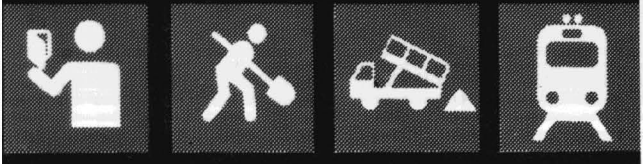
CEMP-CE Engineer Pamphlet 415-1-261 Volume 1	Department of the Army U.S. Army Corps of Engineers Washington, DC 20314-1000	EP 415-1-261 Volume 1 2 January 1992
	Construction Quality Assurance Representative's Guide General Information and Sitework	
	Distribution Restriction Statement Approved for public release; distribution is unlimited.	

US Army Corps
of Engineers

EP 415-1-261
Volume 1
January 1992

Quality Assurance Representative's Guide



General Information and Sitework

DEPARTMENT OF THE ARMY EP 415-1-261
U.S. Army Corps of Engineers
CEMP-CE Washington, D.C. 20314

Pamphlet
No.415-1-261 2 January 1992

Construction
QUALITY ASSURANCE REPRESENTATIVE*S GUIDE
FOREWORD

This guide is one of four volumes reprinted with revisions from guides first published in 1964. The reason for their existence and continuance is to provide construction representatives, those with quality control/quality assurance responsibilities, a reliable checklist type reference for each phase of construction.

Quality Assurance/Quality Control (QA/QC) representatives will find the information useful and appropriate for their roles of assuring and controlling construction quality in accordance with the plans and specifications. The guide will, therefore, become a valuable reference when implementing project plans and specifications. Their contents will also help refresh the memory of experience, training, and good old common sense. The application of sound knowledge together with a proper sense of responsibility and use of authority will result in meaningful decision making, a factor considered essential for effective quality assurance/quality control. The objective is to produce quality products for our customers worldwide.

FOR THE COMMANDER:

Milton Hunter

MILTON HUNTER
Colonel, Corps of Engineers
Chief of Staff

This Volume 1 of EP 415-1-261 supersedes Volume 1 EP 415-1-261, November 1981

TABLE OF CONTENTS

Chapters numbered in the guides contain the same subject information as the numbered divisions in the specifications for both military and civil works construction projects. They are identified by specific volume as follows:

Chapter Number	Volume 1	Subject
1		General Requirements
2		Sitework: earthwork, underground utilities, paving, plantings, and railroads
	Volume 2	
2		Sitework (continued): piles, levees, dams, relief wells, drilling, lock and dam gates, penstocks, revetments, dredging, jetty, breakwater, and groin construction
	Volume 3	
3		Concrete
4		Masonry
5		Metals
6		Wood and Plastics
7		Thermal & Moisture Protection
8		Door & Windows
9		Finishes
10		Accessories & Specialties
12		Furnishing & Casework
	Volume 4	
13		Special Construction
14		Conveying systems
15		Mechanical
16		Electrical

CHAPTER 1A
GENERAL INFORMATION

INDEX

CHAPTER 1A

GENERAL INFORMATION

1A-01. INTRODUCTION

As Quality Assurance and Quality Control Representatives (QA/QC), you should be thoroughly familiar with all the provisions of the contract documents, including submittals. Plans and specifications should include all revisions, changes, and amendments. In addition, you should be thoroughly familiar with the administrative policies of your supervisors. The general requirements for quality control and quality assurance are given in paragraph 1A-04, Quality Control and Quality Assurance.

1A-02. RESPONSIBILITY

Quality Assurance/Quality Control Representatives have different responsibilities and authorities, dependent upon the organizational set—up under which they work and upon their own capabilities. Each QA/QC, however, needs to know the part he has in the organization, and should have or obtain clear and precise answers to the following questions:

a. Do I understand the importance of my responsibility for the highest quality construction?

b. Do I have the technical knowledge, tact and good judgment to effectively perform my quality assurance duties?

c. Do I fully understand the extent of my responsibilities? Ask yourself:

(1) Have I accepted all of my responsibilities?

(2) Have I overlooked any of my potentialities?

(3) Will I use my authority tactfully?

(4) Do I understand my supervisor*s expectations with respect to my responsibilities?

(5) Am I aware of my responsibility to record in my daily report all verbal instructions given and received?

1A-03. AUTHORITY

a. Make sure you know the extent of your authority. Your authority constantly involves the requirement that work be accomplished in accordance with the contract plans and specifications. At times implementing this authority requires advice and assistance.

b. Check with your supervisor on policies with respect to your authority to stop contractor operations for such things as safety violations as well as construction deficiencies.

1A-04. QUALITY CONTROL AND QUALITY ASSURANCE

a. Contractors* Quality Control (CQC) is a requirement in all Corps of Engineers construction contracts. Quality

Assurance is that function which is provided by the representatives of the contracting officers in the Construction Divisions supervision and administration of the contract.

b. The quality assurance role is to be able to assure the Contracting Officer, and through him the owner, that the quality requirements of the contract have been satisfied.

c. Contractor Quality Control requires that the contractor implement the program and use its provisions daily to control quality of the work.

d. Effective CQC requires a serious and concentrated effort on the part of the supervisory and inspection personnel.

e. Contract requirements provide the tools for the accomplishment of the goals, as follows

(1) CQC personnel are described as to education, experience, and capability.

(2) Before start of construction, the Resident Engineer shall conduct a Mutual Understanding Meeting with the contractor and discuss the contractor*s quality control system. Construction start will be delayed until after the Mutual Understanding Meeting and submittal/acceptance of at least the interim CQC plan. The CQC plan will be viewed with a critical eye. The QA Representative will assure that the CQC Plan and actual CQC staffing are sufficient to obtain the quality of construction designed in the contract plans and specifications. Quality assurance monitors and confirms quality, but quality control must provide it.

(3) Preparatory Phase Meetings. These CQC held (QAR Attended) meetings will be held before each definable feature of work to ensure that the documentation is complete, materials are on hand, and the people who are to perform the work understand what they need to know about the feature of work. Both the contract specifications and those referenced in the contract specifications must be in the Contractor*s library and available to the CQC inspectors. For instance, the welding specifications will depend entirely on the American Welding Society (AWS) Specifications for all requirements. If CQC does not have the AWS specifications, the CQC cannot know or enforce these provisions. QA personnel can be helpful to the CQC in obtaining referenced specifications. The contractor*s job hazard analysis plan for the particular work item on the agenda must be reviewed at this time

(4) Initial Inspections. These CQC/QA inspections must be conducted in a timely manner at beginning of a definable feature of work. A check of the preliminary work will determine Whether or not the Contractor, through his CQC organization and the craftsmen involved, thoroughly understands and is capable of accomplishing the work as specified. Safety, using the Job Hazard Analysis plan, is also checked for proper implementation at this time.

(5) Follow—up Inspections. These inspections, also conducted by the Contractor*s quality control staff, occur daily when work is in progress and are for the purpose of assuring that the controls established in the earlier phases of inspection continue to provide work which conforms to the contract requirements. Most of the comments in both the CQC and QA daily reports result from these inspections.

f. In all projects there is work that is ‘cut and cover*, that is, work that cannot be inspected “after the fact*. This includes concrete, where the size, number and location of reinforcing steel cannot be readily determined after the concrete is placed. Most of the underground utilities cannot be inspected after covering. Work of this nature must be closely controlled and monitored.

g. A disadvantage with the system arises from the fact that CQC personnel, as employees of the contractor, are unlikely to readily take actions which will result in delay and expense to the contractor for the sake of quality. If concrete is to be placed with a maximum slump of 2”, it is unlikely that a load with 4” or 6” slump will be rejected. If roofing bituminous material is overheated, it is unlikely that it will be rejected. The deficiencies occasioned by these conditions may become latent defects revealed long after any possible contractor liability can be enforced.

h. The foregoing situations may occur and the Corps representative responsible for quality assurance has a vital role in assuring that these and similar situations do not occur. Responsibility for compliance should not be left wholly to the contractor.

i. As a Quality Assurance representative must closely monitor the CQC program to assure that the 3-phase control system is being correctly performed and that the contractor is effectively controlling all operations. In the event that CQC personnel are not capable and/or are not inspecting properly, your supervisor should be notified immediately, with a view to correcting performance by using one or more of the enforcement tools provided for in the contract. Your records and reports will document all facts.

1A-05. PLANS AND SPECIFICATIONS

a. Make a thorough review of plans and specifications during bidding period.

(1) Watch for omissions.

(2) Watch for discrepancies between plans and specifications.

(3) Check plans and specifications against requirements with which you have had problems with on similar jobs.

(4) Compare elevations, grades and details shown on plans as existing, with those at the actual site.

(5) Report all errors, omissions, discrepancies, and deficiencies to your supervisor.

b. Always keep a posted and marked up set of plans and specifications convenient for ready reference.

c. Make sure that the contractor has this same information.

d. Anticipate contractor*s operations by reviewing the plans and specifications for each operation before it begins.

(1) Discuss contract requirements in each Preparatory Phase Meeting with the contractor before each operation begins.

(2) Highlight and/or make notes of those provisions which need special attention, such as:

(a) Unusual requirements.

(b) Those which other contractors have overlooked.

(c) Repetitive deficiencies.

e. Use the checklists in these guides to help find significant items in the plans and specifications.

1A-06. SHOP DRAWINGS

a. Review designer*s prepared contractor submittal register, plans, and specifications. Check submittal register for inclusion of all shop drawings required including layouts of equipment, equipment rooms, etc.

b. The contractor is required to enter his data onto the submittal register and submit it to the contracting officer. Compare this submittal with your check list.

c. The contractor is required to periodically update the submittal register.

d. Make continual checks of the submittal register to avoid untimely and omitted submittals so as to avoid delay of construction.

e. Compare the shop drawings to the contract requirements and report apparent differences to your supervisor. (Approved shop drawings do not constitute a waiver of a contract requirement.)

f. Make sure each detail on the shop drawing is clearly understood.

g. The contractor must make note on his submittal of items which deviate from contract requirements.

h. Check material being installed against the approved shop drawing. (If the contractor installs unapproved material, inform him in writing that the material, if not subsequently approved, will be removed at his expense.)

1A-07. QUALITY ASSURANCE REPORT

a. Prepare a complete and accurate daily report, using ENG Form 2538-2. Check for inclusion of the following:

(1) Conditions — weather, moisture, soil conditions, etc. (Note when and how adverse condition hampered or shut down a contractor*s operation).

(2) Activities — work phases, including locations (include description of each activity and the inspection phase, i.e., Preparatory, Initial, Follow-up).

(3) Controversial matters — disputes, questionable items, etc. (Also, note if they were settled and, if so, how they were settled.

(4) Deficiencies and violations — description, location and corrective action.

(5) Instructions given and received - identify recipient and source.

(6) Progress information - report all delays, action taken or action contemplated.

(7) Equipment — report arrival and departure of each major item of equipment by manufacturer, model, serial number and capacity: report equipment in use and idle equipment.

(8) Reports — make sure quality assurance reports are identified, dated and signed.

b. Do not repeat, in the QA daily reports, items that have already been listed on the CQC daily reports.

c. Check the CQC daily report each day for accuracy and to assure that instructions received are noted. Effectiveness of the CQC inspections reported must be checked during the job site visit.

1A-08. PRE-CONSTRUCTION CONFERENCE

a. When possible, both the Quality Assurance Representative and the Quality Control System Manager should attend this conference.

b. Minutes of the conference should be available to each of the quality assurance/quality control representatives assigned.

c. The subject of the proposed Quality Control Plan should be well documented.

1A-09. EQUIPMENT PROPOSAL

a. Does equipment proposed by the contractor have CO approval (more applicable to civil works projects)?

b. Certain equipment requires a safety test or check before initial operation at the site.

c. Some equipment requires a permit or license before use.

1A-10. CLAIMS

a. Always be alert to possible claims or matters of possible dispute.

b. When you discover that a claim or dispute is in the making, notify your supervisor and record all facts in your quality assurance (QA/QC) daily reports.

c. Make sure that adequate and accurate records of facts, materials, labor and equipment associated with the claim or dispute are on file.

d. Situation photographs may be appropriate to supplement the record.

e. Differing site conditions may be cause for claim — contractor must notify CO in writing before disturbing conditions.

1A-11. PROGRESS SCHEDULES

a. Render any necessary assistance to the contractor for his preparation of initial and revised progress schedules.

b. Encourage contractor to submit timely updates.

c. Be familiar with the approved progress schedule and carefully watch for any slippage in progress.

d. Anticipate slow downs and delays affecting progress.

e. Promptly report to your supervisor and record in the daily QA/QC reports, all indications of any slippage in progress.

f. When construction falls behind schedule, carefully examine the construction operations for ways progress can be improved.

g. Be very careful not to direct or dictate the contractor*s operation (the CO may want to direct the contractor to take steps to improve his progress).

h. Keep informed of the required contract completion date and know the advance notice required by higher authorities for pre-final and final inspections.

1A-12. LABOR ENFORCEMENT

a. Keep informed of the labor provisions of the contracts on which you are working.

b. Always avoid taking part in any labor disputes.

c. Promptly inform your supervisor of any labor problems and disputes.

d. Check that anti-discrimination posters and minimum wage rates are kept in a conspicuous place.

a. Assist office personnel in assuring that:

(1) The man-hours worked are accurately shown on payrolls.

(2) Payrolls are required weekly from each subcontractor who worked on the job.

(3) Each laborer and each machine is classified in accordance with the particular work function.

f. Make spot checks with contractor*s employees to verify that at least minimum wage rates are being paid for the work classification being performed.

1A-13. STORAGE OF MATERIALS

a. Check to see that adequate space is available for the contractor*s operations and storage areas.

b. Check that approval has been obtained for temporary sheds, buildings, etc., which the contractor proposes to install.

c. See that material and equipment are properly stored and protected.

d. Make sure that safety requirements, especially in the storage of flammable or explosive materials, are adhered to.

e. Make sure that temporary structures are secured against wind damage.

f. Assure that the necessary heating and ventilating are provided.

1A-14. CONTRACTOR*S PAYMENT ESTIMATES

a. Check specifications for method of measurement and payment for each item of work to be accomplished.

b. Be familiar with schedules of prices and methods of measurement and payment.

c. Assist the Office Engineer in preparation of partial pay estimates.

(1) Make timely measurements of work completed and work accomplished each pay period. It is usually a good idea to seek contractor*s concurrence.

(2) Keep orderly, neat and accurate records of measurements.

d. Check material on hand for which payment is being made for:

(1) Fair market value of materials.

(2) Conformance with contract requirements (see submittal)

(3) Proper storage and protection.

(4) Reduction in quantity by amount of material placed in the work.

e. Be alert to all increases or decreases in quantity of work shown on the unit price schedules.

(1) Make as accurate an estimate as possible of variations in quantities.

(2) Report these variations in quantities promptly to your supervisor.

1A-15. DEFENSE MATERIALS SYSTEM

On applicable contracts check to see that the contractor is abiding by the rules of the Defense Materials System.

a. Is the contractor correctly rating all orders, and are they certified and dated?

b. Is the promised delivery date noted on the orders?

c. Does the order give complete information which will enable a person to precisely identify the order and processing channel?

1A-16. RIGHTS-OF-WAY

Check that all rights-of-way are obtained prior to entrance on property.

a. Require written evidence if contractor-obtained.

b. Check contract provisions if Government—obtained.

c. Know the limits of rights-of-way and locations of bench-marks that may be used to determine location and elevations.

1A-17. PHOTOGRAPHS.

a. If allowable, check for photographs of:

(1) Views of major construction projected during various stages of progress.

(2) Materials or construction related to changed con-ditions, claims, or potential claims.

(3) Work in place for which removal has been ordered because of noncompliance with plans and specifications.

(4) Construction in which unusual difficulties have been overcome or where the subject is of technical interest.

(5) New methods of construction.

(6) property or material damages.

(7) Emergency conditions and safety violations.

(8) Accident scenes.

(9) Defective work.

b. Check that each picture taken is completely described, identified, and dated.

1A-18. RECORD DRAWINGS

a. The contractor*s Record Drawings should be reviewed monthly by the Resident Engineer*s staff to ensure they are correct.

b. Ensure that as soon as a change or addition is made in construction it is noted on the Record Drawing.

c. See that the following items are considered in the changes for Record Drawings:

(1) Size, type, and location of existing and new utility lines.

(2) Layout and schematic drawings of electrical circuits and piping.

(3) Dimensions and details transferred from shop drawings.

(4) Verification of alignment, cross section, and layout of earthwork.

(5) Actual locations of anchors, construction and control joints. etc. in concrete, where they are different from those shown on contract drawings.

(6) Changes in location of equipment and architectural features.

(7) Cross out such words, phrases and details for optional or equal requirements and list or detail specifically the items provided.

1A-19. TRANSFER OF CONSTRUCTION

The following records and materials will be needed for transfer of the construction facilities to the Using Service. They must be obtained and accounted for.

a. Record of Property — Name, make, and model number of each piece of equipment.

b. All equipment test records.

c. Approved shop drawings.

d. Operating and maintenance instructions.

e. Spare parts and tools.

f. Keys.

g. Guarantees with required contact and expiration date.

h. Record Drawings.

1A-20. QUALITY ASSURANCE/QUALITY CONTROL

Remember that QA/QC responsibilities begin at the inception of construction and ends only with the final acceptance by the user. Proper QA/QC verifies what has been done as well as what may have been left out.

1A-21. SAFETY

a. The provisions of EM 385-1-1, Safety and Health Requirements Manual,* which are incorporated into the contract, must be rigidly enforced. This enforcement is as important as any duty of the Quality Assurance Representative.

b. A good QA/QC technique to follow daily is to fully assess the unit of work or operation for safety compliance before proceeding with QA/QC for the technical compliance.

c. Be familiar with the contractor*s accident prevention program and in particular the job hazard analysis plans. These plans should be discussed in the Preparatory Meeting and checked for implementation during the Initial Inspection Meeting.

d. Applicable Occupational Safety and Health Act (OSHA) requirements are included in EM 385-1—1.

CHAPTER 1B

LAYOUT AND QUANTITY SURVEYS

INDEX

CHAPTER 1B

LAYOUT AND QUANTITY SURVEYS

1B-01. GENERAL LAYOUT

It is the responsibility of the Government to establish, at the site, base lines and bench marks necessary to completely lay out the work. The contractor is required to utilize these established points to perform the necessary survey to execute his work.

a. Ascertain that the Government—established points have been found, and that they are maintained and preserved by the contractor.

b. Ensure that the contractor utilizes these Government points and establishes additional prints as necessary to have complete control over the layout of his job.

c. See that the contractor*s layout work is accurately performed and that complete notes are maintained.

d. Ensure that adequate stakes and templates are provided and maintained by the contractor, and that they are clearly marked.

e. Continually check the contractor*s lines and grades of work being accomplished.

