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CONSTRUCTION INSPECTORS

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CONSTRUCTION DEPARTMENT

IOWA STATE HIGHWAY COMMISSION

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FOREWORD

This publication is intended to be a quick reference to be used by persons assigned to various phases of road construction work under the jurisdiction of the Iowa State Highway Commission. It consists of a list of important construction items to be checked by the inspector in connection with projects for various types of construction.

It is intended that the check list for the various items of construction serve as a guide and quick, ready reference for people in the field. It should be used in conjunction with the plans, specifications and construction instructions, and the more complete specialized manuals that are available for various types of work.

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INTRODUCTION TO INSPECTION

GENERAL

Inspection is provided to assure work of good quality in accordance with the plans, proposal, specifications and good construction practice. The best of materials and the most up-to-date designs would not adequately serve their purpose unless the construction was properly performed. Records of the inspector in the field provide written documentation that the work was properly done, and in many instances the records are used to make final determination of pay quantities.

Competent inspection prevents mistakes and encourages efficient work that will produce a finished product of high quality.

QUALIFICATIONS

The inspector must be a person of sound character who is completely honest with himself and everyone with whom he associates. He must know how the work is to be done and why it is to be done in a specific way.

The successful inspector must have strength of character and a forceful personality that will generate the respect and liking of the workmen. He must be firm in his requests, but he must also always be fair and faithful to his responsibilities. He must possess the ability to cooperate with the contractor and with his fellow employees in order to secure good work. It is not necessary that the successful inspector constantly radiate a happy personality and good fellowship. There are times when he must insist firmly that the work be done in a certain way. Industriousness and the tenacity to carry a job through to completion are important attributes of the successful inspector.

One who is to be successful in the field of inspection must be able to receive orders and decisions from his superiors, and conscientiously carry them through to completion.

RESPONSIBILITY

Often the inspector's work is the deciding factor in securing a good job. The inspector should familiarize himself with the specifications, plans, location of rights of way and special agreements for work that may be contained in the right of way contracts. He must also be familiar with utilities agreements, traffic movements and safety regulations.

The start of a phase of construction is especially important from the standpoint of inspection. It is

easier to correct such deficiencies as incorrect methods, inadequate tools or equipment, and unacceptable materials at the start of the work than it is after the condition has been allowed to continue. All preliminary preparations such as necessary tools, equipment and materials should be on the site or readily available before work starts. The importance of advance planning cannot be overlooked.

Whenever possible specifications are written to obtain a desired end result. It is not always possible to specify only end results if good construction is to be the result, so it is often necessary to specify methods and equipment to some degree if the desired end result is to be obtained. These specifications must be met. Where equipment and methods are not specified, the inspector should refrain from issuing specific instructions to the contractor on exactly how to do a phase of work.

AUTHORITY

Forbid the use of materials which have not been tested and approved, and equipment or workmanship which does not conform to the specifications.

Stop any work or suspend operations in a particular phase of the work which is not being done in accordance with the plans and specifications, and notify the engineer in charge of the work immediately. This should be done only as a last resort and usually when the engineer or his assistant is not immediately available for consultation. If work suspension becomes necessary, it should be accomplished in a manner detailed in the specifications and Construction Instructions.

Require the removal or repair of faulty construction, or of construction performed without inspection and not capable of being inspected in place, when conditions warrant. Removal or repair should be ordered only after consultation with the engineer in charge of the work.

RELATIONS WITH CONTRACTOR

The inspector should maintain an impersonal, agreeable and helpful attitude toward the contractor and his employees. He should avoid familiarity with the contractor and should never accept personal favors or gifts.

By dealing fairly and by recognizing and commending good work, he can usually secure the friendly cooperation and respect of the workmen.

Refrain from "knocking" the contractor's organization or boasting of mistakes discovered. Any changes suggested by the inspector should be made for the benefit of the

work, and any requests made solely for the reasons of "showing off" authority must be avoided.

