greatest contour elevation of a pavement with a variable uniform cross slope.

219-4.3 GRADE CONTROL. Grade control between the edges of the recycled concrete aggregate base course shall be accomplished by grade stakes, steel pins, or forms placed in lanes parallel to the centerline and at intervals of 50 ft (15 m) or less on the longitudinal grade and 25 ft (7.5 m) or less on the transverse grade.

219-4.4 MIXING. The recycled concrete shall be uniformly blended during crushing operations and mixed with water in a mixing plant suitable for recycled concrete aggregate. The plant shall blend and mix the materials to meet the specifications and to secure the proper moisture content for compaction.

219-4.5 PLACING. The recycled concrete aggregate base material shall be placed on the moistened subgrade or base in layers of uniform thickness with an approved mechanical spreader.

The maximum depth of a compacted layer shall be 6 inches (150 mm). If the total depth of the compacted material is more than 6 inches (150 mm), it shall be constructed in two or more layers. In multi-layer construction, the material shall be placed in approximately equal-depth layers.

The previously constructed layer shall be cleaned of loose and foreign material prior to placing the next layer. The surface of the compacted material shall be kept moist until covered with the next layer.

Adjustments in placing procedures or equipment shall be made to obtain grades, to minimize segregation grading, to adjust the water content, and to ensure an acceptable recycled concrete aggregate base course.

219-4.6. EDGES OF BASE COURSE. The recycled concrete aggregate shall be placed so that the completed section will wider, on all sides, than the next layer that will be placed above it, as shown on the plans. Approved fill material shall be placed along the free edges of the recycled concrete aggregate in sufficient quantities to compact to the thickness of the course being constructed, or to the thickness of each layer in a .multiple course, allowing in each operation at least a 2-ft (0.6-m) width of this material to be rolled and compacted simultaneously with rolling and compacting of each layer of base course. If this base course material is to be placed adjacent to another pavement section, then the layers for both of these sections shall be placed and compacted along the edge at the same time.

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Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, the unsatisfactory portion shall be scarified, and recompacted or replaced at Contractor's expense.

219-4.10 SURFACE TOLERANCES. The finished surface shall not vary more than 3/8 inch (9 mm) when tested with a 16-ft (4.8-m) straightedge applied parallel with or at right angles to the centerline. The Contractor shall correct any deviation in excess of this amount, at the Contractor's expense.

219-4.11 THICKNESS CONTROL. The completed thickness of the base course shall be within 0.5 inch (13 mm) of the design thickness. Four determinations of thickness shall be made for each lot of material placed. Each lot shall be divided into four equal sublots. One test shall be made for each sublot. Sampling locations will be determined on a random basis in accordance with procedures contained in ASTM D 3665. Where the thickness is deficient by more than 0.5 inch (13 mm), the Contractor shall correct such areas at no additional cost by excavating to the required depth and replacing with new material. Additional test holes may be required to identify the limits of deficient areas.

219-4.12 TRAFFIC. Equipment used in construction may be routed over completed portions of the base course, provided no damage results and provided that the equipment is distributed evenly over the full width of the base course to avoid rutting or uneven
compaction.

219-4.13 MAINTENANCE. The base course shall be maintained until the base course is completed and accepted. Maintenance will include immediate repairs to any defects and shall be repeated as often as necessary to keep the completed work intact. Any area of the recycled concrete aggregate base course that is damaged shall be reworked as necessary .

METHOD OF MEASUREMENT

219-5.1 The quantity of recycled concrete aggregate base course to be paid will be determined by measurement of the number of square yards (square meters) of material actually constructed and accepted as complying with the plans and specifications.

BASIS OF PAYMENT

219-6.1 Payment shall be made at the contract unit price per square yard (square meter) for recycled concrete aggregate base course. This price shall be full compensation for furnishing all materials, for preparing and placing these materials, and for all labor, equipment tools, and incidentals necessary to complete the item. Payment will be made under:

Item P-219-6.1 recycled Concrete Aggregate Base Course -per square yard (square meter)

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ASTM D 693 Crushed Stone, Crushed Slag, and Crushed Gravel for Dry-or Water- Bound Macadam Base Courses and Bituminous Macadam Base and Surface Courses of Pavements

ASTM D 698 Moisture-Density Relations of Soils and Soil -Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in (305-mm) Drop

ASTM D 1556 Density of Soil in Place by the Sand -Cone Method

ASTM D 1557 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.5-kg) Rammer and 18-in (457-mm) Drop

ASTM D 2167 Density of Soil in Place by the Rubber-Balloon Method ASTM D 2419 Sand Equivalent Value of Soils and Fine Aggregate

ASTM D 2922 Density of Soil and Soil-Aggregate in Place by Nuclear Methods

ASTM D 3017 Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods

ASTM D 3665 Random Sampling of Paving Materials

ASTM D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils

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