1B-02. LAYOUT PROCEDURES

a. General

The required order of accuracy of the layout surveys, if not stated in the specifications, must be established at the outset of the work, usually by the Resident Engineer or higher authority. Remember, as a general rule, the layout surveys must be made with sufficient accuracy that the construction which follows can be held within the specified tolerances. For example, if the specifications require a wall to be constructed within ½ -inch of the location shown on the drawings, the work line laid out by the survey party will have to be correctly located within a much smaller margin of accuracy, say 1/8-inch or 1/16-inch, to leave room for normal variations which must be expected in the construction work. On the other hand, the specified tolerances for the surface of a heavy rock fill might be 1-inch above and 6 inches below grade, in which case an error of as much as an inch in the layout would not cause problems.

b. Deviations from Plans

Should it appear necessary or desirable to change the location or dimensions of any part of the work to fit existing work or adjacent work under another contract (in order to take advantage of more favorable terrain or to rectify an error in the drawings or for any other reason) , report the circumstances promptly to your supervisor.

1B.-03. QUANTITY SURVEYS

a. General

The Government is usually responsible for the original and final survey and for the compilation of quantities of work performed or finally in place where estimated quantities are included in the unit price schedule. Quantities of certain materials and equipment are required for installed equipment property records for the owner.

b. Controls

Wherever practicable, cross-section work should be tied into the same horizontal and vertical controls used for the construction layout. If it is found necessary to establish an independent base line and/or bench mark with an assumed elevation, as might be the case when cross-sectioning a borrow area remote from the construction site, these controls must be located so as to preclude the possibility of losing them. Alternatively they must be tied in by careful horizontal and vertical measurements to a sufficient number of safely located reference points to insure that the controls can be re-established in the event of disturbance.

c. Instruments and Equipment

(1) Are all instruments and equipment (used in making measurements) of a type and quality such that they are capable of maintaining the required degree of accuracy?

(2) Have levels and transits been checked before starting work, to ensure they are in adjustment?

(3) Are they checked periodically during the course of the work and readjusted as necessary?

(4) Are adjustments necessary at frequent intervals? This may indicate that an instrument is not in an acceptable condition for the work to be done.

(5) Are tapes and rods checked for accuracy before starting work?

(6) Are tapes and rods checked during the course of the work for damage or wear? Do not permit the use of tapes or rods which have been worn or damaged to such an extent that correction factors must be applied to measurements taken with them.

d. Measuring Procedures

(1) General - Such items as orientation of the cross-section base line, frequency (spacing) of cross-sections and individual shots, accuracy of tape and rod readings for individual shots and required degree of precision in orienting the cross-sections perpendicular to the base line, all depend upon irregularity of the terrain, shape of the excavation, fill, or other volume to be measured, and upon the unit prices of the payment items involved. These standards must be established at the outset of the work, usually by the Resident Engineer or higher authority.

(2) Checking

(a) Is leveling checked by closing on bench marks?

(b) Are distances checked at the end of each cross-section by taping into an auxiliary parallel base line or by comparison with the adjacent cross-section?

(3) Cross-sections

(a) Have specifications been reviewed and list made of all payment items for which surveys will be needed to measure quantities?

(b) Are cross-sections extended far enough to include the "catch points" of excavation and fill slopes, with generous allowances for over-excavation?

(c) Are sufficient intermediate cross-sections being taken to catch abrupt changes in slope of terrain?

(d) Are plans referred to frequently enough to insure that cross-sections are taken where needed to show conditions at changes in alignment and to show shape and grade of work?

(e) Is a chart or marked drawing being maintained to show the relative locations of cross-sections taken, to show the work in progress, and to insure that cross-sections will be taken in advance of the work?

(f) As cross-sections are taken the QA Rep must be alert to all instances where actual conditions differ from those shown on the drawings. Examples: Ground surface higher or lower than indicated; boulders or ledge rock occurring at locations or elevations different from those indicated; evidence of ground water at locations not indicated; underground or overhead utilities not shown on the drawings. Report the existence of any of these conditions promptly to your supervisor. They may indicate future overruns or underruns in contract payment quantities, or troublesome claims by the contractor on account of “differing site conditions.” Early awareness of these conditions gives the Government maximum opportunity to study possible design changes to avoid or minimize extra expense.

(4) Recording

(a) Are all quantity measurements accurately and neatly recorded in an orderly manner in one binder, if possible?

(b) Is the record such that anyone at a later date will be able to readily and understandably re-evaluate or examine all measurements and computations?

CHAPTER 2A

CLEARING AND GRUBBING

INDEX

CHAPTER 2A

CLEARING AND GRUBBING

2A-01. PRE-CONSTRUCTION ACTIONS

a. Extent of Clearing. Grubbing, and Disposal Work

Check by a thorough review of the contract plans, specifications, and by reconnaissance of the area. Check permit restrictions and rights—of—way.

b. Contractor*s Schedule of Operations

Schedule of operations shall be obtained and studied.

c. Work Limits

(1) Determine whether limits have been established in agreement with plans and specifications.

(2) Ensure that area to be cleared and grubbed is clearly marked.

(3) Check the cut-off elevations.

(4) Check depth and size of roots to be removed.

(5) Assure that monuments, markers, special trees are properly protected.

d. Acquisition of Land or Easements

(1) Do not permit contractor to enter any land where easements have not been received or when satisfactory agreement to enter has not been made.

(2) Determine from your supervisor that the rights-of-way are available for construction.

e. Safety of Personnel and Equipment

(1) Identify and post existing and potential hazards, including poison oak, poison ivy, and poison sumac.

(2) Be sure that First Aid Stations are clearly marked and that signs are posted showing location of the station.

(3) Check the contractor*s accident prevention plan for each particular phase of operation before each phase begins.

(4) Check personal protective equipment; hard hats, gloves, snake-proof leggings, etc.

(5) Inspect equipment for fire protection, guarding of moving parts and pinch points.

f. Existing Power lines and Other Utilities

Note whether they are properly posted, protected, relocated, or removed as required.

g. Work Requirements

(1) Know the requirements for the different areas.

(2) Check the terrain, soil conditions and growth.

(3) Assure that contractor has proper controls for erosion and drainage, noise and air pollution. Ensure that Environmental Protection Plan, if required, has been approved.

2A-02. CLEARING

a. Swamping

(1) Check removal of underbrush, vines, and small trees that will interfere with felling operations.

(2) Determine the number and spacing of workmen in the area engaged in hand clearing work (brush hook and axe operations) to insure safe working conditions.

(3) Inspect the operation of equipment (power saws, dozers, etc.) for sufficient clearance.

(4) Check protective devices and warning signals of equipment and operators.

(5) Establish that the piling of swamped material does not interfere with felling and logging operations.

b. Felling

(1) Check tree-climbing equipment.

(2) Note any leaning trees, hollow trees, snags or lodged limbs that may cause trouble during felling operations.

(3) Mark and protect trees to be left standing.

(a) Check trimming of trees to be left standing.

(b) Use approved tree wound paint on scars 1-1/2 inches in diameter and larger, caused by falling timber.

(c) If a tree surgeon is required, consult your supervisor.

(4) Ensure that felled trees are kept inside work limits.

(5) Check rig for topping.

(6) Determine that workmen are kept properly positioned, within sight or hearing range during tree felling operations. Insist on overhead protection for bulldozer operators.

(7) Check felling methods when such hazards exist as slopes, slippery terrain, rock, or outcrops.

(a) Check undercutting and wedging.

(b) Inspect the condition of such equipment as axes, crosscut saws, power saws, dozers and winches.

(c) Prevent damage to trees to be left standing , existing structures, and/or structures under construction.

c. Decking (Stacking)

(1) Identify marketable logs.

(2) Inspect hand and power equipment used for bucking operations and the protective equipment required for operators.

(3) Check stacking methods for pile locations, distribution of brush and logs in pile, compaction of pile, and type of decking. Locate piles above high water level.

d. Logging

(1) Check loading and hauling equipment.

(2) Check protective devices and warning signals.

(3) Check access and haul roads for bridge and road limits, clearances, steep grades and hairpin turns.

(4) Check dumping operations.

2A-03. GRUBBING

a. Observe removal depths of all stumps and matted roots.

b. Determine maximum size of roots and other materials that may remain in the area.

c. Check method of measurement and payment.

d. Cut stumps to ground level in revetment areas.

e. See that depressions from grubbing are properly filled and compacted.

f. Inspect operation of equipment.

g. Insure that blasting procedures for stump removal are in accordance with approved methods listed in the Safety and Health Requirements Manual.

h. Check specified limits of grubbing areas.

2A—04. DISPOSAL

Determine the disposal requirements and insist that the operation closely follows the clearing.

a. Check disposal of unsalvageable material. Debris must not enter waterways.

b. Check piling and disposal equipment and procedure and the operators* protective devices.

c. Check arrangements made by the contractor for piling and storage of clearing debris on private lands.

(1) Check that the contractor has a signed letter from the owner acknowledging arrangements made. Get a copy for files.

(2) Report to your supervisor any unwarranted entry by the contractor or unauthorized disposal of material on privately—owned lands.

d. Locate debris areas above high water flow lines.

e. Observe location, number and size of piles.

f. Check local fire district, county, state, Environmental Protection Agency, and US Forest Service Regulations prior to burning.

(1) Location and size of piles.

(2) Time of year burning is permitted.

(3) Standby equipment required.

g. Assure that burning is not allowed in areas where it might cause damage to existing structures, construction in progress, trees, and other vegetation.

h. Check burning schedule for interference with other operations.

i. Determine the kind and usage of fire kindling materials.

j. Complete decking prior to the start of any burning operations.

k. Do not permit burning in high winds.

l. Require constant attendance of burning operations.

m. Check suitability and safety of operations for periodic bunching of deck materials during burning.

n. Ensure that fire fighting equipment and personnel are supplied by the contractor.

o. Ensure burning is complete. Reduce materials to ashes.

p. Provide that no burning is permitted on the surface of revetments, roads, or existing rock or gravel-type construction.

2A-05. CLEAN-UP

Thoroughly check final cleanup.

CHAPTER 2B

EARTHWORK

INDEX

CHAPTER 2B

EARTHWORK

2B-01. GENERAL

a. Scope

This chapter covers embankments, grading and preparation of subgrade for roadways, railroads and other earthwork structures of similar nature plus excavation, filling and backfilling for building construction.

b. Survey and Soils Control

(1) A survey crew is generally assigned to conduct surveys or to check contractor*s surveys. Soils testing is usually performed by project laboratory personnel or by approved commercial laboratory.

(2) The Quality Assurance Representative normally will not physically perform surveys or soil testing. However, he must be familiar with surveys and soil testing to determine that job requirements are met as the work progresses, and to make sure that the surveying and testing is appropriately performed as required. He should record tests made and any action taken as a result of the tests.

(3) Confer with your supervisor, survey personnel, and laboratory personnel. Establish liaison so that all concerned will be continually informed of surveys and soil tests. Also arrive at a clear understanding of the nature and scope of records, reports, and other construction data required, as well as individual assignments for obtaining data, and preparation and submission of reports.

c. Samples of Material

Samples of certain types of soils, such as capillary water barrier under floor slabs and base material for roadways, are required to be tested by the contractor prior to use in the work. Use only tested and approved materials in the work.

d. Standards of Inspection

(1) Uniformly high quality earthwork construction is required. Each step of the numerous operations involved must be given close and continuous attention.

(2) Several classifications of excavation and of embankment materials are generally involved. Control can best be accomplished by maintaining a chart or tabulation of quantities and distribution of materials.

(3) If the contractor fails to operate according to specification requirements or otherwise fails to operate in a manner to produce a satisfactory end product, notify your supervisor and make recommendations for appropriate action. Keep a record of your recommendations in your daily report.

28-02. TOPSOIL

a. Stripping

(1) Check contract requirement for stripping of topsoil.

(2) Verify the topsoil to be stripped meets the definition of topsoil.

(3) verify the depth of stripping of topsoil.

(4) Check the stripped topsoil is not contaminated with subsoil, slag or cinders.

b. Stockpiling

(1) Determine location for stockpile.

(2) Ensure the stockpiling is kept neat, well-drained and in a workable condition at all times.

c. Spreading

(1) verify the total requirements for topsoil. Check the quality of topsoil meets the specifications.

(2) Check for favorable soil and weather conditions to give beneficial results.

(3) Verify the scarifying depth of subgrade.

(4) Check the method and depth of placement for even distribution of topsoil over the area.

(5) Check the stripped topsoil to see that it is free from stones, sticks, roots, trash or other material larger than one—half inch in diameter, and free from viable plants or plant parts.

(6) Ensure compaction of the placed topsoil is prevented.

28-03. EXCAVATION

a. Earth Excavation

(1) Prior to the start of excavation operations, take photographs of the construction area, make sure that sufficient cross—sections are taken, and continue to take progress photographs during construction.

(2) Review the log of borings to ascertain the elevation of the water table and to determine if unsuitable soils are likely to be encountered. Dewatering equipment may be necessary, and disposal for unsuitable material must be provided.

(3) Check Post utility maps prior to the start of excavation to ascertain existing lines not shown on contract drawings.

(4) Evaluate materials being excavated against logs of borings. If differences are noted, consult your supervisor for determination of action to be taken.

(5) Check that approved disposal areas and haul roads are used.

(6) Check for location of required protection to sanitary and storm drains, electrical cables, communications cables and gas lines subject to damage by heavy earth-moving equipment.

(7) Insure the utilization of satisfactory materials from excavations.

(8) Determine moisture condition of suitable excavated materials in advance of needs.

(9) Insist that excavation is performed in specified sequence.

(10) Assure that drainage is provided continually as excavation progresses.

(a) Do not permit ponded water in any construction area.

(b) Be sure that drainage ditches are maintained free flowing.

(11) Insure that required tests for soil bearing characteristics are made upon completion of excavation.

(12) Coordinate planning of borrow excavation to insure that the right materials will be available as needed for embankment construction, and that borrow will not be unnecessarily used when excavated material is available.

(13) Inspect borrow pits for:

(a) Adequate stripping.

(b) Orderly removal of materials.

(c) Satisfactory drainage.

(14) After total material removal, check borrow pit areas for conformance with final shaping and drainage requirements.

(15) Determine average volume hauled for each type of hauling equipment. Record daily load count for various classifications of excavation when required for partial payments.

(16) Take final cross-sections.

(17) Provide that quantity surveys are made for payment purposes.

(18) Examine all excavating equipment for compliance with General Safety Requirements.

b. Earth Excavation - Building

(1) Check for contractor*s location, identification and necessary protection for site utilities before operations begin.

(2) Excavated material intended for use as fill must be free of limbs, stumps, roots, brush, vegetation and debris from building foundations, pavements, utilities, etc.

(3) See that the foundation bearing materials agree with the borings.

(4) Check for the proper fill of all depressed areas or holes. (Fill is not permitted beneath footing to correct over excavation.)

(5) Inspect sides of excavations for safe slope (angle of repose) or if sides are made vertical, check adequacy of required bracing to safely retain the sides.

(6) Define provisions made for preventing damage to adjoining property.

(7) Observe method of dewatering excavations and water disposal.

(8) Insure that footing beds in dewatered areas are not disturbed or softened.

(9) See that proper sequence of excavation is carried out for components of the building at different elevations.

(10) Inspect footing and foundation excavations for clearances sufficient to permit erection of forms, installation of services and inspection.

(11) Identify corrective methods used in cases of over-excavation.

(a) Do not modify or change established elevations without written approval of the Contracting Officer.

(b) Correct over-excavation by placing approved, compacted backfill or concrete fill, depending on location.

(c) Keep a detailed record of any such corrective work.

(12) Check provisions for preventing surface drainage into the excavated area.

(13) See that footing drains are installed where required.

(14) Determine special instructions and/or requirements when excavations require use of caissons and cofferdams.

(15) Check safety requirements for heavy equipment operating close to deep excavations.

c. Soil Poisoning

(1) Check the requirement for soil poisoning under and around building structures.

(2) Check for approval of material to be used and watch specifically for required concentration.

(3) Check application for coverage and quantity of material used.

(4) Check EPA restrictions.

d. Rock Excavation

(1) Inspect contractor*s procedures for compliance with proposed and/or approved plan of operation.

(a) Drilling and blasting are the commonly used methods for rock excavation. However, picking, barring and wedging are used to some extent.

(b) Check methods proposed for use in rock excavation for a safe operation (see below).

(2) When overburden has been removed, and prior to rock excavation, see that necessary surveys are made to determine pay quantities.

(3) Determine compliance with all Safety Regulations.

(a) Carefully inspect handling, storage and use of explosives.

(b) Insure compliance with city, county and/or state regulations relative to explosives.

(c) Abide by provisions made for warning notices prior to blasting, including: curtailment of radio transmission, protection at highway and railroad crossings, and warning system for personnel.

(d) Check compliance with restrictions on blasting near fresh concrete.

(e) Check that requirements for monitoring of blasts are being carried out.

(4) Check qualifications of contractor*s supervisor, drillers and powdermen assigned to blasting operations.

(5) Inspect drilling and blasting equipment. Do not permit use of unsafe, workout or obsolete equipment.

(6) Check drilling depth, evidence of materials encountered in drilling, water in or flowing from holes, and indications of seams or faults shown by drill drop or rate of drilling.

(7) Verify drilling pattern for blasting, quantity and firing sequence of explosives.

(8) Keep records of the quantities of explosives used.

(9) Check results of each blast, particularly as final excavation lines and/or grades are approached.

(a) Look for overbreak, damage to adjacent features, and safety. Drilling pattern and/or quantity of explosives should be modified if unsatisfactory conditions result.

(b) Observe and record overbreak that results from structural weakness of rock for which payment will be made.

(c) Examine for and correct unstable rock on sides of completed excavation.

(d) Evaluate installation of necessary rock supports and recheck periodically to see that they are secure.

(e) Insure compliance with restrictions on blasting as final grades or excavation lines are approached.

(f) Insofar as possible, provide that the rock is left in an unshattered, solid condition.

(g) Inspect scaling and removal of loose material from slopes.

(h) Make sure that rock foundations are marked down to a satisfactory bed and side wall to receive concrete.

1. Smooth sloped surfaces are to cut into rough steps or benches. Vertical height of steps or benches should be limited to 3 feet.

2. Smooth flat surfaces are to be roughened.

(10) Evaluate trench excavation.

(a) Determine if separate trenches are needed for water and sewer lines.

(b) Insure that trenches are excavated to the minimum required depth below the bottom of pipe and to the required gradient.

(c) Examine for and correct unstable rock on sides of trench.

(11) Observe the drainage of excavated areas.

(12) Check the disposal of material from rock excavation. Be sure that satisfactory rock is handled and used as required.

(13) Implement necessary surveys for payment purposes.

(14) Watch for the excavation of trenches too far ahead of pipe laying.

(15) Make sure that the specified density is obtained when backfilling trenches.

(16) Maintain a complete record of all unusual conditions encountered.

2B-04. FOUNDATION PREPARATION

a. Foundations Other Than for Buildings

(1) Refer to Chapter 2A of this Guide for check items relative to clearing and grubbing.

(2) Observe depth of stripping and disposal of stripped material.

(3) Examine earth foundation areas for evidences of peat, mulch, humus and other unsuitable material and remove.

(4) Inspect filling and compacting of foundation depressions.