Instructions should be given only to authorized representatives of the contractor, usually the superintendent or foreman. In minor and routine matters, instructions may be given directly to the workmen when agreeable to the contractor. Usually the instructions may be given in the form of a caution that faulty work will not be accepted by the Commission.

Before issuing instructions, the inspector should be sure that his judgment is sound and fair. The decision should then be firmly supported without personal arguments.

The contractor is in business to make money and the inspector's task is to see that the job gets done right, and it does not necessarily follow that friction need develop. It is entirely possible to maintain an attitude of helpfulness and cooperation with the contractor and his organization to get the job done properly, and still exercise firm control and sound judgment.

Be diplomatic by asking, suggesting or requesting rather than "ordering."

The inspector usually deals directly with the sub-contractors unless his instructions are disregarded or a question of area of responsibility arises, in which case he should then contact the prime contractor.

RELATIONS WITH PUBLIC

Remember that the public is your employer, and all roads are built for the public at their expense and for the use of the public. Give prompt, courteous consideration to problems of property owners, the traveling public, municipal and county officials, and cooperate with other members of your own project crew.

DOCUMENTATION

1. Do not substitute one item for another.
2. Enter all oral agreements in field book.
3. Extra work orders require approval before work is done.
4. Index field book contents.
5. Only one project per field book, normally.
6. Keep field books separate from other project records.
7. List inspectors in field book with dates on job.
8. Form 314 must agree with field measurements.
9. Use sketches with notes and dimensions.
10. Get written agreements on plan quantity payments.
11. Separate participating from nonparticipating items before job starts.
12. Enter positive action notes in diary, such as contractor's progress or lack of it, and when certain actions started such as forming.
13. Make double checks during progress--don't wait.
14. Identify all scale tickets with project, contractor, date and initials.
15. Read specifications for methods of measurement.
16. Record calibrations of scales, mixers and plants.
17. Do not erase.
18. Use separate page for each pay item.
19. Keep a complete diary.
20. Sign or initial all entries.
21. Check with your immediate supervisor when in doubt.
22. Keep your supervisor informed at all times.

GRADING

Plans and Contract Documents

1. Have a set of profile plans and cross sections, 10-scale if city work.
2. Have a set of right of way contracts for the project.
3. Have a Specification Book, Supplemental Specifications and Special Provisions.
4. Furnish contractor a set of right of way contracts.
5. Study plans and be informed of special areas of construction as noted on the plans and cross sections such as treatment areas, moisture density areas, sand blankets, reclaimed surface material, etc.
6. Check with instrumentman on correct interpretation of grade stakes.
7. Be sure all original cross sections have been taken on all classifications of material before grading operations start.
8. Be familiar with specifications that are applicable.
9. Make sure the method of measurement for each pay item is clearly understood.
10. Fill out all required report forms.
11. Keep a daily diary and accurate record of pay items.
12. Set up headings for field books as suggested in "Construction Records" booklet.

Clearing and Grubbing

1. Measure trees 18 inches above ground for size.
2. Stumps will be measured by taking the average diameter at cutoff.
3. Save ornamental trees when possible.
4. Do not dispose of stumps in fill areas or bury them within the limits of the roadway.
5. Contractor to obtain written agreement with property owner for disposal of stumps and timber.
6. Ask contractor to observe the measuring of clearing and grubbing items.

Removal of Unsuitable Soils

1. Excavate unsuitable soils to depth and width as shown on plans.
2. Make sure that measurements are made of excavated areas.
3. Do not use peat or muck in the construction of an embankment.
4. Dispose of unsuitable material as indicated on the plans. Refer to Standard Road Plan RL-1.
5. Check for unstable areas where below-grade excavation and subsequent backfilling with suitable material would improve the roadbed. Bring these potential unstable areas to the immediate attention of the resident construction engineer.