(5) Evaluate densities of earth foundation materials prior to constructing embankment.

(6) Note drainage of foundation area.

(7) Assure that scarifying of earth foundation areas or other procedures required to effect bond between foundation and embankment materials are properly employed.

(8) Insure that rock foundations to receive impervious fill have all loose rock and other foreign material removed by specified methods.

(9) Similarly, check rock foundations to receive concrete.

(10) Define special foundation treatment required.

(11) Inspect marking and protection of all features that are to remain in the construction area, such as trees, poles, and structures.

(12) Record all cracks or faults, actual or possible, by taking pictures and/or plot maps, calling them to your supervisor*s attention.

b. Building Foundations

(1) Compare foundation conditions with conditions shown on the drawings. Report and record unusual conditions.

(2) Make note of unsuitable materials in the foundation bed. Remove unsuitable materials and backfill with suitable materials. Keep accurate records of any such work.

(3) Review grade, smoothness, and compaction of bottoms of excavations.

(4) See that final grade for foundations in rock is carefully excavated so as not to cause breaking or shattering.

(5) Consider the order of footing excavation. Lowest footing areas should be placed first.

(6) Check the effectiveness of dewatering excavations. Do not permit accumulation of water in footing excavations.

(7) Insure that provisions are made to prevent surface water from entering excavations.

(8) Over-excavation at footings shall be filled with concrete during footing placement.

2B-05. EMBANKMENTS AND BACKFILL

a. Survey Control

(1) Be familiar with locations of Government-established bench marks and base lines. Be sure that all control points are protected from damage during construction.

(2) Determine that the contractor*s layout of work complies with specification requirements.

(3) Insist that all original ground surveys necessary for use as basis of payment to the contractor are made in the project area, borrow areas, etc.

(4) Assure that final surveys are made as each phase of the work is completed.

(5) Review elevations of all completed excavations and embankments for compliance with specifications.

2B-05. EMBANKMENTS AND BACKFILL

a. Survey Control

(1) Be familiar with locations of Government-established bench marks and base lines. Be sure that all control points are protected from damage during construction.

(2) Determine that the contractor*s layout of work complies with specification requirements.

(3) Insist that all original ground surveys necessary for use as basis of payment to the contractor are made in the project area, borrow areas, etc.

(4) Assure that final surveys are made as each phase of the work is completed.

(5) Review elevations of all completed excavations and embankments for compliance with specifications.

b. Preparation

Prior to the placement of embankment or backfill, check:

(1) Removal of required vegetation, such as roots, brush, heavy sods, heavy growth of grass, decayed vegetable matter, rubbish and other unsuitable material.

(2) Compaction of ground surface.

(3) Plowing, stepping or benching of sloped surface steeper than 1 vertical to 4 horizontal.

(4) Determine the contractor*s plans for the installation of all drainage and drainage structures before placing embankments.

c. Haul Roads and Ramps

(1) Inspect haul road layout. Restrictions on haul road type and haul routes may be imposed.

(2) Inspect haul road construction within an embankment area and require that the same material with the same moisture density relationship be used for the embankment.

(3) View construction ramps. Do not permit cutting through a compacted embankment; construct ramps out from the embankment.

(4) Provide that original moisture content of haul road surfaces within permanent fill and excavation areas is maintained.

(5) Route vehicular traffic on embankment sections so that compactive effort will be uniformly distributed over the area.

(6) Insist that established roadways used for hauling are kept clean and smooth at all times, and that dust is kept to a minimum.

d. Ditching

(1) Maintain control of ditching operation with timely spot cross-sectioning, and the checking of grades, shapes and slopes.

(2) Area of excessive excavation should be immediately backfilled and compacted.

(3) Inspect for the complete removal of all roots, stumps, rocks and foreign matter inside the excavated area.

(4) Insure the adequate disposal of excavated material. In no case should the material be left closer than 3 feet from the edge of the ditch.

(5) Inspect the maintenance of the ditch. It is usually the contractor*s responsibility to maintain ditches until final acceptance of the work.

(6) Be sure that the excavation is carried out in such a manner as to prevent surface water from flowing into a trench or other excavation.

e. Embankments

(1) Meet classification of the soils being used for embankment formation. Dispose of all unsuitable material rapidly and check that it is not deposited in the embankment.

(2) Evaluate contractor provided hauling and compacting equipment for safety, quantity, type, and condition.

(3) Check soil moisture requirement by determining workable moisture content ranges of the soils to be used and the natural moisture content of the soils.

(4) Scrutinize the contractor*s operations to see that full advantage is taken of the soil*s natural moisture.

(5) Determine that adequate testing is performed and that results indicate that satisfactory moisture and density are obtained.

(6) Determine the need for wetting, drying, or mixing of fill obtained from excavations or from borrow pits. Insure that action is taken to uniformly moisture condition the soils as necessary in advance of needs.

(7) Note controls for spreading embankment material

(a) Insure adequate mixing equipment (such as plows, discs, etc.) on site for the mixing and breaking up of material and to provide uniformity of moisture distribution and material.

(b) Measure lift thickness.

(c) Notice uniformity of materials and moisture content.

(8) Note compaction of the material and record results.

(a) Start compaction operations as soon as possible after soil has been placed and satisfactorily conditioned with the specified moisture content.

(b) Check rollers and roller coverage.

(c) Check for tearing action in roller turn areas. Reroll area as necessary to obtain required density.

(d) Check roller action for evidences of excessive moisture content in the soil or for evidences of exceeding the soil bearing capacity. Soil densities should increase with an increase in the number of roller passes to the point of maximum density for a fixed moisture content.

(e) Evaluate operation of land-manipulated tamping equipment for complete compaction coverage at optimum water content.

(f) Measure compacted layer thickness.

(g) Determine uniformity of density.

(9) Check for surface drainage of each lift.

(10) Insure removal of oversize stones, roots, and debris from materials as they are placed.

(11) Investigate installation of required settlement gages and piezometers.

(a) Check connections and plumbness of each section as progressively installed.

(b) Obtain and record readings each time the tubes are extended.

(12) Determine that required record tests are taken.

(13) Observe final alignment, section and grade.

(14) Seal each layer with light pneumatic equipment to preserve the moisture.

(15) Scarify and wet each layer prior to placing each succeeding layer, and check bonding between layers.

f. Backfill of Trenches and Building Excavations

(1) Analyze condition of material at bottom of trenches and/or excavations. Remove wet or unstable material and replace with compacted, suitable material.

(2) Evaluate material employed for pipe bedding. A minimum overdepth and bedding is required for rock trench bottom.

(3) Look into the shaping of pipe beds for bottom quadrant of gravity storm and sanitary pipe. See that bell holes are being excavated so that pipes are uniformly supported over their entire length at the required grade. Grading should precede bell hole excavation.

(4) Check the material for plasticity, gradation, and frost susceptibility, and see that the proper material is placed in the correct section.

(5) Check width of trench bottoms for sanitary and storm drains. Width should not be greater than the dimensions specified.

(6) Examine materials to be used for all backfill. Insure that material is compacted under pipe haunches.

(7) Inspect all excavations for removal of all debris and frozen material prior to backfilling.

(8) Notice placement of layers and unformity of compaction and density results.

(a) Insure that precautions are observed in backfilling against walls, and that sufficient time has elapsed for curing of concrete.

(b) Assure dewatering of excavations to be backfilled.

(c) Insist that material be placed at optimum moisture content.

(d) Observe all cold weather placing requirements.

(9) See that sufficient depth of fill is over the pipe prior to permitting heavy equipment to pass.

(10) Report to your supervisor all indications of damages to walls or structures by backfilling operations, and determine if corrective action is required.

2B-06 FINAL GRADING AND SUBGRADE PREPARATION

a. Final Grading

(1) Compel conformance to required lines and grades.

(2) Insist on uniformity of smoothness and compliance with surface smoothness requirements.

(3) Check drainage of finished surfaces.

(4) Observe the functioning of ditches and drainage structures.

b. Subgrade Preparation

Note: Subgrade as used herein is defined as that portion of the surface of any embankment, fill or excavated area on which protective or base course materials are to be placed and all areas to be top-soiled and seeded.

(1) Check lines, grade and shaping of sub-grade.

(2) Check for evidence of soft, yielding or otherwise unsatisfactory material. Remove and replace as necessary.

(3) Check for boulders and ledges in cut areas. Remove or break off to required depth.

(4) Check moisture content and compaction immediately prior to placement of protective or base course materials.

(5) For additional check items, see Chapter 20, Paving, of this guide.

2B-07. DRAINAGE FILLS FOR SLABS AND STONE PROTECTION

a. Drainage Fills for Slabs

(1) Check material for compliance.

(2) Check rolling and/or operation of hand-operated tamping equipment for complete and uniform compaction coverage. Particularly watch compaction adjacent to walls, columns and other similar areas.

(3) Check layer thickness.

(4) Check for uniform required compaction.

(5) Check shaping of surface for conformity with line, grade and surface tolerances.

b. Stone Protection

(1) Check approval of materials.

(2) Check uniformity of stone size and/or gradation prior to and after placement.

(3) Check equipment used and placement procedures.

(4) Check thickness of protection.

(5) Check lines and grades for conformity with tolerances.

CHAPTER 2C

UNDERGROUND PIPE SYSTEMS

INDEX

CHAPTER 2C

UNDERGROUND PIPE SYSTEMS

2C-01. GENERAL

This chapter covers excavation, trenching, backfilling, and laying of underground pipe systems to a point within five feet of buildings and structures. The types of underground pipe systems considered are as follows: Water, storm subdrainage, sanitary, fuel, gas, steam, high and low temperature hot water.

a. Plans. Specifications, and Layout

Prior to the start of field construction, the plans and specifications should be thoroughly reviewed. The QC rep must check and review isolation of any utility lines that are to be worked on. Also, QCR must check and review the permanent disconnection and capping of critical utility lines such as; natural gas, fuel oil, LPG, etc., that are to be abandoned.

(1) Observe existing utilities and all possible interference with existing systems.

(2) Confer with local utility agents to ascertain that all utilities are indicated on the contract drawings. Utilities not shown on contract drawings should be entered on record drawings.

(3) Check all electrical facilities, both aerial and underground, in accordance with EP 414-1-261, Vol 4.

b. Accessibility of Valves. Hydrants, and Manholes

All valves, hydrants, and manholes should be constructed in such manner that they can be utilized in the future. Hydrants should be accessible for operation.

c. Lines and Grades

Lines and grades should be established and staked, and reference bench marks should be set before any excavation or pipe-laying operations.

(1) Check each type of utility being installed within a project for conflict as to the layout and elevations at each point of crossing.

(2) Check for conflict with existing utilities.

d. Connections to Existing Utilities

Plan and coordinate connections to existing utilities. Under no conditions will an existing utility service be interrupted without full coordination with the operator of such service.

e. Interference

Hold traffic interference to a minimum when installing utilities in or under walks, streets, or railroads. QA/QC should ensure that jacking and boring of pipe, where required by the contract, is carried out in a manner so as not to disrupt traffic or other surface activities.

(1) Determine that materials are on hand and that work is organized, so that interference will be held to a minimum.

(2) Insure that warning signs, barricades, and obstruction lights are placed and that regular traffic is not tied up excessively.

(3) Traffic interruptions and detours must be coordinated with the facility or agency responsible for the service.

f. Damages

See that completed pipe installations are not damaged by movement of construction equipment over or near pipe.

g. Testing

Pressure tests shall be performed prior to backfilling for visual inspection of joints. Alignment tests on all pipes and drain lines are made before backfill is completed. Test results shall be recorded. Check to:

(1) Inspect every joint.

(2) Assure that corrective action is in accordance with requirements.

2C-02. PIPES AND FITTINGS

a. Material Compliance

(1) Determine the quality of all material delivered to the work site for specification compliance.

(a) Pipe, pipe fittings, valves and other components should be checked to insure that they carry the appropriate stamp and standards organization designations such as ASTM or ASME.

(2) Compare official submittals with material brought to the job. Check labeling for type, grade, strength, classification and determine size and condition of materials. Make sure that pipe fittings, such as tees, ells, and couplings, correspond to the weight of pipe, and are made in the U.S.A.

(3) verify the quality of miscellaneous items such as valves, service boxes, stops, special connections, tapped tees, etc.

b. Handling and Storage

(1) See that pipes and fittings are handled with the proper tools and equipment. Do not permit dragging and handling of pipe with chains, wire ropes, etc.

(2) Check for damaged pipes, fittings, and pipe coating. Reject all damaged materials promptly, and have rejected materials removed from the job site immediately.

(3) Make sure adequate and accessible storage area has been provided.

(3) Determine requirements for repairing damaged surface coatings.

c. Field Coating

(1) Check the availability of an approved coating test device.

(2) Check for breaks and abrasions of pipe coating.

(4) Implement requirements for cleaning of surfaces before coating.

(5) Follow the requirement for painting with primer and sealer.

(6) Check for the requirement to coat edges or ends of pipe and bolt threads.

d. Laying Pipes - General

(1) Check the gradient, line, and grade of the pipeline trench or bed before laying proceeds and after completion of each section.

(2) Observe method of jointing permitted.

(3) Use pipe manufacturers installation information. Where there is a difference between this information and the contract specifications, this difference should be called to the attention of your supervisor.

(4) Check for cleanliness of pipe (especially joints) during placement and after completion. Cover pipe openings with temporary protection.

(5) Insure that all pipe to be placed on earth is placed on dry, firm soil.

(6) Check for obstructions in pipe, such as pipe plugs, debris, etc.

e. Water lines

(1) Grade lines to avoid high points as much as possible. Where high points occur, check specifications for requirements for vacuum and relief valves.

(2) See that fire hydrants are plumb with pumper nozzle (4 and ½ inch opening) facing the roadway. Check location of hydrant shut-off valve and post indicator valve (no shutoff valve between the PIV and the building it serves.)

(3) Measure height of the lowest nozzle above finish grade. An 18-inch clearance is required.

(4) Check that fire hydrant threads conform and fit the hose or fire fighting equipment which will be connected to them.

(5) Observe the hydrant barrel drain.

(a) Plug the drain in locations of high ground water where the hydrant is specified to have no drain. All hydrant valves must sit on a 15″ by 4″ thick concrete pad.

(b) In area where the ground water is low, the drain plug must be removed and drainage aggregate (18 inches of crushed stone) provided.

(6) A well installed water main does not move.

(a) Check thrust blocking and/or tie rods.

(b) Check for movement at joints, bands, dead ends and hydrants.

(c) Check wedging at all fittings.

(7) Require the hydrostatic pressure test and specified leakage tests.

(8) Do not omit the sterilization phase of the construction work on water lines.

(a) Main to be thoroughly flushed with water until all mud and debris have been removed.

(b) Add disinfecting agent in easily applied form and recommended dosage.

(c) Solution to remain in contact with line at least 8 and preferably 24 hours.

(d) There should be no less than 10 ppm residual at extreme end of line at end of contact period.

(e) Flush entire system thoroughly.

(9) Insure that valves are accessible and try turning the valve nut after backfilling is completed.

(10) Check distance requirements between parallel and crossing water and waste piping.

f. Fuel Gas Lines

(1) Do not permit lines to be buried under buildings, nor in trenches with other utilities.

(2) Enforce safety regulations rigidly during construction of gas lines.

(3) Check and recheck the area with a detector for an explosive atmosphere.

(4) When there is indication of an explosive condition, do not commence work until the explosive condition has been cleared.

(5) Install gas pipes above other utilities which they cross, and with a minimum cover of 2 feet. Pipe under pavements or heavily traveled areas will be encased or located deep enough so that there will be no damage from heavy traffic.

(6) Check cleanliness of pipe before lowering into trench.

(7) Check pipe coating for damage during connection, laying, and backfilling operations. Permit coated piping to be handled only by hand or with nonmetallic flexible slings.

(8) Keep pipe clean during installation by careful handling and by keeping ends of pipe closed.

g. Sanitary Sewers

(1) Check distance separating sewers from water line. Always install sewer or force main below water line if the lines are within 6 feet horizontally, unless special provisions are taken at crossings; otherwise spacing must be at least 10 feet horizontally. Check for special requirements where sewer lines or force mains cross above water lines. Require leakage tests for sanitary sewers and force mains. QA/QC to verify that special backfill and compaction requirements for plastic pipe have been followed.

(2) Check to see that spigot end of pipe is pointed downstream in pipeline.

(3) Check that uniform grade is maintained between manholes. Assure that top elevation of manhole is flush with paving grades or higher than finished grade of ground surrounding area, as specified.

(4) There are specific safety precautions to be taken when working in sewers. Sewer gas may be explosive or incapable of supporting life. Check need for assigning at least two men to the work.

(5) Handtools must be used to round the trench bottom and dig bell holes so that at least the bottom quadrant of the pipe rests firmly on undisturbed soil.

h. Storm Sewers

(1) Check that installation is performed by proceeding upgrade with spigot or tongue end of pipes pointing in the direction of flow.

(2) Check the installation of all fittings, joints, connections at manholes, and connections to existing facilities.

(3) Check grade, elevation, and finish of paved inverts.

(4) Check that elliptical pipe sections are handled carefully in transporting, storing and installing.

(5) Check for installation of all subdrain tile as shown on plans.

(6) Where watertight joints are required, see that hydrostatic test requirements are met, and that rubber gaskets are not affixed more than 24 hours prior to pipe installation and are protected from sun, dust, and other deleterious agents.

(7) provide covering to prevent the entrance of earth into the pipe.

(8) Require shaping the trench bottom as for sanitary sewers.

i. Heat Distribution Lines

(1) All heat distribution piping is subject to expansion

and contraction. Check that all lines are straight, both vertically and horizontally.

(2) Expansion of piping will be absorbed by expansion joints or fabricated pipe loops. There must be room for the pipe loop to move and for maintenance.

(3) Verify strength, security, and proper placement of anchors and supports.

(4) Inspect rigid installation of anchors.

(5) Require uniform pitch of steam pipe. Trap all low points.

(6) Follow the manufacturer*s recommended installation procedure for the insulation materials, unless there are specific changes on the approved shop drawings.

(7) Store and protect insulation from the weather.

(8) Keep underground pipe conduit system dry during and after construction.

(9) Examine waterproofing very carefully. There are many details for both field applied and factory applied waterproofing to protect the insulation.

(10) Valve pits should be watertight and have sumps or drains, if not advise your supervisor. Check for proper valves, fittings, supports, seals around pit openings, casing, drain, vents, sump, aluminum jacketing over insulation, ladder, etc.

(11) Valve pits should also be checked to insure that they are of the required size and that valves, flanges and other components have been located as to be accessible and to provide sufficient space for ease of maintenance.

(12) Check welding of pipe lines for compliance with specification requirements and the applicable codes.

(13) Insure that all changes in direction are done with approved type fittings.

(14) Check welds or metal casing on underground steam lines for leaks and holidays in asphalt coatings.

(15) See that the Class A or B underground system materials have been tested for acceptability.

(16) Require that all low points in the system are drained and high points are vented.

(17) Assure that the field testing is satisfactorily performed, including hydrostatic, visual and holiday detector tests.

(18) Check for removal of ground water from system.

j. Fuel Lines

(1) Fuel lines in this section pertain to underground liquid petroleum systems.

(2) Check drain connections at low points and air releases at high points.

(3) Check that field application of covering on joints is not done until the pneumatic pressure test has been conducted and the joints proved satisfactory.

(4) Check if screens and filter elements are installed; check mesh and material; check installation for proper direction of flow; and check clearances for removal of screen and access to drain connection.

(5) Vapors of fuel may accumulate in pits or enclosed areas and can cause serious explosions.

(a) Provide adequate ventilation during operation in a liquid fuel area.

(b) Prohibit open fires, sparks, or static electricity in the vicinity of vapors which may be explosive.

(c) Check by use of a detector for explosive atmosphere.

2C-03. JOINTING OF PIPES

a. General

(1) Check to see that all jointing surfaces are kept clean. Check to insure that pipes of different materials, densities or manufacturers can and are being properly joined. For example, heat fusion of plastic pipe of different densities is problematic. This piping should be joined with mechanical couplings to insure a leak proof connection.

(2) Do not join pipes in mud and water.

(3) Constantly be on the alert to check tightness of joints.

b. Hot-pour Joints

(1) Hot-pour joints must be clean and dry. The presence of moisture may cause explosion and possible injury.

(2) Check for uniformity of annular space.

(3) Check method of application and make sure all joints are adequately filled.

(4) Check temperature of the compound.

c. Poured Lead Joints

(1) Check packing for uniformity and tightness.

(2) Check depth and amount of lead being placed in joints.

(3) Check the pouring operation for method of filling and for one continuous pour.

(4) Check driving during caulking. If lead is permitted to be displaced to a depth greater than 1/4 inch, the joint should be remade.

d. Flexible Joints

(1) Check for approved material, make, type, and number of splices. etc.

(2) Check placing and positioning of flexible gasket.

(3) Check depth of gasket with a gauge.

(4) Check use of lubricant.

(5) Make hydrostatic test as soon as possible.

e. Tapered End Couplings

Drive tapered end couplings up tight when joining bituminous fiber pipe.

f. Cement Mortar Joints

(1) Determine specific requirements for types of joints, whether Oakum, Diaper band, etc.

(2) Insure that mortar meets requirements of specifications.

(3) Observe that the jointing operation will completely fill joints and form a bond on the outside.

(4) Cure cement mortar joints.

(5) Remove excess grout from inside and outside of pipe.

g. Pipe Threads

(1) Cut pipe threads with sharp tools.

(2) provide proper length thread; the pipe taper is lost by overlength threading.

(3) Ream pipe flush on the inside surface.

(4) Apply joint compound to the threads on the pipe, not to the fittings.

(5) Make up all joints tightly.

h. Copper Tubing Joints

(1) Correlate types of pipes and fittings used against types required.

(2) Cut copper tubing off square and remove burrs.

(3) Insure clean tubing before fluxing and soldering.

(4) Check type of tools used for flaring compression type joints.

i. Welded Joints

(1) Inspect welders* qualifications and approved procedure.

(2) Prior to any welding, obtain the code designation assigned to each certified welder to insure that welded joints are stamped with the welder*s code and can be properly identified.

(3) Fabricate and weld as much as possible before lowering pipe into trench.

(4) Check against possible cave-in when welding in trench.

(5) Explore for explosive gases within pipes and before welding in fueling areas.

(6) Check pipe ends for bevel.

(7) Make a very careful inspection of welds in hard to reach areas.

(8) Remove all welding slag before visual inspection.

j. Mechanical Joints in Manholes

Install in accordance with manufacturer*s instructions.

k. Flanged Joints in Manholes

Install gaskets, bolts and assure that flanges are not damaged. Use proper bolt torquing procedures.

l. Corrugated Banding

(1) Laps of all circumferential joints in the pipe should provide that the outside lap be on the downstream side of the joint with the longitudinal laps on the side of the in-place pipe.

(2) All markings indicating the top of the pipe should coincide with the specified alignment of the pipe.

(3) While the connecting band is being placed, assure that the band is going to fit tightly.

(4) Check for the requirement, or necessity, to use bituminous material at the joint after jointing.

m. Caps or Plugs

(1) Close open ends of pipe when work is not in progress.

(2) Keep pipelines clean of all debris, rodents, or water.

2C-04. MANHOLES, CONCRETE CRADLES AND ENCASEMENTS

a. Materials - Check material requirements with delivered materials at the preparatory inspection.

b. Construction

(1) Check dimensions and layout.

(2) Check invert elevations and details of the invert channels in manholes.

(3) Check placement of material such as concrete, reinforcement, brick, block, plaster, frames and covers, rungs, etc., for the same workmanship as for other structures.

(4) See that manholes are not obstructed by dumped waste concrete or other construction material.

2C-05. EXCAVATION, TRENCHING AND BACKFILLING

a. Excavation - Existing underground utilities will be carefully excavated and protected. Existing utilities will be suitably supported to prevent damage to them and to prevent transferring any direct load on to the new piping system below.

(1) Check need for shoring or excavate to required side slope.

(2) Report all damaged existing utilities to your supervisor immediately to determine corrective measures.

(3) Note location of all unknown or unreported utilities for inclusion on revised utility plan.

(4) Determine that access steps or ladders are provided in trenches, where necessary, and that they are maintained in safe condition.

b. Trenching — Begin trench excavation for sewers at the lower end of the line and proceed upgrade to protect the work from possible flooding, unless job conditions prohibit.

(1) Check specifications and job requirements for maximum width of trench and minimum depth of pipe.

(2) Check bed of the trench for grade and suitability of materials before any pipe is laid. If the trench is overexcavated, bring the bed to grade and compact. When encountering rock excavations, check the minimum overdepth specified and check that backfilling is performed with select bedding material.

(3) Keep water from the trenches during construction. Use pumps or a well point system.

(4) Check that final hand grading precedes pipe laying by no more than the amount of pipe that can be installed the same day. Special conditions may limit hand graded distance to a few feet.

(5) Check excavation of bottom of trench. Is it graded and shaped to bottom quadrant of sewer pipe, and has excavation under all bells been performed as specified?

(6) Inspect distance between potable water lines and sanitary sewer trenches for minimum allowable clearance.

(7) Check pipe-handling procedures and do not allow loads being swung over the heads of workmen.

c. Backfilling - QC to ensure that special care is taken when backfilling around ductile iron pipe that has been encased in a polyethelene sleeve. Require leakage tests for sanitary sewers. QC to verify that specific backfill and compaction requirements for plastic pipe have been followed.

(1) Permit placement of backfill only between pipe joint locations until all lines have been tested and/or approved, unless job conditions require otherwise. In the case of pressure testing, place sufficient backfill material to prevent pipes from moving out of place. In the case of wrapped and coated piping, do not permit any backfilling until the coating at welds and fittings has been completed and the entire coating tested for holidays. Assure that backfill in contact with the piping does not injure protective coatings. Make sure that all lines are located on as-built drawings before backfilling.

(2) Check backfill material, assuring placement in uniform layers on each side of the pipeline.

(3) Insure removal of foreign materials and large stones prior to backfilling.

(4) Backfill operation check:

(a) Thickness of each layer for moisture content and compaction. Especially watch for compaction around lower portion of pipe, and watch for any movement of pipe.

(b) Do not machine compact fill on top of a pipeline until required minimum cover has been placed.

(c) That there are no large or sharp rocks used.

(d) The maximum size of stones permitted.

(e) Assure that all requirements are clearly understood by QC Representative. Backcheck for validation with density testing when necessary.

(5) Check sewer lines to manhole after the backfilling operation. Check from manhole for broken pipe, settlement in the line, lateral movement, and cleanliness.

2C-06. SUMMARY

a. The plans and specifications must be rigidly adhered to at all times.

b. During the constructibility review the QA must insure that red-lined as built drawings and system O&M manuals are submitted to the installation as soon as possible after completion of all or each section of the system if the construction is phased. In any case the appropriate “red-lined* drawings and O&M manuals should be given to the installation before any portion of the system is placed in operation or the facility is occupied.

c. All questionable items should be reported to your supervisor.

CHAPTER 2D

PAVING

INDEX

CHAPTER 2D

PAVING

2D-01. GENERAL

a. Objective

The objective in constructing any pavement is to provide a pavement satisfying design criteria and possessing such uniform characteristics of quality that it will have maximum serviceable life with minimum maintenance. This objective may be achieved only through painstaking attention to each step in the construction of a pavement. This check list will call to your attention items requiring careful thought and consideration relative to preparation of sub-grade, construction of sub-base and base courses, priming of prepared base course, tacking bituminous binder course, and placement and finishing of the pavement surfacing.

b. Control Testing - General

(1) The determination of satisfactory materials on the basis of samples submitted prior to construction and the design of starting mixes for bituminous and portland cement concrete pavements is normally a function of a paving engineer.

(2) Modify concrete batch weights to maintain uniformity of grading and to adjust for free moisture on the aggregates.

(3) A project laboratory is usually equipped to conduct soils tests and to control mixing plant production. The inspector normally will not physically conduct tests but he must be familiar with the tests and significance of tests results.

(4) Minimum frequency of control testing is generally established by specifications and otherwise as good judgement dictates.

(5) Adequacy of processing, batching and/or mixing plants is normally determined through joint inspection by the QC/QA and the paving engineer.

(6) Confer with project laboratory, paving engineer, and your supervisor and agree on a form of liaison such that all concerned will be kept informed of test results, changes in character of materials, mix changes, behavior of mix, etc. During this conference, arrive at a clear understanding of the nature and scope of records, reports, and other construction data required as well as individual assignments for obtaining data, and preparation and submission of reports.

c. Contractor Proposals

(1) The specifications require the contractor to submit samples of soils, aggregates for pavement surfacing, bitumens, concrete curing compound, joint-sealing compounds, etc. for testing prior to use in the work.

(a) Be familiar with arrangements for testing the materials.

(b) See that materials are submitted far enough in advance so as not to delay construction.

(c) Know test results.

(d) Permit only tested and approved materials in the work.

(2) Obtain a copy of the minutes of all construction conferences from your supervisor and carefully review their contents.

(3) Check that all equipment used by the contractor has the approval of the Contracting Officer.

(a) Contracting Officer approvals of equipment constitute approval as to general adequacy only.

(b) Continued use of equipment during construction that does not produce acceptable work should not be permitted.

d. Changes in Plant Operation

(1) The inspector should be very cautious in making direct changes in any plant operation. If approval has been obtained through necessity, the following changes can be made:

(a) Modify bituminous mix hot bin weights to maintain grading and bitumen content within limits established by job mix formulae or revised formulae.

(b) Changes in gradations and/or proportions, if changed in the design mix.

(2) The possible cause or causes of deviations may be discussed with the contractor or plant superintendent to assist or give guidance, but be careful of instructions, directed or implied.

(3) If the contractor fails to operate in accordance with specification requirements or otherwise fails to operate in a manner to produce a satisfactory end product, your supervisor should be notified and recommendations made concerning appropriate action necessary.

2D-02. PREPARATION OF SUB-GRADE

a. Planning

(1) Have good knowledge of the project area including clearing, grubbing and stripping requirements, location and extent of cut and fill areas and nature of soils anticipated to be encountered.

(2) Is the planned order of work for handling, disposing and using excavated materials suitable?

(3) Determine that contractor layout of work complies with specification requirements. Be familiar with required grades of finished sub-grade.

(4) Be certain that all original ground surveys, necessary for use as a basis of payment to the contractor, are made in the project area, borrow areas, etc.

(5) Be thoroughly familiar with drainage features and all embedded items that may be existing or are to be installed below top of sub-grade

(6) Know requirements for soils and compacting for various features of the work in cut and fill areas.

(7) Is contractor-proposed order of work in clearing, grubbing, stripping, excavation, backfillinq, spoiling, embankment construction and compaction in cut areas proceeding in accordance with approval procedures, using approved equipment, with sufficient number of units, to accomplish the work in scheduled time?

b. Construction

(1) Are the materials encountered of the same soils classification as those indicated on the contract drawings? If not, notify your supervisor without delay so that appropriate action may be taken.

(2) Is suitable material from excavations being used to the maximum extent practicable?

(3) Is excavation being performed to provide drainage from the excavated area at all times, if natural drainage is possible?

(4) Are all pockets of soft, yielding or otherwise unsatisfactory material being removed and replaced with suitable material? If in doubt concerning removal of unsatisfactory material, consult your supervisor.

(5) Have ground surfaces to receive sub-grade embankment material been prepared?

(6) Are embankments being constructed in the specified layer thickness of suitable material and compacted?

(7) Are embankment surfaces (sub-grade) struck-off leveled and compacted to grade and surface smoothness tolerances?

(8) Are surfaces in cut areas being compacted with suitable equipment to obtain the specified depth and degree of compaction?

(9) During the compaction of each layer of embankment, check to see if the moisture content of the soil is being maintained at or near the optimum moisture content. If not, require drying by aeration or moistening by watering, as the case may be.

(10) Do prepared surfaces of cut areas (sub-grade) meet grade and surface smoothness tolerances?

(11) Is finished sub-grade protected from traffic or other operations until the sub-base or base is placed?

(12) Are subdrains required? If so, are they being installed at the required locations and grades?

(13) Is trench backfilling being performed as required, using satisfactory materials compacted in specified layer thickness?

(14) Is control testing of the sub-grade and sub-grade materials being performed in accordance with the minimum sampling schedule developed for the project?

(15) Do test results indicate that materials meet all specification requirements? If not, has action been taken to correct any deficiency? Where action has been taken to correct deficiencies revealed by tests, have retests been made, recorded and cross-referenced to test failure?

(16) Are all test results properly recorded on established reporting forms and adequate project records maintained?

2D-03. SUB-BASE AND BASE COURSES

a. Review Prior to Construction

(1) Review project specifications.

(a) Know requirements for the types of base course materials.

(b) Know the maximum and minimum compacted layer thicknesses permitted.

(c) Know the compaction requirements for each type of base course material.

(d) Know acceptable construction procedures.

(e) Know grade control and surface smoothness requirements.

(f) Check the Special Conditions of the specifications for items that may amplify or supplement the Technical Provisions.

(2) Review project drawings.

(a) Fix in your mind the type or types of base courses required for the various pavements involved.

(b) Know the location and extent of the various types of pavements.

(c) Know the total thickness of each base course type.

(d) Be familiar with grades to which the base courses are to be constructed.

(e) Be sure you are familiar with the location and nature of all utilities in place or to be constructed. You should plan to have offset reference stakes set so that position of utilities may be determined after embedment, if necessary.

(f) Know the nature and location of all drainage features.

(g) Know the location of all handholes, manholes, observation risers and other structures or features to be installed within the pavement area.

(3) Review proposed source or sources of base course material.

(a) Check with your supervisor on status of materials approval and obtain copies of approval letters.

(b) Tentative approval only is given on materials at their source. Final approval is based on tests of material in place and compaction. (c) Results of tests on samples submitted which were the basis for tentative approval.

(d) In general, ensure that select and sub—base materials are natural or bank—run materials which may be obtained from site excavations or from on-site or off—site borrow areas. Base materials are generally crushed and plant—processed materials.

(4) Inspect approved source or sources of material.

(a) If material is bank—run, be sure pit is stripped of all unsatisfactory material and that excavation will result in obtaining a uniformly acceptable material.

(b) If bank—run materials are to be stockpiled, check that stockpile area is cleared and leveled as required and that proposed methods of stockpiling are satisfactory.

(c) If material is plant processed, inspect plant and determine that processing, handling and stockpiling methods established will produce uniformly acceptable material at a rate to satisfy approved construction progress.

(5) Check all equipment brought on the job by the contractor.

(a) Be sure that specified and approved equipment types are available.

(b) An adequate number of units in good mechanical condition must be furnished to perform the work in accordance with approved construction progress schedules.

(6) Determine proposed procedures of handling high-quality base course materials.

(a) Some high quality base course materials are required to be furnished in two or more size groups and blended by means of a mixing process.

(b) Check that equipment for mixing is on hand and is adequate to produce acceptable material at a satisfactory rate.

(7) Determine that the necessary equipment is available for quality control of soils and for checking lines, grades and smoothness of base courses as they are constructed.

b. Construction

(1) Are the weather and temperature within the limitations specified?

(2) Inspection of pit or quarry operation

(a) Is the pit yielding material that will, with little or no question meet requirements for in—place and compacted base course?

(b) Are uniform materials resulting from the excavation and handling operations?

(c) Are unsuitable materials being wasted or otherwise handled to prevent using in the project?

(d) Is material being processed as necessary and do materials produced leave any question as to suitability?

(e) Check that method of stockpiling is controlled to minimize contamination and/or segregation.

(f) Are the base course materials being sampled at source in accordance with locally established procedures and are they being tested?

(g) If materials are not properly excavated, processed and/or handled, or if materials produced leave any question in your mind, have you taken steps to correct the difficulty?

(h) Check that pits and/or quarries are left in a satis-factory condition.

(3) Test embankments may be required.

(a) Check for this requirement, as in some cases, proce-dures and equipment required are established on the basis of test embankment a.

(b) If required, be sure test embankment is constructed and determination of procedures has been made prior to full scale placement of base courses.

(c) Know procedures and equipment required by results of tests of the test embankment.

(4) Hauling equipment.

(a) Do not permit vehicles to continually follow in the same tracks in areas to be paved.

(b) Spread out the tracking over the area insofar as possible.

(c) See that hauling equipment complies with General Safety Requirements.

(d) Determine if backup alarms are required; if so, they must be provided and maintained in operating condition.

(5) Check methods being employed to spread the material.

(a) Methods differ for different types of base courses.

(b) Spreading must be carefully controlled to minimize segregation.

(6) Check method of mixing.

(a) Check method specified.

(b) Check equipment used.

(c) Check result being obtained.

(7) Check to see that base and sub—base materials do not become mixed.

(8) Check thickness of layers. Do they meet limitations on maximum and minimum layer thicknesses?

(9) Check compaction of each layer of sub-base and/or base course.

(a) Is approved equipment used and is uniformity and complete coverage of the area attained?

(b) Watch for change in types of materials in that different types of materials are best handled and compacted with certain types of equipment and different compactive effort.

(c) Check equipment for conformance with specification requirements.

(d) If approved equipment types or procedures do not produce the specified results, consult your supervisor.

(10) Check for ruts or soft yielding spots produced during rolling. Has proper action been taken to correct such weak spots either through stabilization procedures or removal and replacement of materials?

(11) Is water being added to the base course material or is the material being aerated to obtain optimum moisture content and maximum compaction?

(a) Compaction increases strength of most soils. However, some soil types lose strength when compacted or may have other unusual characteristics.

(b) Your specifications will adequately cover any special procedures necessary for the soil type used.

(12) Be alert for poorly compacted material near manholes or other embedded items and along rows or grade stakes. It may be necessary to move or reset grade stakes.

(13) Check each layer of material in place to determine compliance with thickness, density and crown requirement,

(14) Check the elevation crown, and surface smoothness of the completed sub—base and base courses.