Placement of Selected or Special Backfill

1. Backfill excavated areas with the specified material.
2. Compact selected and special backfill material in accord with specifications, or as indicated on the plans or by the special provisions.
3. Special backfill may be measured by converting tons to cubic yards.
4. Record conversion factor in field book.
5. Initial scale tickets.

Preparing Roadway Foundation

1. Remove and dispose of all surface vegetation.
2. Remove sod where height of fill is 5 feet or less.
3. Scarify old road surface to depth of 6 inches; recompact with other material to avoid an impervious layer being formed when old roadway lies below or within the embankment area.
4. Rebuild embankments only when new roadbed overlaps an existing roadbed. Refer to Standard Road Plan RL-1.
5. Embankment to be benched into an existing slope.
6. Check for isolated sand pockets in the roadbed of cut sections.
7. Remove old road metal if used for selected backfill.
8. Scarify and windrow road metal before loading.

Embankment Construction

A. Regular Compaction

1. Check weight of rollers. Rollers to exert not less than 200 pounds per square inch, with feet or lugs $6\frac{1}{2}$ inches from surface of drum.
2. Sandy or granular material may be compacted with a pneumatic-tired roller weighing not less than 200 pounds per inch width of roller.
3. Fills to be constructed in horizontal layers not over 8 inches in loose thickness.
4. Separate dump and compaction areas required when width of fill is 36 feet or more and within 36 feet of structures. Width of fill less than 36 feet, empty haul unit may travel through compaction areas. Width of fills less than 30 feet, separate dump and compaction areas are not required.
5. Discing required when material as deposited contains an average of more than one lump per square yard.
6. Smooth layers to uniform depth before compacting.
7. When possible, alternate layer of wet soil with dry soil.
8. Berms, when shown on plans, are to be built concurrently with the roadway embankment. Excess dirt may be used for building additional berms.
9. Make sure that fill areas drain properly at end of each day's work.
10. Check finishing of bridge berms before turning them over to bridge contractor.
11. Check axle load limits over culverts, pavement and bridges.
12. Never butt two fills up against each other--always overlap them.
13. No frozen material shall be used in the fill.
14. No material shall be deposited on frozen ground.
15. Cut reinforcing steel from old pavement before placing the broken concrete in the fill.
16. Avoid placing rock in bridge approach fills where piling are to be driven.

B. Moisture and Density Compaction

1. Any type of equipment may be used for compaction.
2. Moisture limits obtained from special provisions for the project.
3. First layer compacted to 90 percent of maximum density; balance of fill compacted to 95 percent maximum density.
4. Check moisture before compaction.
5. Fills to be constructed in horizontal layers not over 8 inches in loose thickness.
6. Take enough density tests to be assured that the lifts are compacted to the required density.
7. Report moisture-density tests on Form 387A.

Rock Fills and Cuts

1. Contractor to clean earth from the rock surface to permit accurate original rock cross sections.
2. Mats or other protective means should be used where necessary to minimize adjacent property damage from blasting.
3. Rock fills to be built in layers not exceeding 4 feet in thickness; smaller lifts should be used if the size of the rock fragments permits.
4. Nesting of large fragments or boulders without sufficient surrounding fine material must be avoided in fills.
5. Indiscriminate overwidth or overdepth break-out will not be paid for.
6. Rock fills to be constructed 2 feet below finished grade line. Next foot of fill, rock spalls and fine fragments. Last foot of fill to be of earth or material specified.
7. Rock cuts to be excavated one foot below grade and with no projection more than 6 inches inside neat lines of a template section.
8. Loose and broken overhanging rock must be removed from backslopes.

Backslopes and Ditches

1. Backslopes of cut sections shall be rounded at the top with a 10-foot vertical curve.
2. Construct intercepting ditches back of the top of the slope where necessary for erosion control. These interceptor ditches should be placed, even though they are not shown on the plans, when they can prevent washing of the backslopes.
3. On primary projects, all backslopes shall be roughened by scarifying.
4. Check ditches for depth, width and direction of flow.
5. Turn ditches out at point of transition from cut to fill to prevent water from following along toe of fill.
6. Check bottom of ditches for an excess of loose material.
7. Check ditches for duck ponds.