(15) Check that sampling of in place materials has been done in accordance with minimum sampling requirements and that test results are suitable, Verify with QA tests.

(16) If failure to meet specification requirements is indicated by a test or tests, has the area involved been determined and immediate appropriate action taken to correct the deficiency? Evaluate density tests daily, verify with QA tests.

(17) Require the specified width of shoulder be placed and compacted along with and at the edges of each layer of sub-base and base course.

(18) Is grade control being performed by the contractor, and has the contractor*s work been spotchecked by a Government survey party?

(19) Proof-rolling base courses and tops of sub-base is necessary for some portions of flexible pavements. Check proof-rolling requirements.

(20) Check that the edges of sub-base and base courses or shoulders are being treated as specified. Check requirements for forms.

(21) Check for adequate maintenance of sub-base courses.

2D-04. BITUMINOUS PRIME AND TACK COATS

a. Advance Planning

(1) Review project plans and specifications.

(a) Know the grades of bitumen specified for the prime and tack coat.

(b) Know the quantity limitations of bitumen application for both the prime and tack coats.

(c) Know requirements for sampling, testing, and approval of the bitumens.

(d) Know application requirements and limitations.

(e) Know methods of measurement of and payment for application of prime and tack coats.

(2) Determine proposed sources of bitumens. Determine that test samples have been submitted, tested, and approved as required.

(3) Check contractor*s equipment.

(a) Does distribution equipment conform to requirements for proper heating and circulation of bitumen, for control of spreading rate and uniformity of application, and for measuring and indicating devices?

(b) Is specified power equipment available and in good operating condition for the cleaning of surfaces to be primed or tacked?

(c) Know requirements for equipment that will be needed to store materials.

(4) Check with field laboratory to insure that base course to be primed or pavement course to be tacked has met all test requirements.

(5) Inspect base course and/or pavement course to be sure it is clean and free of foreign material or free water.

(6) Check temperature and weather outlook to be certain that the bitumens will be applied in accordance with specified weather limitations.

b. Application

(1) Is the area to be primed well defined by using strong lines to insure sufficient primed area with true lines and neat edges?

(2) Is surface ready to receive primer or tack?

(a) Is it cleaned of objectionable substances.

(b) Is it too wet or too dry for primer?

(3) Check weigh bills and delivery tickets to be sure that the required and approved bitumen is being applied.

(4) Make continuous check on functioning of distributor.

(a) Is rate of bitumen application as specified?

(b) Does the amount of prime applied completely seal the surface voids of base courses without a surplus remaining on the surface after the curing period?

(c) Does the amount of tack applied appear to be sufficient for bonding but not in excess of the minimum necessary for bonding?

(d) Is application of bitumen uniform?

(e) Take prompt corrective actions in the event of unsatisfactory distribution.

(5) Check to insure that the bitumens have adequately cured in the minimum time or whether additional time is necessary for proper curing.

(6) Is the primed or tacked area being protected prior to and during paving operations?

(7) Record quantities of bitumens used each day.

(8) Check that proper protection is provided to keep bitumen off posts, guard rails, and other roadside structures during spreading operations.

(9) Are junctions satisfactory?

2D-05. BITUMINOUS PAVEMENT

a. Initial Checks

(1) See that adequate fire protection is provided.

(2) Review project plans and specifications.

(a) Know the specification requirements for aggregates, aggregate handling, mixes, mixing plant, and hauling, placing and rolling equipment.

(b) Know construction procedures for spreading and rolling of the mix and preparation of joints.

(c) Know requirements for grade control and surface smoothness.

(d) Be thoroughly familiar with physical location of pavements, thickness and number of pavement courses required, and finished pavement grades.

(3) Aggregate submissions and mix designs

(a) Has approval of proposed materials and development of the starting job-mix formulae been made?

(b) Review and become familiar with aggregate and mix test data developed at time of approval.

(4) Aggregate storage facilities

(a) Make sure the required separate stockpiles are provided.

(b) Check preparation of area proposed for stockpiling of aggregates to insure against contamination of aggregates.

(c) Review stockpiling methods on transferring facilities. Check for segregation, contamination and/or intermixing of the different aggregate sizes.

(5) Check bituminous liquids storage facilities.

(a) Is storage tank capacity sufficient for at least a one days run?

(b) Are pipe lines and fittings insulated?

(c) Are storage tanks equipped with heating facilities?

(d) Has a system been provided for circulation of bituminous liquids between the storage tank and the mixer?

(6) Batching and mixing plant

(a) Check type of plant that contractor proposes against type specified. Some of the following items may not apply specifically to the type of automatic or semiautomatic plant being used.

(b) Check aggregate dryers for capacity and control of moisture conditions of the materials, aggregate discharge temperature measuring devices, and capability for changing slope and rotation speed.

(c) Check condition and operation of hot aggregate screens. Damaged screens should be replaced. Screen sizes used should maintain a reasonable uniform distribution between the several hot bins.

(d) Make sure that a sufficient number of cold bins are provided.

(e) Check hot bins for capacity and condition.

1. Are at least three compartments provided, and does each have an accurate weigh—box and a control gate?

2. Are the partitions free of openings that would allow run—through of material from one bin to another?

3. Have overflow pipes been installed in each bin compartment to prevent overflow of material from one bin to another?

4. Has provision been made for accurately and safely sampling hot bin materials?

(f) Check accuracy of aggregate weighing or proportioning devices. Have separate adjustments been provided to proportion each aggregate bin?

(g) Check bitumen weighing or volumetric-measurement devices and test calibrations for accuracy. Has provision been made for positive control of temperature of the bituminous material?

(h) Check calibration of mineral filler proportioning device.

(i) Check dust collector and method of handling dust.

(j) Check thermometric equipment provided for measurement of bituminous liquids and hot aggregate temperatures.

(k) Check mixer unit.

1. Is mixer of at least the minimum capacity and in satisfactory operating condition?

2. Has provision been made for properly heating the mixer?

3. Check blade clearances. If a continuous-mix plant is employed, are blades adjustable and reversible?

4. Have the time lock, for control of mixing time, and the batch counter been provided and do these devices function properly?

(1) Check pug mill discharge hopper.

1. Check capacity.

2. Is the discharge hopper positioned at the proper height for the transportation equipment?

3. Check ability to completely dump all of the mix.

(m) Check all safety features of the plant for compliance with contract safety requirements. Check for guards over belts, gears, chains, pulleys, projections, rotating parts, etc. Check the insulating of hot piping.

(7) Transporting, placing and finishing equipment

(a) Check trucks that are hauling mix.

1. Are truck beds tight, clean and smooth?

2. Have suitable covers been provided to protect the mix?

3. Have facilities been provided for cleaning the inside of truck bodies and coating with a minimum amount of a concentrated solution of hydrated lime and water?

4. If long hauls are contemplated, have the truck bodies been insulated to insure that delivery temperatures of mix are within the range specified?

(b) Check spreader.

1. Inspect for overall condition and freedom from obvious damage or fault.

2. Stringline screed for correct alignment. Slight camber in the order of 1/8—inch is recommended on front screed.

3. Check for indented and irregular area. This is a sign of a defective spreader.

4. Check functioning of screed heating system.

5. Inspect tamping bar for wear and proper movement and clearance from screed.

6. Inspect hopper, bar—feeders, distributor screws and similar devices for ability to prevent segregation.

7. Check controls for speed of motion and guidance.

(c) Check rollers.

1. Determine that the minimum number and types of rollers required have been provided.

2. Check roller weights.

3. Inspect roller wheels for smoothness. Check scrapers, sprinklers and water spreading pads for even wetting of wheel surfaces.

4. Check operation of rollers for range of speeds and capability for changing direction smoothly.

5. Inspect pneumatic-tired rollers for tire sizes, number of tires, tire pressures, tracking, weights, and wetting devices to properly moisten the tire surfaces. If not self- propelled, be sure towing unit is adequate and smooth-tired.

(d) Check handtools.

1. Necessary and specified lutes, rakes, shovels and other hand tools must be available.

2. Equipment for maintaining small tools in a hot condition must be provided.

3. Material and equipment must be on hand for painting cold joints.

(8) Sampling schedule for materials and mixes.

(a) Check that previous arrangements made to sample and test bituminous liquids, aggregates and plant mixes in schedule are in force.

(b) Similarly, check that samples of the completed pavement are obtained and tested.

(9) Plant dry runs and test sections

(a) Plant dry runs are considered desirable and in some cases are specified. This operation consists of placing the batching plant in operation, filling the aggregate hot bins and obtaining aggregate samples. It permits observation of general plant operation and the checking of cold aggregate proportioning and resulting hot aggregate separation prior to producing mix.

(b) Prior to full scale paving operations, it may be required that a quantity of mixture be produced to construct a test section. Observe all operations in connection with the test section as this is the basis of final determination of adequacy of materials, equipment and construction procedures.

b. Paving Operations

(1) General — Placing and finishing operations for hot and cold paving mixtures are essentially the same, except that the control of temperatures on delivery and during rolling is not required for cold mixtures.

(2) Layout

(a) Check the contractor*s operation at the beginning of placement.

(b) Has he started at the highest lane in the area, and is he moving in the direction of the main traffic flow?

(c) Is the operation laid out so as to maintain a uniform surface?

(d) Will the lanes be placed so the joints will have required texture, density and smoothness?

(e) Have the necessary stringlines been established?

(f) Stringline parallel to centerline of full pavement width should be used to align first lane. Pavement must be laid parallel to the centerline and excessive edge irregularities should not be tolerated.

(3) Production control

(a) Control of the production of bituminous mixtures is usually the responsibility of the Project Control Laboratory. The inspector should be familiar with the laboratory facilities, test methods, control tests, and records maintenance.

(b) Test methods to be followed are incorporated in the project specification by reference to appropriate Federal, Corps of Engineers, ASTM, etc. standards. Copies of all standards, together with current Corps of Engineers manuals, should be on

file in the Project Engineer office and available to you for reference.

(4) Placement of Mix

(a) Check temperature of mixture (hot-mix) as delivered. Specifications prescribe minimum acceptable placing temperatures for hot-mix. Reject mixtures arriving at the spreader having temperatures less than the specified minimum.

(b) See if weather limitations are being met.

(c) Appearance of mixture should be noted as indication of properly batched and mixed material. See Plate No. 1 for common types of mix imperfections and probable causes.

(d) Plant Inspector should be notified immediately if mix is found unsatisfactory for any reason.

1. Reject any unsatisfactory mix delivered and instruct contractor to suspend placing operations until necessary corrections are made.

2. Report such action to your supervisor immediately.

3. Record details of suspension of operation in the project log.

(e) Hopper surfaces, tamper, screed, and other contact surfaces of spreader will be maintained in a clean condition.

(f) Set screed on board of approximate thickness of new pavement at start of run (or lanes), or start off previously placed lane.

(g) Check adjustment of screeds to lay course of desired thickness; make further adjustments if course thickness varies excessively.

(h) Screed contour will be straight on rear (trailing) edge, crowned approximately 1/8-inch on front (leading) edge.

(i) Check spreader operation frequently to prevent overloading and spilling, segregation, irregularity in alignment, and grade.

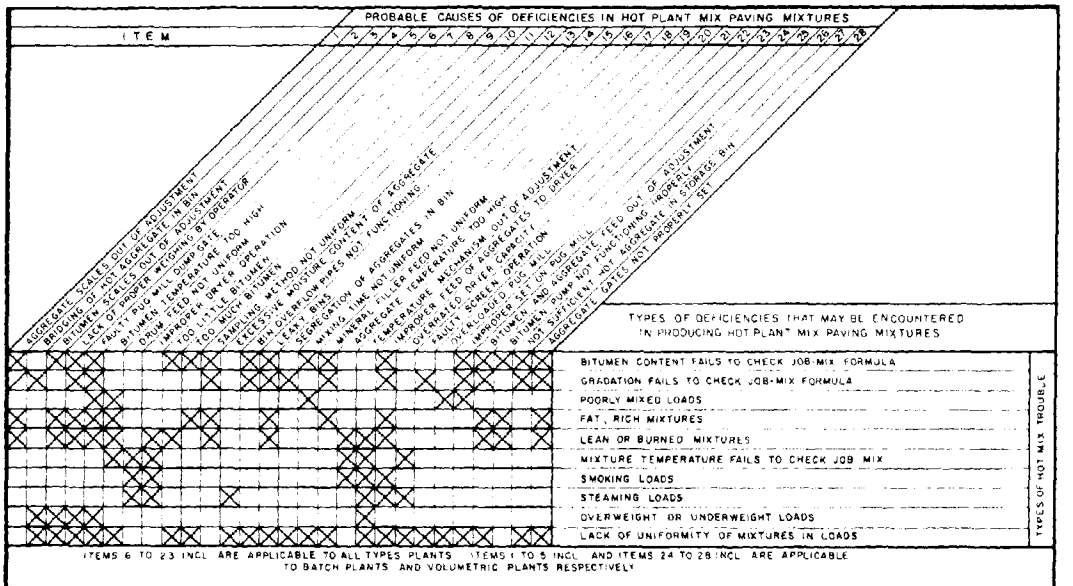
(j) Check rate of feed of mixture from hopper, operation of distributing devices, and screed adjustment and take corrective measures promptly when irregularities in thickness, surface smoothness or width of laid mixture are found.

(k) Check irregular spots.

1. Rakers will level off any irregular spots, but avoid excessive raking.

2. Do not permit raked out material to be cast over the fresh surface.

3. See that all course particles unavoidably raked out to the surface are removed from the mat.



TYPES OF HOT PLANT MIX PAVING MIXTURE DEFICIENCIES AND PROBABLE CAUSES PLATE NO 1

(1) Preparation and placing of paving mixture at joints should be checked to insure well-bonded and dense joint areas and even surfaces after rolling. Lane widths and layout of longitudinal joints for multiple course pavements must be planned so that joints of completed pavement courses will break by at least one foot.

(m) Stop placement of paving mixture when weather conditions preclude laying of pavement in a satisfactory manner. It is customary to permit loads in transit to be placed unless conditions are so severe that satisfactory results appear unattainable. Loads wet excessively by rain should be rejected.

(n) Record of location of truck loads should be kept so that identity can be correlated with in-place samples subsequently taken for tests.

(o) Keep weigh tickets of material placed as a basis for payments and to account for rejected loads.

p Check yield twice daily by measuring area of lanes laid and comparing with weigh tickets of material delivered.

(q) Check roller operation and rolling procedures.

1. Rollers and rolling requirements are specified. Determine the precise rolling pattern and method to be followed during placement of the required strip. Check requirements for vibratory rollers.

2. Are rollers being operated within specified speed range, do they reverse without back lash, and are drum scraping and wetting devices functioning to keep wheels clean and moist?

3. Keep rollers moving; do not permit them to stand on freshly placed mix. Make sure the rollers make the required overlap.

4. Rubber tired rollers are effective only on warm mixture; such rolling is not effective when the pavement temperature is below 130” F.

5. Roll longitudinal joints while the mix is hot to produce a tight, well-bonded joint.

6. Straightedge check for surface smoothness compliance, after the first roller coverage.

a. The time to correct smoothness and grades is when rolling first begins.

b. To correct depressions, loosen material by raking to a depth of ½-inch and add necessary hot material by shoveling and raking.

c. To correct humps, loosen by raking to a depth below final grade, remove excess material and rake smooth.

7. Check for compliance with smoothness requirements immediately following completion of tandem rolling. Take necessary corrective action.

8. Surface checking and movement of the mat on the first or second pass of the roller may be caused by one or more factors illustrated in Plate No. 2 attached. Check base course surface for loose fines, moisture or excessive primer, and the binder course surface for cleanliness and excessive tack coat.

9. Transverse and longitudinal cracks occurring under rolling usually result from soft base conditions but may be a result of inadequate control of mix temperatures and mix proportioning. Removal and replacement of pavement and base courses are generally necessary in the case of soft base conditions.

10. Check final finish of pavement to assure that voids or scars are not left in the pavement surface.

(r) Strict adherence to the grade and surface tolerances for all courses is mandatory. Take corrective actions if deficiencies exist.

(s) Spot check daily finish grade and smoothness of pavement as a guide to continuing operations. Determine that complete grade and surface smoothness checks are made and recorded by Government personnel.

(t) Finish shoulder adjacent to finished pavement as soon as possible.

(u) Safety requirements should be rigidly enforced. Watch for unnecessary smoking, fires, and open flames. See that the necessary respirators are used around toxic fumes.

(v) Check for special requirements.

1. Check requirements for joints between old pavements and new ones, or for cutting into old pavements. Cold joints require different treatment than hot joints.

2. Check requirement for any special treatment required at edges of pavement.

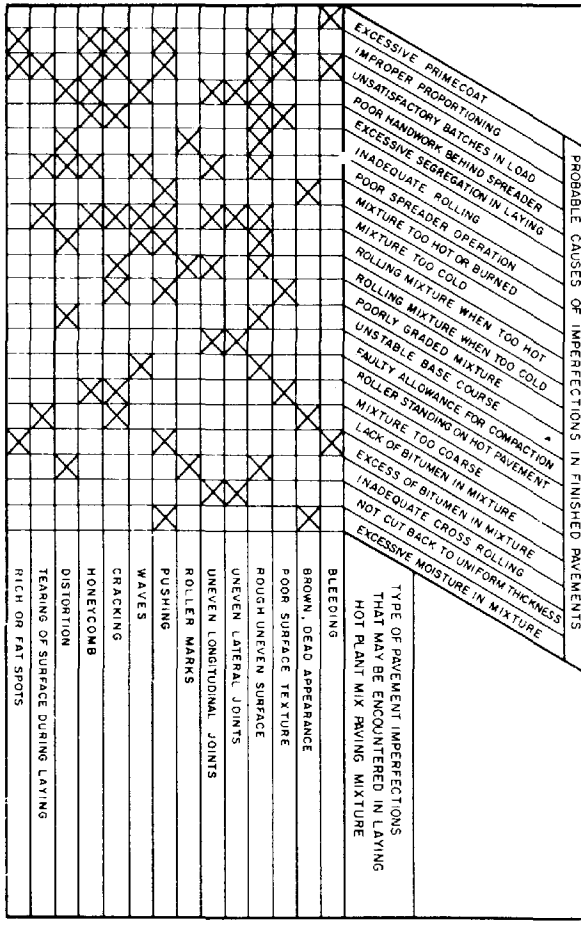
3. Check requirements for any patching of existing pavements.

c. Check Sampling and Testing - Although the plant control laboratory is responsible for control, the inspector has certain related responsibilities and must be familiar with sampling and testing procedures to determine that the pavement is properly constructed. The frequency of a complete coverage series of teats during a production run normally will be one set of samples for about each 200 tons produced. A complete coverage series will normally include the following, but additional or repeated tests may be required:

(1) Specific readings for temperatures of bitumen and aggregate on discharge from hot bins or dryer.

(2) Samples from each hot bin for gradation tests and moisture determinations.

(3) Samples of bituminous mixture after discharge from pug-mill.