Circular Culverts

1. Check for approval stamp, correct size, class and length of pipe.
2. Check the culvert stakes for location and elevation of flow line.
3. Check pipes for damage from shipping and unloading.
4. Check inlet and outlet against natural ground elevation, elevations of proposed ditch grades and correct skew.
5. Camber grade line for expected settlement. Refer to Standard Road Plan RF-4.
6. Check for unstable foundation material.
7. Check for proper bedding of pipe.
8. Place with hub, bell or groove end upstream.
9. Check culverts for alignment and closure of joints during construction.
10. Make sure that backfill under and around the pipe is properly compacted.

Drain Tile

1. Check with property owners for tile lines that may not be shown on the plans.
2. Check tile flow lines for tile grade.
3. Check tile for damage from shipping and unloading. If metal pipe, check for damage to protective coating.
4. Check tile joints and alignment during construction.
5. Special tile connections required at junctions and where a change in diameter is greater than 2 inches.
6. Joint and connections at junctions in metal pipe require connecting bands and properly designed fittings.
7. Check for proper backfilling of trench.
8. Make sure that the proper amount of porous backfill is placed around and above pipe when porous backfill material is specified.
9. Inform contractor of the location of tile lines.
10. Check to see that tile lines are in working order after grading is completed.

Storm Sewers

1. Check with city officials and utility companies for locations and elevations of existing water, gas and sewer mains.
2. Ask city or utility officials to have one of their men on job while constructing storm sewers.
3. Check for unstable foundation material.
4. Check for proper bedding of pipe.
5. Do not place pipe on rock--excavate 6 inches below grade and backfill with suitable material.
6. Check alignment, joints and grade of pipe during construction.
7. Check backfill under and around the pipe for compaction.
8. Check for proper backfilling of trench.
9. Check for overdepth excavation.

Sanitary Sewers

1. Check with city officials and utility companies for locations and elevations of existing water, gas and sewer mains.
2. Ask city or utility officials to have one of their men on job while constructing sanitary sewers.
3. Check for unstable foundation material.
4. Check for proper bedding of pipe.
5. Do not place pipe on rock. If rock is encountered, excavate one foot below grade and backfill with suitable material.
6. Check alignment and grade of pipe during placing.
7. Check pipe joints for proper construction.
8. Do not backfill until joints have set.
9. Check for proper backfilling under and around pipe.
10. Check for proper backfilling of trench.
11. Check for overdepth excavation.

Catch Basins, Intakes and Manholes

1. Make sure that the proper type of structure is built at the correct location.
2. Check the structure for elevation of inlet and outlet pipes, top of structure and footing.
3. Check forms for alignment, dimensions and bracing before pouring concrete.
4. Check steel reinforcing for size, spacing and location as shown on the plans before concrete is placed.
5. Plaster outside surface of brick or block sanitary manholes with 1/2 inch of mortar.
6. Make sure that top casting is set in full mortar bed.
7. Check for proper backfilling around structures.
8. Four feet is minimum depth of structure to be constructed. Measurements made from flow line of gutter to top of footing.
9. Make sure each catch basin, intake and manhole is cleaned out and in working order before releasing contractor.

GRAVEL SURFACING

1. If necessary, have Maintenance smooth and shape surface of roadbed before placing surfacing material.
2. Make allowances for surfacing drives, mailbox turnouts and crossroads when determining rate of application.
3. Make sure loads are loaded to measured capacity.
4. Check for loads greater than truck license permits.
5. Check truck boxes for tightness to insure against loss of material between loading and delivery point.
6. If material is weighed, make sure that scale tickets are initialed at point of loading and at delivery point.