TYPES OF HOT PLANT MIX PAVEMENT IMPERFECTIONS AND PROBABLE CAUSES PLATE NO. 2

(4) A series of compaction tests (not less than four specimens per test) of the bituminous mixture sample for the determination of Marshall stability, flow, voids (total mix), voids (filled with asphalt), and unit weight.

(5) An asphalt cement extraction test on the sample of bituminous mixture.

(6) At the completion of determinations in the complete test series, the laboratory posts results on trend wall charts. These charts should be reviewed frequently by the inspector.

(7) Plant control laboratory personnel will frequently inspect batching and mixing operations for accuracy.

(8) Sufficient cores (4 inches in diameter) or sawed samples for determining thickness, density and composition should be taken and tested daily to determine conformance with the specification requirements. One-half the number of all density samples should be taken at a joint, so that the joint is approximately in the center of the sample to be tested. Corrective measures in rolling and placing methods will be taken immediately in the event density of samples does not conform to specification requirements. Check the specifications for nondestructive test methods such as the Nuclear Density Meter Test.

(9) Exchange of information and test data between placing inspector and field laboratory will be made promptly. Coordination between the inspector, the technician and the paving engineer or his equivalent is a must.

(10) A test section or sections is required to be constructed before full scale paving operations are started for airfield pavements; test sections will be constructed as required by the project specifications. Full scale paving may be started only when inspection, sampling and testing of the test section indicates satisfactory procedures and results. Any unsatisfactory test section constructed in an area of the permanent work should be removed and replaced.

2D-06. SPECIAL APPLICATIONS OF ASPHALT

a. Check for special applications of asphalt such as for athletic facilities or special use material such as epoxy asphalt. A manufacturer*s technical representative may be required at the site during mixing and laydown.

b. Check for gradation requirements and special mixes.

c. Check for special density and smoothness requirements.

d. Check for color coating.

(1) Check curing time of bituminous surface prior to applying coloring.

(2) Check rate of application of color coating.

(3) Check material being applied for required characteristics.

(4) Check application of line paint.

(5) Check for crazing, peeling, and bleeding of asphalt through the coatings.

(6) Check for testing requirements.

2D-07. CONCRETE PAVEMENT

a. Items to Check Prior to Beginning of Pavement

(1) Review plans and specifications.

(a) Become familiar with location, extent and grades of all pavement features.

(b) Become familiar with requirements for survey control.

(c) Know required thicknesses of pavement and the required jointing system. Become familiar with the various types of joints required.

(d) Know location and nature of embedded items within and below the pavement and of all structures within the pavement.

(e) Know requirements for materials, plant and equipment.

(f) Know specified construction procedures.

(g) Determine the number of test specimens required. Review test specimen curing procedure.

(2) Materials

(a) Acceptance or approval of cement, air-entraining admixtures, concrete curing compounds and joint-sealing compounds is based on tests of samples taken at origin of shipment. Each shipment to a project is inspected at origin and sealed or otherwise identified as accepted material. Determine through your supervisor that sources of materials have been proposed by the contractor and that arrangements have been made for sampling and testing.

(b) When above-mentioned materials arrive on site, check approvals and identifications to be certain that materials have been shipped from pre-tested stock.

(c) Determine that proper storage facilities for the above-mentioned materials have been provided.

(d) Check on concrete aggregate.

1. Have samples been submitted for acceptance tests and mix designs in accordance with specification requirements? Contractor sampling must be witnessed by a Government representative.

2. study aggregate approvals as available and be familiar with the source and type of aggregate and results of tests on samples submitted.

3. Determine that the aggregate storage area has been prepared to avoid inclusion of foreign material with the aggregate and that the area is graded to provide drainage.

4. Give particular attention to initial aggregate shipments to determine that the materials furnished are similar in every respect to samples submitted for approval.

(e) Check to see that miscellaneous materials, such as reinforcements, tie bars, dowels, joint fillers, and water have been approved.

(f) Check requirement for the contractor*s obtaining approval of the design mix for the concrete which he will use. Make sure that exact proportions of materials composing the concrete mix have been approved.

(3) Batching plant

(a) Inspect plant for general overall compliance with specification requirements.

(b) Is the plant capable of batching at the minimum rate or at a rate consistent with proposed construction progress? Can the plant maintain the accuracy required?

(c) Check aggregate bins or compartments for condition and size. Is the arrangement of the bins and provisions for loading the bins such that there will he no intermixing of the various aggregate sizes?

(d} Check linkages of weighing devices for condition, cleanliness and freedom of movement.

(e) Check cement and aggregate scales for accuracy.

(f) Has provision been made for interlocking batching controls.

(g) Check recorders and their operation.

(h) If a central mix plant is employed, check water batcher for accuracy of batching and interlock of filling and discharge valves; also check air-entraining admixture dispenser.

(i) Have facilities been provided for obtaining samples of aggregate from each bin?

(j) Does the plant conform to all safety requirements?

(4) Concrete mixing plant

(a) Check mixers for general condition, cleanliness, blade wear and mixing capacity.

(b) Are timing devices provided on stationary mixers and are they interlocked with the discharge mechanism?

(c) Are truck mixers, if permitted, equipped with accurate revolution counters?

(d) Are batch-counters provided?

(e) Check water batcher for accuracy.

(f) Check air-entraining admixture dispenser.

(5) Check paving equipment and tools.

(a) Is all paving equipment on the job and in good operating condition?

(b) Have the machines been adjusted and checked for accuracy of strike—off, screeding, and floating?

(c) Do the vibrators comply with specification requirements?

(d) Check hand tools such as edging tools, hand floats, and straight edges for required dimension and condition.

(e) Are all necessary materials and equipment on hand for curing the pavement?

(f) Is all necessary equipment for construction or forming of all types of joints on hand and in good condition?

(g) Is adequate equipment on hand for sealing joints?

(h) Has the contractor provided and set up adequate facilities for making and curing test beams?

(6) Check base course surface preparation as follows:

(a) Is approved equipment being operated in a manner to properly fine-grade the base course?

(b) Is the base course prepared to produce a smooth, compacted surface conforming to grade and smoothness requirements?

(c) Is the base course surface being maintained in a firm, moist condition?

(d) If paving is carried on during cold weather, is the base course being properly protected against freezing and have you checked to insure that base materials are entirely free of frost when concrete is placed?

(e) Is base preparation and form setting being performed sufficiently in advance of concrete placement? Note minimum specification requirement.

(7) Prior to setting forms, determine that the surface of the base course has been constructed to or slightly above required grade and that the material meets all test requirements.

(8) Check forms.

(a) Are the forms identical in all respects to the form or forms approved for use on the work?

(b) Are the forms free of warps, bends, and/or kinks and are they free of battered top surfaces and distorted faces and/or bases? Remove damaged form sections from the project.

(c) Check forms as they arrive on the job site. Straightedge tops and vertical faces of forms after setting for deviations. Sight along forms to detect major deviations from true alignment.

(d) Check dimensions, position and securing of the metal keyway forms. Keyways must be exactly as detailed on the contract drawings.

(e) Does the base of each form section have full bearing for its entire length and width on fully compacted material?

(f) Be sure that form pins are of adequate length, are properly wedged in the pin pockets, and that they are free from mushroomed heads.

(g) Check locking devices between form sections for secureness and freedom from looseness or play.

(h) Determine that forms have been set to required grades. If correction of grade is necessary, remove form sections, adjust the grade and thoroughly recompact base material prior to resetting forms.

(i) Properly clean and oil forms after each use.

(j) Set forms well in advance of paving operations.

(9) Check grade surfaces between forms.

(a) Check to see that sub—grade, base course, or filter course is free of foreign matter, waste concrete, cement, loose aggregate or other debris.

(b) Check contractor*s scratch template and template operation to assure that the rods are obtaining the required results.

(c) Check the prepared surface with the approved scratch template immediately ahead of the paving operation.

(d) Check the setting of the rods on the scratch template to insure that proper thickness of concrete will be obtained.

(10) Check embedded items.

(a) Are dowels provided of the required diameter (or diameters) and length (or lengths)?

(b) Are dowels clean, straight, and smooth with ends free from burrs or distortion?

(c) Is the dowel basket and/or expansion joint assembly identical to the basket approved for the project?

(d) Have means been provided for anchoring the dowel assembly securely in its required position?

(e) Has a template been provided for checking dowel position?

(f) If reinforcing steel is required, check type, dimension and cleanliness. Also check spacing, clearance, and method of securing in place during the paving operation.

(g) Check tie-down anchors and, if grounding electrodes are required, see that they meet the specified resistances.

(h) Check all other embedded items for location and proper installation.

(11) Check area and grade control.

(a) Determine that adequate plans for area and grade control have been formulated by the contractor and that plans have been made for checking the contractor*s control of the grades of the concrete as placed.

(b) Be sure that control is set up to maintain pavement joint alignment.

(c) Determine that all utility lines within a paved area have been properly referenced so their position may be readily re—established if necessary.

b. Inspections During Paving

(1) Batch plant

(a) Check identifications of cement shipments received to determine that it is tested and approved material.

(b) Check temperature of cement.

(c) Check handling and storage of cement for complete protection from exposure to moisture. Be sure that older cement is used first and that any cement in storage for more than four months is retested and approved prior to use.

(d) Make weight checks of bag cement.

(e) Check aggregate and aggregate handline as follows:

1. Check stockpiling methods to insure that segregation or contamination of materials is not occurring. Operation of bulldozers or hauling equipment on stockpiles is not permitted.

2. Observe and test aggregate for grading, moisture content, and cleanliness to determine acceptability, possible changes in quality and major differences from materials originally submitted as representative and approved.

3. Check handling of aggregate into the batch plant bins to see that there is no spillage or mixing of the different aggregate sizes, and that there is no other undesirable material.

(f) Compare batch volume with computed volume for the day*s run. Report significant variations to your supervisor.

(g) Make periodic checks of cement and aggregate scales for accuracy and proper operation. Make similar checks of water batchers and air-entraining agent dispensers if the plant includes these facilities.

(h) Check batch counters and recorders for accuracy of recording and otherwise satisfactory operation.

(i) Check mix design computations. Adjust for aggregate surface moisture and size of batch employed.

(j) Check scale settings for each material batched.

(k) If a central mixing plant is employed, check mixers for mixing efficiency, rate of drum rotation, mixing time and proper setting and operation of locking devices to provide the required mixing time.

(1) Check batch plant and related equipment and its operation for compliance with all safety requirements.

(2) Paving operations

(a) Check placing, spreading and vibration of concrete as follows:

1. Slow down or stop placement of concrete if for any reason subsequent operations lag behind sufficiently to affect the quality of the concrete.

2. Be sure that concrete placement and vibration in the vicinity of embedded items is performed in such manner that they will not be disturbed. Transverse dowel assemblies should be covered carefully so as not to disturb the cage position.

3. Adjust spreader to strike-off concrete at a level such that when vibrated, the proper amount of concrete will remain for finishing.

4. In the case of reinforced pavement, adjust spreader to strike-off concrete at the proper depth.

5. Check that protection is provided on the newly placed slab when the spreader is operated on a previously constructed slab. Make sure the slab is strong enough to support traffic.

6. Check operation of vibrators for effectiveness in consolidating the concrete. Check frequency of vibration and that they are operated at proper depth and that vibration is completely effective including vibration along the forms. Do not allow vibration in one location for more than 20 seconds duration.

7. See that an extra vibrator, or sufficient parts for replacing and repairing a vibrator, is maintained on the job.

8. Prevent workmen from unnecessarily walking in fresh concrete.

(b) Check embedded items as follows:

1. Reinforcing steel, if required, must be of required size and spacing, properly cleaned and set in the required position.

2. Reinforcing steel mats must be lapped. He certain that the reinforcing is not extended through a pavement joint.

3. Is one end of each dowel painted and greased?

4. Are the dowel assemblies being maintained in correct position and alignment during placement and finishing operations?

(c) Check machine finishing as follows:

1. Periodically check adjustments of the transverse and longitudinal finishing machines on the slipform paver. Need for change of adjustments may be determined by visual observations and straightedge and/or string-line checks of the pavement surface left by the machines.

2. Forward screed of transverse finisher should carry a uniform roll of concrete of about 4 to 8 inches in diameter; rear screed should carry a uniform roll of concrete of about 2 inches in diameter.

3. If transverse finishing machine produces a slurry ahead of the screed after the first pass, concrete mix should be adjusted. Slight reduction of water will often correct this condition.

4. Transverse finishing machine should leave the concrete surface at proper grade and essentially to proper smoothness.

(d) Check hand finishing as follows:

1. Use hand-manipulated floats sparingly. Hand floating should be necessary only to remove local surface irregularities.

2. Majority of hand-finishing should be performed with straightedges. Straightedge is not a heavy-duty cutting tool. Its purpose is to remove minor surface irregularities and score marks.

3. Check all straightedges for trueness.

4. Check surface of plastic concrete with a straightedge including check across longitudinal joints as straightedge finishing is completed. Surface of plastic concrete must fit straightedge without deviation except at crowns and other planned breaks in grade.

5. Final surface finish is generally required to be produced by burlap dragging.

6. Timing of burlap dragging is important to produce the required surface texture Drag when most of surface sheen has disappeared but while the concrete at the surface is in a plastic state.

7. Be sure the burlap drag is constructed and operated as required and that it is kept moist and clean.

8. Joints requiring hand tooling should be carefully formed. Check that edging tools are of required dimension and that the edging tool is not tilted during tooling of the joint or otherwise improperly manipulated to result in surface irregularities at the joint.

9. Do not permit use of soupy mortar to fill out depressions along joints during hand tooling; use fresh concrete.

10. Check that all spillage of grout and concrete on adjacent concrete surfaces is cleaned up immediately. Particularly

watch for removal of mortar accumulations on radius and sides of that part of a longitudinal joint formed in the previously placed, adjacent lane.

11. Eliminate tool marks by burlap dragging along joint with a small, hand-operated drag.

12. Filler-type or sawed transverse contraction joints are generally required. It is important to insert or cut the joint at the correct time.

13. Install filler strip of filler type joint exactly as specified. Check that the filler strip as installed is properly aligned, is vertical, and is set flush with or slightly below the pavement surface.

14. Carefully observe finishing in the vicinity of the filler-type joint and immediately after finishing, check across the joint with a straightedge. If depressions are found, fill out with freshly mixed concrete and refinish the surface.

15. Recommend inserting nails in the center of the filler strip at each side of the lane to assure continuous joint alignment and positively locating filler strip at the time of subsequent sawing.

16. Re-check pavement with a straightedge upon completion of finishing while concrete is plastic and make necessary corrections.

17. Dowel transverse construction joints as required for a properly aligned and smooth joint.

(e) Check curing as follows:

1. Make sure that effective curing is maintained for at least seven days.

2. Check to see that unhardened concrete is always protected from rain and flowing water.

3. Make sure that the necessary materials and equipment for the curing are on the job prior to beginning the paving operation. See that necessary stand-by equipment is also at the site.

4. Check that curing procedures are suited to prevailing climatic conditions.

5. Make sure the method of curing used provides complete and continuous protection of the concrete against cracking.

6. When forms are used, check within one hour after removal to see that sides of slabs are protected.

7. Check the initial curing for proper method, timely application and duration.

8. Check final curing for type of covering used, method of applying the covering, and wetting of surface before the application of one of the optional covering specified.

a. Check weight of burlap and lap of edges.

b. Check the wetting operation.

c. Check method of holding down the waterproof paper covering and the cementing or taping operation. Make sure continuous cover with completely closed joints is provided.

d. Rechecks required for timely repairs to damaged coverings.

e. Check application of curing compound. The compound is not to be sprayed on a dry surface and must be applied at the proper time.

f. Check machine used to apply membrane. It should be automatic, self—propelled, able to provide continuous and uniform coverage of compound of the same consistency.

g. Check for overlap coverage to assure that two—coat application is being obtained and the coverage is no more than 200 square feet per gallon for both coats.

h. Carefully check for any discontinuities, pin holes or abrasions and have these surfaces recoated immediately.

i. Check that joints to receive joint sealing are protected from membrane curing.

9. Check for any special requirements for curing concrete placed during cold weather.

(f) Pavement Protection — See that curing compound or covering is protected during the curing period. Check on the erection and maintaining of barricades to exclude all unnecessary traffic from the pavement for at least 14 days after the concrete paving.

(g) Jointing of old pavement to new.

1. Check the conditions for continuous bond between old pavement and freshly placed pavement.

2. Check surface against which the new material is to be placed. It should be clean and properly coated with the material specified.

c. Inspections Subsequent to Paving

(1) Form removal — Do not permit removal of forms until maximum time after placement has elapsed. See that proper care is exercised to prevent injury to the concrete by form removal.

(2) Sawed contraction joints

(a) Determine that sufficient equipment is on hand and that satisfactory provisions have been made to carry on the sawing operation day or night as necessary.

(b) Determine that alignment of joint is properly established prior to sawing to assure straight and continuous joints.

(c) Determine proper time for sawing by field trial. Sawing should be performed as soon as the concrete may be cut

without excessive tearing and raveling of the concrete and without undercutting or washing at the sides of the cut.

(d) Check width and depth of cut.

(e) Thoroughly flush saw cut and adjacent concrete surface with water immediately after each cut is made.

(f) Insert cord to prevent entry of foreign objects into cut until widened.

(g) Examine concrete surface in vicinity of planned joint location prior to sawing. If an uncontrolled crack has occurred, do not permit sawing of the joint. Discontinue sawing if crack forms ahead of the cut during the sawing operation.

(h) See that curing coverings removed to permit sawing are replaced immediately after each joint is sawed.

(i) If curing compound is used, check to see that joints are cured as specified and that curing compound does not enter the joint.

(3) Joint sawing

(a) Saw filler type joints to width and minimum depth required. Carefully examine sides of cut to be certain that all traces of the filler strip have been removed.

(b) Check to see that all joints, longitudinal and transverse, are sawed out to the required joint dimensions prior to joint sealing.

(4) Joint cleaning

(a) Check joint cleaning operation for required performance and sequence in preparation for joint sealing.

(b) Check to see that concrete saws, saw blades, sand blasting equipment and sand, air compressors, air nozzles and accessory small tools are available, suitable, and in good working condition.

(c) Check sand blasting operation to insure that the proper nozzle or nozzles are used and that they are positioned and aligned to obtain satisfactory results.

(d) Carefully examine final results to determine that the joint walls, joint bottoms, and ½-inch of adjacent pavement surfaces have been thoroughly cleaned and the joint is free of all foreign materials that would prevent bonding of the joint sealer to the concrete.

(5) Joint sealing

(a) Determine that the correct type of joint sealing compound and the specified equipment for the joint sealer employed is being used. Sampling and testing may be required.

(b) Do not permit sealing of joints under weather conditions outside specification limitations unless by waiver in writing from the Contracting officer.

(c) Check that sealers are heated when required. If two component sealants are used, check that proportions in place are correct. Have contractor read and follow instructions on pails without exception. Check that placing equipment is suitable for materials used.

(d) Nozzle for sealer application must be of such dimension that it can be inserted well into the joint groove to effect filling the groove from the bottom up without formation of voids.

(e) Fill the joints to within 1/4-inch + 1/8-inch of the pavement surface. Remove excess and spilled material from the pavement surface and waste.

(f) Maintain complete records of the sealing operation.

(6) Check surface smoothness of hardened concrete.

(a) Is the contractor straightedging the finished pavement in the specified manner and within the specified time?

(b) Check to see that the contractor is taking required action to correct deviations outside smoothness tolerances.

(c) If rubbing is performed to correct minor deviations during curing period, flush rubbed area with water and continue effective curing without delay.

(d) Straightedge-check the finished surface for acceptance or rejection of the pavement.

(e) If subsequent grinding of deficient pavement is approved, determine that limitations on area corrected by grinding are not exceeded.

(7) Finished-grade checks -Normally, finished-grade surveys will be made by a Resident Engineer staff survey party. The inspector should be familiar with survey results as he will be responsible for assuring work is corrected in the event deficiencies are found.

(8) pavement-thickness checks - Pavements will be checked for thickness by means of coring. The coring program normally is set up and performed by the project laboratory but, as in the case of grade-checks, the inspector should be familiar with results.

(9) Pavement deficiencies and corrections.

(a) When pavement areas are removed for replacement, check adjacent pavement or damage such as cracking, breakage of concrete at the edges, and damage to keyways or other load—transfer devices. Such damage may necessitate further concrete removal and/or correction of load-transfer consult your supervisor on such cases.

(b) Replacement slabs shall conform to minimum dimensional requirements and otherwise conform to all specification requirements.

(c) Most random cracks occurring in pavements may be repaired. If there is no provision in the contract for repair of

such cracks, check with your supervisor. Be sure that specified and/or proper equipment is issued and that repair methods are very carefully followed in every detail,

d. Control Tests. These tests are the responsibility of the contractor*s quality control laboratory. Quality assurance testing or joint testing in the contractor*s laboratory will also be required.

(1) Aggregate

(a) Run sieve analysis of aggregate size at least twice daily for a full day*s paving operation.

(b) Test for surface moisture at start of paving and periodically during each day*s operation depending on changes in moisture condition.

(c) Organic-impurities test (color test) for each shipment of sand, or more frequently if deemed necessary.

(d) Specific-gravity test about weekly, or when visual check indicates a change in the material.

(2) Concrete

(a) Supervise the making of test specimens by the contractor. Take specimens at about 4-hour intervals. Determine slump, entrained-air content and temperature of concrete from same sample.

(b) Make and record periodic slump or Kelly Ball penetration tests and entrained air tests during the day. Frequency should be consistent with uniformity of mix.

(c) Measure and record ambient air and concrete temperatures at hourly intervals.

(d) Determine that test specimens are cured and tested in strict accordance with standard procedures.

2D-08. CONCRETE SIDEWALKS. CURBS AND GUTTERS

a. General — The construction of concrete sidewalks, curbs and gutters, in general, requires the same steps in inspection as a large scale paving operation to assure quality construction.

b. Sub-Grade and Base Course

(1) Check in-place materials and/or fill materials for bearing quality and compactibility, especially over utility trenches.

(2) Check results of rolling for firmness of compacted sub-grade Check compaction with density tests as required.

(3) Check sub—grade for grade and cross—section. If sub—grade is prepared to receive concrete directly, check grade and cross—section with required template resting on side forms.

(4) If a base course is required, check materials, compaction, and surface grade and cross-section for conformity with requirements.

(5) Check moisture content of sub-grade prior to concrete placement.

c. Forms. Concrete Placement. Finishing and Curing

(1) Check forms for condition, cleanliness, rigidity and conformity with required dimension of the structure.

(2) Check form setting including full bearing of form bases on prepared sub-grade or base course, securing forms in place, adequacy of clamps, braces and spreaders as applicable, provision for removable form sections, adequacy of forms for curb returns and alignment and grade.

(3) Check location, grade, and dimensions between forms.

(4) Check the oiling of the forms and the time the forms are to be removed.

(5) Check availability and adequacy of materials required to form contraction and/or expansion joints. Check location and spacing of joints.

(6) Check to see that concrete mix employed is the mix designed for the work being performed. Check slump and entrained-air content of the concrete.

(7) Check placement and consolidation of concrete to insure that segregation does not occur and that honeycomb does not result.

(8) Observe forming of contraction and expansion joints for proper installation and finishing of the exposed joint edges.

(9) Check that exposed surfaces are finished by required methods.

(10) Inspect tops and faces of curbs, surfaces of gutters and surfaces of sidewalks for conformity with surface smoothness and shape requirements.

(11) Assure that an approved curing method is employed and that the curing is performed in accordance with the method, and that curing is started immediately after the finishing operations. Check that curing is continuous for the required curing period.

(12) verify protection of concrete against damage during backfill or other operations. Damaged concrete shall be repaired and/or removed and replaced as required.

(13) Check cleaning and sealing of expansion joints in curbs and gutters, and expansion and contraction joints in sidewalks. Clean joints thoroughly immediately prior to sealing and fill joints with approved material using approved equipment. Require cleaning of surfaces where spillage has occurred or excess sealer has been applied.

2D-09. PATCHING CONCRETE PAVEMENT WITH EPOXY

a. Materials

(1) Check both coarse and fine aggregate for conformance with requirements.

(2) See that epoxy—resin has been approved and that the proper type is being used for the atmospheric temperature conditions.

(3) verify other miscellaneous materials such as those to be used in curing, the Portland Cement, air—entraining admixture, joint—sealing materials and water.

b. Storage

(1) Check aggregates to assure no breakage, segregation, or contamination by foreign material.

(2) Check the Epoxy storage area to see that it will be in compliance with requirements. Also check to see that the material has been maintained at a temperature between 70 and 85 degrees F. for 48 hours prior to use.

(3) Check for cement being maintained dry.

c. Mix

(1) Check for approval of mix.

(2) Check to make sure that control can be maintained.

(3) Continue to check result of mix for workability and strength.

d. Equipment

(1) Check for approval of all equipment which will be used in the operation.

(2) Check to assure that the equipment is being maintained in good working condition.

e. Preparation for Placement

(1) Check the removal of existing pavement to the depth specified and to a depth where surface to be paved will be sound and free of un-weathered concrete.

(2) Check sandblasting procedures when this operation is necessary.

(3) Check for removal of all joint filler and sealants which will prevent bond between concrete and the patch.

(4) Assure that necessary fiberboard fillers are used to prevent the closing of any existing joints.

(5) In order to provide adequate bonding of old and new surfaces prior to placing of epoxy, check that the surface has been blasted with both a high-pressure water jet and an air jet to remove free water.

(6) Observe the application of a thin film of epoxy resin grout on the freshly cleaned surface.

(a) Verify mixing of material for the grout.

(b) Check safety of the operation. Require full face shields, coveralls, and protective cream on workmen, and check adequacy of fire protection.

(c) Check thickness of film.

(d) Check number of coats.

f. Placing: Check the following:

(1) Batching and mixing of materials.

(2) That the initial epoxy grout is still tacky when fresh concrete is placed.

(3) Handling and the placing of the concrete.

(4) Atmospheric and material temperatures.

(5) Consolidation of concrete.

(6) Making the necessary tests.

(7) Finishing and curing.

(8) Finished grade and alignment of joints to see that they match the grade and alignment of the adjoining surface.

(9) For protection of patched areas.

(10) The resealing of joints as required.

g. Safety

(1) See that all workmen are provided with:

(a) Rubber or neoprene gloves.

(b) Face shields or goggles.

(c) Protective creams.

(2) Insure that manufacturer*s recommendations are followed.

(3) Fire extinguishers should be provided during the epoxy mixing operations.

(4) Assure proper ventilation when using epoxy in enclosed area.

(5) Avoid contact with skin and follow treatment/emergency methods recommended by manufacturer.

CHAPTER 2E

ESTABLISHING GRASS AND PLANT MATERIAL

INDEX

CHAPTER 2E

ESTABLISHING GRASS AND PLANT MATERIAL

2E-01. GENERAL

This chapter covers the materials and procedures required for installing and establishing seed, sod, sprigs and plant material.

2E-02. ESTABLISHING GRASS

a. Delivery, Storage. Handling

(1) Verify the material upon arrival at the site as meeting quality in accordance with the section, "MATERIALS", 2E-02.b.

(2) Determine the storage area for turf and materials.

(3) Ensure the sod and sprigs are protected from desiccation by keeping them moist and protected from injury.

b. Materials

(1) Seed

(a) Obtain the certificate of compliance for the mixture, percent pure live seed, minimum percent germination and hard seed, maximum percent weed seed content, date tested and state certification.

(b) Reject wet, moldy or otherwise damaged seed.

(2) Sod

(a) Obtain the certificate of compliance stating the variety, species, mixture percentage, percent purity, quality grade growing location and certification. The source of sod may be checked to determine local growing conditions for compatibility with the project.

(b) Check the sod for no visible broadleaf weeds when reviewed from a standing position. The turf should be visibly consistent with no obvious patches of foreign grasses. In no case may the total amount of foreign grasses or weeds exceed two percent of the total canopy. The sod should be neatly mowed and mature enough to be picked up at one end and handled without damage.

(c) Check that the thickness of the sod is in accordance with the inspection and shows uniform soil thickness. The measurement for thickness excludes the top growth and thatch.

(d) Reject irregularly shaped, torn or uneven sod.

(e) Reject sod that is heating up, dry, moldy or yellow.

(3) Sprigs

(a) Obtain the certificate of compliance stating the cultivar, genetic purity and growing location.

(b) Check that attached roots have two or three nodes and are four to six inches in length. Ensure no weeds exist with the sprigs.

(c) Reject sprigs that are exposed to heat, dry, moldy or yellow.

(4) Soil amendments

(a) Agricultural Limestone. Obtain the certificate of compliance stating the calcium carbonate equivalent and sieve analysis.

1. Check that the limestone is delivered in the original and unopened containers.

2. Reject open limestone containers or wet limestone.

(b) Fertilizer. Obtain the certificate of compliance stating the chemical analysis and composition percent.

1. Check that the fertilizer is delivered in the original and unopened containers.

2. Reject open fertilizer containers or wet fertilizer.

(c) Organic Soil Amendments

1. Delivered Topsoil

a. Obtain a soil test stating the pH, particle size, chemical analysis and mechanical analysis of the delivered top soil.

b. Verify the topsoil is either loamy sand, sandy loam, clay loam, loam, silt loam or sandy clay loam without subsoil, slag, cinders, stones, lumps of soil, sticks, roots, trash or other material larger than one and one-half inch in diameter. The topsoil should be free from viable plants or plant parts.

c. Check that the delivered topsoil is amended as recommended by the soil test.

2. Sand. Obtain the sieve analysis.

(d) Mulch

1. Straw and Hay. Check for freedom from weeds, mold and other deleterious material and for an air dry condition.

2. Wood Cellulose Fiber. Check for composition on air dry weight basis and for pH.

(e) Asphalt Adhesive. Obtain the certificate of compliance to meet the ASTM.

c. Planting Times And Conditions

(1) Planting times

(a) Check that the seasonal requirements for the establishment of turf are being met in the contract work schedule.

(b) Check phased construction requirements for temporary turf cover.

(2) Planting conditions

(a) Check for favorable soil and weather conditions to give beneficial results.

(b) Stop the planting operation during excessive drought, moisture, wind or other unfavorable condition. Stop the planting operation when there is excessive compaction of the soil from interim rain or construction equipment.

d. Site Preparation

(1) Equipment

(a) Check the type, condition and calibration of the equipment to be used.

(b) Record the calibration settings.

(2) Soil Test. Obtain a soil test stating the pH, particle size, chemical analysis and mechanical analysis for the area to be turf ed. When stockpiled topsoil is spread over the turf area, it also requires a soil test.

(3) Application of soil amendments

(a) Check that the soil is amended in accordance with recommendations of the soil test to meet the local growing conditions for the variety and species os turf specified.

(b) Soil amendments may be incorporated into the soil during tillage.

(4) Fertilizer and Agricultural Limestone

(a) Check the bag label with the certificate of compliance.

(b) Check the rate of application.

(c) Check that the fertilizer and limestone are incorporated in the soil to a minimum depth of four inches.

(5) Soil conditioner

(a) Check the bag label or invoice with the certificate of compliance.

(b) Check the rate and depth of application.

(c) Check that the soil conditioner is spread uniformly over the area and incorporated in the soil.

(6) Quantity check

(a) Retain empty bags and record amounts used.

(b) Retain weight certificates for bulk loads and record amounts used.

(c) Compare the amounts used with the total area covered with soil amendments.

(7) Tillage

(a) Check time limitation when soil amendments are to be incorporated into the soil during tillage.

(b) Check the minimum depth of tillage on slopes.

(8) Placement of topsoil

(a) Check the total requirement for topsoil. Ensure the quality of the topsoil meets the certificate of compliance.

(b) Check the method and depth of placement.

(c) Check for even distribution over the area.

(d) Check that compaction of soil is prevented.

(9) Finished grading

(a) Check that the drainage patterns are in accordance with the drawings and the grades slope a minimum one percent from buildings and facilities.

(b) Check that the finished graded area is a minimum of one inch below the adjoining grade of surface areas (walks, pavements) and is blended into the existing turf area.

(c) Check that all areas compacted by construction equipment are tilled.

(d) Check that the completion of finished grading occurs prior to commencing with the establishment of turf.

(e) Removal of stone and debris

1. Lawn area. Check that debris and stones larger that one inch in any dimension are removed.

2. Field area. Check that debris and stones larger than three inches in any dimension are removed.

(10) Protection. Check that existing turf areas, plant material, pavement and facilities (to include the tilled areas) are protected from damage by the contractor.

e. Seeding

(1) Equipment

(a) Check the type, condition and calibration of the equipment to be used.

(b) Record the calibration settings.

(2) Field mixing. Observe the field mixing of seed.

(3) Broadcast seeding.

(a) Check the bag label with the certificate of compliance.

(b) Check the rate of application.

(c) Ensure the broadcast seed is covered to an average depth of one-quarter inch.

(4) Drill seeding

(a) Check the bag label with the certificate of compliance.

(b) Check the rate of application.

(c) Ensure the seed is driulled to an average depth of one—half inch, the drills not more than six and one—half inches apart and seed bins on the drill are maintained at more than one-half full during seeding.

(5) Rolling. Check that rolling occurs immediately after seeding, and the roller does not exceed ninety pounds for each foot of roller width.

(6) Hydroseeding

(a) Check the bag label with the certificate of compliance.

(b) Check the rate of application.

(c) Check that seed and fertilizer are thoroughly mixed with the water.

(d) Check that the wood cellulose fiber is added to the mixture at the recommended rates and produces a homogenous slurry.

(e) Check that mixture is applied uniformly over the area within time limitation.

(f) Reject slurry exceeding this period.

(7) Mulch

(a) Spreading straw or hay mulch. Check that mulch is applied the same day as the area is seeded and applied uniformly to the area and not bunched or matted.

1. Mechanically anchoring. Check that anchoring occurs immediately following the spreading of mulch. Check the method to be used for anchoring mulch.

2. Anchoring with tackifier.

a. Asphalt adhesive tackifier. Check that anchoring occurs immediately following the spreading of mulch, and sunlight is not completely excluded from penetration to the ground surface.

b Non-Asphaltic tackifier. Check that anchoring occurs immediately following the spreading on mulch. Ensure the hydrophilic colloid is thoroughly mixed with water and applied uniformly over the area.

(b) Spreading Asphalt Adhesive Coated Mulch . Ensure mulch is applied the same day as the area is seeded, uniformly to the area and not bunched or matted, and sunlight is not completely excluded from penetration to the ground surface.

(8) Watering

(a) Verify that the quality of water is not toxic to plant life.

(b) Check the time limitation for watering.

(c) Check the rate of application to meet moist soil conditions to a minimum depth of one inch. Ensure the prevention of run-off and pudding.

(9) Quantity check

(a) Retain empty bags and recorf amounts used.

(b) Retain weight certificates for bulk loads and record amounts used.

(c) Compare the amounts used with the total area established with seed.

f. Sodding

(1) Check time limitation is met between harvestimg and placing sod. Sod not installed within this period requires checking for quality and approval prior to placement.

(2) Placing sod

(a) Check the sod with the certificate of complance.

(b) Prior to placing sod, ensure adequate soil moisture exists to a minimum depth of one inch.

(c) Check that rows of sod are parallel and tightly placed against each other with joints staggered and tightly butted.

(d) Check that the sod is laid at right angles to the slope, and at right angles to the flow of water in drainage ways.

(e) Check that the sod strips are not stretched or overlapped and anchored when required.

(f) Reject sod that shows heating up or desiccation.

(3) Finishing

(a) Check that the sod is rolled to remove air pockets andto smooth the surface.

(b) Check that frayed edges are trimmed and holes or missing corners are patched.

(4) Watering

(a) Verify that the quality of water is not toxic to plant life.

(b) Check time limitation for watering.

(c) Check the rate of application to ensure moist soil conditions to a minimum of one inch. Ensure the prevention of run-off and pudding.

(5) Quality check

(a) Verify the area covered with sod.

(b) Compare the quantity of sod used with the total area established with sod.

g. Sprigging

(1) Equipment

(a) Check the type, condition and calibration of the equipment to be used.

(b) Record the calibration settings.

(2) Check that the time limitation is met between harvesting and placing sprigs. Sprigs not installed within this period require checking and approval prior to placement.

(3) Broadcast sprigging

(a) Check the plants with the certificate of complance.

(b) Check the method of application.

(c) Check that the sprigs are planted to meet specification and drawing requirements, such as the number of sprigs per square yard, the spacing between sprigs and the depth of the sprigs.

(4) Hydroplanting

(a) Check the plants with the certificate of complance.

(b) Check that sprigs and water are thoroughly mixed and applied uniformly over the area.

(c) Check that sprigs are covered by a topdressing to a minimum depth of one inch.

(d) Check that the topdressing meets the requirements stated in section, “DELIVERED TOPSOIL,” 2E-02b.(4)(c)l.

(5) Row sprigging

(a) Check the plants with the certificate of complence.

(b) Check the method of application.

(c) Check that the sprigs are planted to meet specification and drawing requirements, such as the spacing between rows, the spacing between sprigs, and the depth of the sprigs.

(6) Overseeding

(a) Check the bag label with the certificate fc complance.

(b) Check the rate of application. Ensure seed is uniformly broadcast over the sprigged area.

(c) Make similar checks as stated in section SEEDING," 2E-02e. Overseeding provides a quick green up and mulch is not necessary.

(7) Rolling

(a) Check that rolling occurs immediately after sprigging to remove air pockets and to anchor the sprigs, and the roller does not exceed ninety pounds for each foot of roller width.

(8) Finishing

(a) Check that the finished surface is flush with the finished grade.

(b) Check that twenty—five percent of each sprig plant length extends above soil.

(9) Watering. Make similar check as stated in section, "WATERING, 2E-02f.(4).

(10) Quantity check. Make similar check as stated in section, "QUANTITY CHECK," 2E-02f.(5).

h. Temporary Turf Cover (When Required)

(1) Conditions

(a) Check the conditions requiring a temporary turf cover.