GUARDRAIL

1. Check guardrail for correct line and grade.
2. Make sure that correct length of post is below the surface of the ground and that bottom of hole is firm to prevent settlement.
3. Make splices of beam rails only at the post.
4. Lap ends of beam rails in direction of traffic, except terminal sections.

RIGHT OF WAY FENCING

1. Check fence for correct location. Fence to be placed one foot from right of way line on state property unless otherwise shown on the plans.
2. Set angle posts when alignment of fence changes laterally 10 degrees or more, or vertically 30 degrees or more.
3. Allow for seasonal changes in temperature when tensioning fence fabric.
4. Fence stretching should be applied in a vertical plan to avoid twisting.
5. Pull posts shall be set at intervals not greater than 960 feet in straight lines of fence.
6. Avoid a gap between face of bridge wings and end of fence when fencing up to bridges.

ROADWAY LIGHTING

Pole Footings

1. Check projection of anchor bolts.
2. Make sure angular position of anchor bolt template is correct.
3. Check position of ground rod reinforcing cage.
4. Make sure anchor bolts remain vertical and parallel as concrete is poured.
5. Check access conduits for sharp burrs or projections. Open ends are to be securely capped until cable is installed.
6. Make sure undamaged insulating bushings are in place before cable is pulled.
7. Check rustproofing of metal conduits threads.
8. Concrete shall meet the requirements for Class C structural concrete.

Circuits

1. Check trench dimensions.
2. Make sure trench is clear of rocks, other abrasive material and water.
3. Circuits may share a common trench when practical, provided all depth, sand cover and clearance requirements are met.
4. Check positioning of cables in trench.
5. Check sand backfill bedding and cover.
6. Make sure all sand backfill is covered by not less than two feet of earth backfill, especially in footing access areas.
7. Make sure cable is not dented, nicked, abraded or flattened at any time.
8. Check compaction procedure, especially near duct terminal ends.
9. Make sure precautions are taken to avoid direct pressure between two cables, or between a cable and a duct wall.

10. Make sure cable splicing allowance will permit fully assembled connectors to clear the pole or sign structure handholes by at least one foot. All excessive cable lengths shall be trimmed to length. Do not permit bundling up of excessive cable slack.
11. Make sure specified splice methods are used, that connector assemblies are sized to the cables, and that all bolts and crimps are tight.
12. Check ballast phase tap connections.
13. Make sure each roadway luminaire is individually wired and fused in both sides of the line.

Poles

1. Check painting of poles.
2. Make sure all mastarms are galvanized.
3. Make sure cable is not damaged during erection of the pole.
4. Check plumbing of poles.
5. Antiseize compound should be used on stainless steel threads.

Ducts

1. Make sure all conduit is cleared and capped. Caps are to remain in place until cable is pulled.
2. Make sure undamaged insulating bushings are in place on all metal conduit before cable is installed.
3. Check rustproofing of exposed metal threads.

Sign Lighting

1. Check positioning of sign luminaires.
2. Make sure specified lamps are used.

Roadway Luminaires

1. Make sure each luminaire is adjusted for specified I.E.S. light distribution. Unless a tilt is specified, each luminaire shall be leveled.
2. Make sure refractor has free fit in retainer clips when door is open, to allow for expansion.
3. Check seal of gasket against refractor when door is closed.

Final Inspection

1. Entire system shall be in satisfactory working order. Megohm readings for each phase line shall be submitted to the resident construction engineer's office for approval.
2. All disturbed areas shall be finished to an acceptable condition.

EROSION CONTROL AND PLANTING

Seeding

1. Before seed is prepared for seeding, inspect seed tags to verify that the seed complies with the minimum purity and germination requirements, current test data and variety.
2. Check to see that the proper inoculant is used for the specific legume.
3. Use inoculant at proper rate for specific legumes and for method of seeding (broadcast or hydraulic).
4. Use fungicide for crownvetch seed and other grass and legume seed when specified, for example: Captan -75, Arasan -75, Orthocide -75, approximate dosage rate: For grass and legume seed one pound per 100 pounds seed.
5. Check fertilizer grade and compute application rate necessary per acre. Engineer may require weight tickets as per Article 2601.04B.
6. Check quality of material used for mulch and determine average bale weight. Specifications require weight tickets as per Article 2601.06B.
7. Check condition of equipment for proper performance of work.
8. Check equipment for proper rate of application of seed and fertilizer.
9. Suggested sequence of operation for "Stabilizing Crop Seeding":
 - a. Preliminary preparation of seedbed.
 - b. Apply fertilizer and stabilizing crop seed.
 - c. Disc for final seedbed preparation.
 - d. Roll with cultipacker.

10. Suggested sequence of operation for permanent seeding with broadcast seeder:
 - a. Preliminary preparation of seedbed and ditch shaping for special ditch control.
 - b. Spread fertilizer where specified.
 - c. Apply nurse crop seed if specified (oats or winter rye).
 - d. Disc in fertilizer and nurse crop seed for final seedbed preparation.
 - e. Apply seed and mulch for special ditch control.
 - f. Apply special ditch control (jute mesh or glass fiber and asphalt tack).
 - g. Roll with cultipacker.
 - h. Apply grass and legume seed for project.
 - i. Items E and F may be used in this part of the sequence.
 - j. Roll with cultipacker.
 - k. Place mulch where specified.
 - l. Till mulch with "mulch tiller."
 - m. Apply crownvetch if not included in seed mix.
 - n. Apply slope protection (jute mesh or glass fiber) as specified.

11. Suggested sequence for seeding with hydraulic seeder:
 - a. Prepare seedbed and shape ditches for special ditch control.
 - b. Apply seed and mulch for special ditch control.
 - c. Apply special ditch control (jute mesh or glass fiber and asphalt tack).
 - d. Roll with cultipacker.
 - e. Apply fertilizer, seed, inoculant, fungicide and water with hydraulic seeder, unless otherwise specified.
 - f. Items B and C may be used in this part of the sequence.
 - g. Roll with cultipacker.
 - h. Place mulch where specified.
 - i. Till mulch with "mulch tiller."
 - j. Apply crownvetch if not part of seed mixture.
 - k. Apply slope protection (jute mesh or glass fiber) as specified.

Sodding

1. Determine area to be sodded, using erosion control field examination plan as a guide.
2. Suggested sequence of work for sodding:
 - a. Shape sodbed (compact washes as required).
 - b. Apply fertilizer.
 - c. Place sod.
 - d. Smooth disturbed areas (preliminary smoothing may be desirable before the placement of sod).

- e. Reseed disturbed areas.
- f. Rake in seed.
- g. Mulch disturbed area.
- h. Water sod within one hour after laying and as specified.
- i. Tamp or roll sod (if necessary to secure bond).
- j. Place special ditch control over sod as specified.

Special Ditch Control - Jute Mesh or Glass Fiber

1. Determine area to be controlled with special ditch control, using erosion control field examination plan as a guide.
2. Suggested sequence of work for special ditch control:
 - a. Shape ditch and prepare seedbed approximately 3/4 inch deep. (Compact washes as required.)
 - b. Install check slots (jute mesh).
 - c. Smooth disturbed area adjacent to ditch control.
 - d. Apply fertilizer.
 - e. Apply seed.
 - f. Apply mulch.
 - g. Apply special ditch control material.
 - h. Apply asphalt tack, RS-2 (glass fiber).
 - i. Water as specified.

Installing Plant Material

1. Suggested sequence of work for installing plant material:
 - a. Excavate planting well.
 - b. Mix peat with backfill.
 - c. Place plant and backfill.
 - d. Fertilize.
 - e. Complete backfilling.
 - f. Water.
 - g. Prune, wrap and remove identification tags.
 - h. Stake and/or guy.
 - i. Shape basin and apply herbicide.
 - j. Apply mulch.