(b) Verify the area requiring temporary turf cover.

(c) Check the type, condition and calbration of the equipment to be used.

(d) Record the calbration settings.

(2) Application

(a) Check the bag label with the certificate of complance.

(b) Check the rate of application.

(c) Check that the method of application meets the requirements stated is section, "SWEEDING," 2E-02e.

(d) Check that the area is tilled and one-half of the required soil amendments are applied. The remaining soil amendments are applied when the permanent turf can be installed.

(e) Make similar checks for watering as stated in section, "WATERING," 2E-02e.(8).

(3) Quantity check. Make similar checks as stated in section, "QUANTITY CHECK," 2E-02e.(9).

i. Restoration. Clean Up. Protection

(1) Restoration. Check that the existing turf areas, pavements and facilities damaged during the turf operation are restored to orginal condition at the Contractor*s expense.

(2) Cleanup. Ensure excess and *waste* material are removed and disposed off site. Ensure adjacemt paved areas are cleaned.

(3) Protection. Ensure each area is protected from vehicular and pedestrian traffic immediately upon completion.

j. Turf Establishment period

1) Commencement

(a) Record the commencement date and length of the period for each turfed area or increment.

(b) Check the method used to identify the areas with different establishment periods.

(2) Maintenance during the establishment period

(a) Repair. Check that eroded, damaged or barren areas are re—established. Ensure mulch is repaired or replaced as required; Check embankments, ditches and the turfed area are protected from erosion. Check that weeds, insects and diseases are eradicated. Obtain the maintenance report.

(b) Mowing

1. Check the method and frequency of mowing. Check that the turf is mowed to the proper height for the species planted.

2. Check that the clippings are removed when the cut grass leaves large clumps blocking out sunlight to the ground surface.

(c) Watering. Make similar check as stated in section, ‘WATERING,* 2E-02e.(8).

(d) Post-fertilization

1. Check thatt a nitrogen carrier fertilizer is applied after the first month and the rate of application.

2. Check the timing of the application with the advent of winter dormancy.

k. Satisfactory Stand Of Turf

(1) Seeded area

(a) Lawn area. Check that a minimum number of fifteen turf plants per square foot ot the species planted are growing and bare spots are less than six inches square.

(b) Field area. Check that a minimum number of ten turf plants per square foot of the species planted are growing and bare spots are less than six inches square.

(2) Sodded area. Check that the sod is living, uniform incolor and leaf texture and that bare spots are less than two inches square.

(3) Sprigged area. Check that a minimum number of two turf plants per square foot of the species planted are growing and bare spots are less than nine inches square.

2E-03. ESTABLISHING PLANT MATERIAL

a. Delivery. Storage. Handling

(1) verify the material upon arrival at the site as meeting quality in accordance with section, "MATERIALS", 2E-03.b.

(2) Determine the storage area for plant materials.

(3) Check that plant material is stored away from other materials and contaminates.

(4) Check that the palnt material is protected from desiccation and injury; bare root plant material is heel—in; and that the soil amendments are delivered in the orginal and unopened containers.

(5) Check that plant material not installed on day of arrival at the site is stored and protected from exposure to wind and shaded from the sun.

b. Materials

(1) Plant material

(a) Obtain the certificate of compliance stating the botanical and common name, size, quantity by species, grade and nursery where grown.

(b) Check that substitutions do not occur without written approval.

(c) Quality of plants

1. Check that plant material is well shaped, vigorous and healthy with healthy well branched root systems.

2. Check that plant material is free from diseas, harmful insects and insect eggs, sun-scald injury, disfigurement and abrasion.

3. Check that plant material exhibits typical form of branch to height ratio for the species and variety specified as stated in the referenced, “American Standard for Nursery Stock.”

4. Check that plant material provided meets the quality stated in the referenced, “American Standard for Nursery Stock” and specifications for species and veriety specified.

5. Reject plant material showing desiccation, abrasion, sun-scald injury or disfigurement.

6. Reject trees that are poled, topped off or headed back.

(d) Size of plants

1. Check the caliper and height measurement of plant material in accordance with the referenced, “American Standard for Nursery Stock.”

2. Caliper equals diameter.

3. Reject plant material that measures less than specified.

(e) Antidesiccant. Check that the plant material is sprayed with an antidesiccant when leaf budding occurs or plant material has soft growth.

(2) Balled and burlapped plants

(a) Check that the ball size and ratio meets the referenced, “American Standard for Nursery Stock.”

(b) Check that the root ball is completely wrapped and securely laced.

(c) Reject plant material with briken or cracked balls.

(3) Balled and potted plants

(a) Check that the ball size and ratio meets the referenced, “American Standard for Nursery Stock.”

(b) Check that the container retains the ball unbroken and that the container is sufficiently rigid to hoild the ball shape and protect the root mass.

(4) Balled and platformed plants

(a) Check the the ball size and ratio meet the referenced, “American Standard for Nursery Stock.”

(b) Check that the root ball is completely wrapped. securely laced and securely fastened to wood platform.

(c) Reject plant material with broken or cracked balls.

(5) Bare root plants

(a) Check that the minimum root spread meets the referenced, “American Standard for Nursery Stock.”

(b) Check that the root system is well branched and characteristic of the variety specified. Ensure the roots show a smooth cut and were not pulled from the ground.

(c) Check that the root system is protected from drying out.

(6) Container grown plants

(a) Check that the container size meets the referenced, “American Standard for Nursery Stock.”

(b) Check that the plant was grown in the container sufficiently long for new fibrous roots to develop and for the root mass to retain its shape when removed from the container. Check that the container is sufficiently rigid to hold the ball shape and protect the root mass.

(7) Soil amendments. Make similar check as stated in section, “SOIL AMENDMENTS,” 2E-02b.(4).

(8) Topsoil. Make similar check as stated in section, “DELIVERED TOPSOIL,” 2E-02b.(4)(c)1.

(9) Organic mulch. Check mulch for type and size and free from weeds and mold.

(10) Geotextile for weed control. Check that the geotextile provides a weed barrier and is water permeable.

c. Planting Times And Conditions

(1) Planting times. Check that the seasonal requirements for the plant material are being met in the contract work schedule.

(2) Planting conditions

(a) Check for favorable soil and weather conditions to give beneficial results.

(b) Stop the planting operation during excessive drought, moisture, wind and other unfavorable condition.

d. Site Preparation

(1) Finished grading. Check that the completion of the finished grading occurs prior to commencing with the installation of plant material. Make similar check as stated in section, "FINISHED GRADING," 2E—02d.(9).

(2) Protection. Check that the turf areas, existing plant material, pavement and facilities are protected from damage by the contractor.

(3) Layout

(a) Check that the layout of plant locations and bed outlines are in accordance with the drawings and specifications.

(b) Check for conflict with utilities or underground structures, ditches and have plants relocated as necessary.

e. Excavation

(1) Plant pit

(a) Check depth and diameter in accordance with the specifications.

(b) Check for vertical sides and flat uncompacted bottoms.

(2) Percolation Test. Check that a percolation test is performed in selected plant pits in each area to be planted.

(3) Plant bed

(a) Check that the entire root system of grass in the plant bed area has been removed.

(b) Check slope and drainage of plant bed.

(c) Make similar check for tillage of the plant bed as stated in section, "TILLAGE," 2E-02d.(7).

(d) Make similar check for placement of backfill soil mixture as stated in section "PLACEMENT OF TOPSOIL," 2E-02d.(8).

f. Backfill Soil Mixture. Check that the backfill soil mixture consists of topsoil and is proportioned in accordance with the recommendations of the soil test.

g. Setting Plants

(1) Check that the plant material is set plumb and even with the depth at which it is grown.

(2) Check method of backfilling each plant pit.

(3) Ensure material that is not biodegradable is removed from the root ball and the plant pit.

(4) Check that for balled and burlapped plants the burlap is rolled back from the top one-third of the root ball.

(5) Check that bare root plant material is muddied into the backfill soil mixture in the pit.

h. Earth Saucer. Check that the height of the earth saucer is a minimum four inches high for retaining water and is constructed along the edge of the plant pit.

i. Staking And Guying. Check for proper staking and guying of all trees and ensure the guying wires do not girdle the trees.

j. Mulch

(1) Check the time limitation for placing mulch.

(2) Check that the mulch covers the entire earth saucer area or plant bed.

k. Trunk Wrap

(1) Check the time limitarion on trunk wrap.

(2) Check that trees with a trunk caliper greater than one and one-half inches are wrapped.

l. Pruning

(1) Check the installed plant material for proper pruning. Ensure the typical growth habit is retained. Ensure clean cuts are made flush to the parent trunk.

(2) Ensure “headback” cuts at right angles to the line of growth are not permitted.

(3) Ensure the trees are not “poled” or the leader removed or “topped off.”

(4) Reject trees that are poled, topped off or headback.

m. Watering. Check that each installed plant is ‘water-in* to remove air pockets in the backfill soil mixture.

n. Maintenance During Planting Operation. Check the installed plants are maintained during the planting operation. Make similar check as stated in section, “MAINTENANCE DURING THE ESTABLISHMENT PERIOD,” 2E-03p. (2).

o. Restoration. Clean Up, Protection. Make similar check as stated in section, 'RESTORATION, CLEAN UP, PROTECTION," 2E-02i.

p. Plant Establishment Period

(1) Commencement

(a) Record the commencement date and length of the period for the planted area.

(b) Check the method used to identify the areas with different extablishment periods.

(2) Maintenance during the establishment period

(a) Repair. Check that plant material is straightened and the stakes and guys are tightened. Check that trunk wrap is repaired, that mulch is repair or replaced as required and the planted area is protected from erosion. Ensure weeds, insects and diseases are eradicated Check plant material for girdling of the trunk.

1. Obtain the maintenance report.

2. Obtain the maintenance instruction.

(b) Fertilizing

1. Check the timing of the application with the advent of winter dormancy.

2. Check the method and rate of application.

3. Check that dry fertilizer does not adhere to the plant material.

(d) Settlement

1. Check that topsoil is added to maintain the grade and earth saucer at which it was grown.

2. Check that each plant is maintained at the sane growing depth at which it was grown.

3. Check that plants showing serious settlement are replanted.

q. Unhealthy Plants

(1) Check plants for being in a healthy growing condition. A plant is considered unhealthy when the main leader has died back or twenty-five percent of the crown is dead.

(2) Check that unhealthy or dead plants are removed immediately.

(3) Check that plants are replaced when seasonal conditions permit.

r. Warranty

(1) Ensure furnished plants are guaranteed to he in a vigorous growing condition for a period of twelve months.

(2) A plant is replaced one time under this guarantee.

(3) Obtain written calendar time period for the guarantee.

CHAPTER 2F

RAILROADS

INDEX

CHAPTER 2F

RAILROADS

2F-01. GENERAL

This chapter covers the inspection of railroad construction, including ballast, sub-ballast and track materials on a previously prepared sub—grade

a. Contract Documents

In addition to the plans and specifications and shop drawings, QC/QA should have a copy of the latest American Railway Engineering Association publication and should be familiar with its contents.

b. Work on Lines Adjacent to In—service Lines

(1) Prior to commencement of work, check to see that arrangements have been made with the adjacent railroad for provision of flagmen, light signals, slow boards or other requirements of the railroad or ICC Regulations for the protection of equipment and personnel of both parties.

(2) Check to ensure coordination of action when tie-in between new and existing construction is to be made.

C. Work on Lines Crossing Roads or Highways

Prior to commencement of work, check for coordination between the contractor and state or local authorities for detours, barricades, crossing guards, lights and similar related items.

2F-02. SUB-GRADE

a. Sub-grade Prepared Under Another Contract

(1) Check angle of repose and erosion of side slopes in cut and fill sections.

(2) Check for drainage between roadbed and bank in cut sections. Are culverts installed as required?

(3) Check size, shape, grading and compaction of roadbed.

(4) To avoid possibility of claims, secure acceptance of existing roadbed by railroad contractor.

b. Sub-grade Prepared Under Railroad Contract

(1) Review appropriate chapter of manual pertaining to placement of fill.

(2) Check for removal of unsuitable materials in cut sections.

(3) Check fill materials for acceptability as stated in specifications.

(4) Check for compliance with specifications in placing, compacting and grading fill.

(5) Check for proper methods of construction on slopes in fill sections and that correct slopes are maintained in both cut and fill sections.

(6) Check for compliance with plans as to drainage facilities, size, shape, location, methods of construction and materials.

(7) Ensure that work areas are graded to drain when work is stopped for any reason. Check daily, weekends, and when progressing to new areas.

2F-03. MATERIALS

a. All materials, equipment and supplies shall be new and in unused condition, unless otherwise specified, and should conform to applicable standards.

b. If materials are Government-furnished, an inventory should be made with the contractor as to condition, quality, quantity and a receipt obtained from the contractor. Your supervisor should be notified immediately of unsuitable or insufficient materials.

c. All of the following items shall be checked for compliance with approved samples, certificates of compliance, plans, specifications or applicable Federal or other standards, as the case may require:

(1) Ballast - Check for type, quality, soundness, gradation and continued conformity with previously approved materials.

(2) Ties — Check species, size, method of treatment and condition. Check for anti-splitting device installed on each end of hardwood ties,

(3) Rail - Check for length, weight and section, condition, and drilling pattern.

(a) Rails may be bent or straightened only with appropriate bending devices, not with sledge hammer or localized application of heat.

(b) Chipped or cracked rails must be set aside.

(4) Joint Bars - Check for drilling condition, weight, type and size.

(5) Tie Plates - Check for punching, size, weight, condition and type.

(6) Track Bolts, Nuts, Spring Washers - Check for condition and size.

(7) Track Spikes - Check for condition, type and size.

(8) Tie Plugs - Check for size and preservative treatment.

(9) Turnouts - Check all metal material for condition, size, number, weight, section, and length as appropriate.

(10) Switch Stands - Check for compliance with submittals.

(11) Rail Anchors - Check for size, weight, condition and number of each type or size required.

(12) Derails - Check for size, condition, and the number of each size required by plans.

(13) Bumpers - Check for conformity with submittals and number required.

(14) Signal Equipment - If required, shall be checked for compliance with submittals and specifications, as applicable.

2F-04. TRACK CONSTRUCTION

a. Contractor Operation

Discuss the contractor*s complete operation with him during the preparatory inspection.

(1) Check the schedule of operation to assure that it is in compliance with contract requirements.

(2) Check equipment proposed. Do not allow the use of equipment that will rut or damage the roadbed.

(3) Check storage and handling of material procedures.

(4) Check sequence of operation.

b. Roadbed

The roadbed should be constructed sufficiently far in advance of track laying operations to avoid slow down of this work.

(1) Depressions should be filled and compacted.

(2) Sub—grade should be graded to provide drainage under the ballast when required,

c. Ballast

Ballast should be placed to the depth and cross section indicated on the plans.

(1) Watch for contamination with sub—soil or other foreign materials which might impair drainage qualities.

(2) Placing of ballast will be done, in part, prior to placing of ties or completely after placing of ties and rails in accordance with the provisions of the specifications.

d. Ties

(1) Ties should he laid with the heartwood face or the widest surface down.

(2) Check spacing of ties by counting number per rail.

(3) Select ties so that the best ones are used at rail joints.

(4) The handling and placing of ties with tapping—pick, spike-mauls, sledges and shovel should not be permitted. Ties should be handled only with tongs.

(5) Check the surfaces of the ties to assure that full bearing is provided for the tie plate.

(6) Check that ballast if tamped under ties to provide a firm bearing for tie track has been raised to grade.

(7) The end of ties shall be aligned at the same side of the track.

(8) Tamping stone ballast will normally be done from a point 15 inches inside each rail on both sides of the ties to the ends of the ties. Tamping shall not be permitted in the center of the tie between the above stated limits; this center shall be filled lightly with ballast using a ballast form or shovel.

(9) All cut surfaces of ties should be slushed with creosote oil and holes left by withdrawn spikes should be slushed with creosote oil and plugged with proper size creosoted plugs, cut-off flush.

e. Rails

(1) Check method of laying. Watch for bumping and striking of rails.

(2) If more than one rail section is authorized, the different sections should not be mingled.

(3) Check for staggering of joints.

(4) Rails should be laid to standard gage (4* 8-1/2") except on curves over degrees, where specified tolerances will be observed.

(5) Check spacer shims between rail ends to see that provision is made for expansion of rails as established in the project specifications.

(6) Check drilling and sawing. Do not permit use of a torch.

(7) Check for proper number, location, and size of bolt holes permitted. A variation up to 1/32-inch in location of the bolt hole will be permitted.

(8) Rails should be laid on curves with the super elevation maintained throughout the circular part of the curve and run off in the spiral portion of the curve.

(9) The weight, make and location of different weight rails should be shown on the as-built drawings.

f. Tie Plates

(1) Check size, punching and type of tie plates being used.

(2) Check, that bottom of rail, the tie plate, and the bearing surface of the tie are clean to provide full bearing.

(3) Check spiking.

g. Joint Bars

(1) Check for correct number, spacing and correct size of holes to mate with rail holes.

(2) Check, after installation, for correct number and size of bolts, nuts and spring washers. Nuts must have full thread on bolts.

(3) If more than one rail section is authorized check for use of proper compromise joints between rails of different weight.

h. Spiking

(1) Check driving of spikes. They shall be driven plumb with one face in contact with the rail. Those driven out of plumb or sledged to rail should be removed and replaced.

(2) Bent spikes will not be permitted.

(3) Check staggering of spikes on the ties to prevent splitting of ties.

(4) Check number of spikes being placed.

(5) Check spiking on tangents and curves. (Four holding spikes on tangents and six on curves.) Spikes to be staggered with outside spikes in each tie near the same edge and inside spikes near the opposite edge.

(6) Check driving of spikes. Do not over-drive.

i. Rail Anchors

(1) Check that rail anchors are being installed in the locations indicated on the drawings.

(2) Check proper positioning against ties and securing to rail.

j. Turnouts and Crossovers

(1) Check locations, sizes, types and installation.

(2) Locations, sizes, etc. should be made a matter of record.

(3) Check that all moving parts are oiled and switch is in proper adjustment so that for each position the points are held tightly against rails.

k. Guard Rails

Check for location, rail section, spiking, and spacing.

1. Derails and Bumpers

(1) Check accuracy of location of derails and bumpers.

(2) Check for secure anchorage.

m. Oiling Track Fixtures

Check for oiling of track bolts, joint bars and fishing spaces of rails.

n. Clearances

(1) Prior to actual construction, overhead and side clearances should be checked for compliance with regulations of the switching railroad, unless otherwise specified.

(2) During and after construction, overhead and side clearances should be checked at track side structures erected under other contracts.

o. Signal Devices (Electric)

If bonding of rails is required for signal systems, or other reasons, the bonding wires should be checked for correct type and proper installation. If insulation joints are required, check that they are provided where and as specified.

2F-05. SAFETY

Continuing check shall be made to secure compliance with applicable safety requirements of Federal (ICC), State, Local, adjacent railroads and the Corps of Engineers “Safety and Health Requirements Manual”.