For detailed information on any item of work refer to Instructions to Resident Construction Engineers, Section XV, Roadside Improvement.

PORTLAND CEMENT CONCRETE PAVEMENTS

Batching Plant

1. Plant site must be approved by district engineer.
2. Check adequacy of bin footings and erection.
3. Scales and mixer must be calibrated and approved.
4. Check with district materials engineer about stockpiling aggregates.
5. If project is over 6,000 square yards, cement scales must be automatic.
6. Batching must be accurate.
7. Batch trucks must have separate cement compartments.
8. Endgates must not leak.
9. Test beams must be properly handled, stored and tested at prescribed age.
10. Review Plant Manual.

Subgrade

1. Form line should not be undercut.
2. Use straightedge or string line to check forms for straightness.
3. Check subgrade for elevation and crown.
4. Consult with resident construction engineer about treatment of soft areas.
5. Subbase material requires Proctor tests.
6. Place subbase material at field optimum moisture.
7. Fill out, collect, initial and save load weight tickets for subbase material.
8. Excess material must be salvaged and measured for deduction or reused.
9. Sprinkle or use plastic on subgrade or subbase as provisions require.
10. Be sure forms are well bedded and true to grade.

Mixing and Placing Concrete

1. Mixing time of one minute is required after all solids are in the drum. Check several times daily.
2. Slump must be within allowable limits. Use cone. Cone should be marked at 1/3 volume points with paint stripe. First lift is 2.6 inches, second lift 6.1 inches, both measured from base.
3. Check air content at least four times daily and more often if variation occurs. Make allowance for loss of air by vibration.
4. Check form settlement twice daily.
5. Keep plastic tight. Don't let concrete get under plastic, if used.
6. Make depth checks in fresh concrete.
7. Check crown after each change in screed crown setting.
8. Vibrators must operate at a minimum of 3500 r.p.m.
9. Steel must be placed before vibration.
10. Manhole rings and covers, except in form line, should be preset before paving.
11. Pavement should be edged at form line.
12. See that tail blade doesn't ride up on high spots.
13. Concrete must extend to bottom of form.
14. If mesh is used, see that it is properly placed and tied.
15. Make and store test beams for each run, as instructed.
16. Curing must comply with specifications.
17. On continuously reinforced pavement, check positioning and lap of steel reinforcing bars.

Joints

1. Dowel assemblies must be true to grade and square with centerline. Check spacing and occasionally check depth after finishing concrete.
2. Free dowel ends only must be greased.

3. Expansion joints must be normal to grade and centerline.
4. Expansion joints must be edged.
5. Sawing of the 80-foot contraction joints must begin as soon as possible and continue until raveling becomes excessive. Other transverse joints must be sawed within three days.
6. Use extreme care in placing parting strip at block-outs to keep it vertical. Avoid use of soupy mortar adjacent to parting strip.
7. Longitudinal joints must be sawed within seven days.
8. All joints must be sealed before traffic is permitted on pavement. Use care in filling joints.
9. Day's work headers must be square with centerline and normal to subgrade. Dowels must be parallel to subgrade and centerline. Day's work joint dowels are not to be greased.

Form Removal

1. Use care in removal of form pins to prevent chipping of pavement edge.
2. Pins must be removed before forms are removed.
3. Honeycomb, if present, must be patched before edges are cured.
4. Build check dams as required.
5. Handle forms carefully.

Paving Reports

1. Plant equipment reports.
2. Daily plant report.
3. Daily grade report.
4. Test beam report.
5. Reports must be legible, complete, and sent in promptly.

CONCRETE BOX AND ARCH CULVERTS

Storage of Materials

1. Steel and concrete materials must be safely and properly stored.
2. Insist on good housekeeping practices.

Location of Structure

1. Check on location as to stationing, barrel length compared to roadway cross section, skew and flow lines.
2. Check stakes for labels on flats.

Excavation

1. If relocated, raised or lowered, measure excavation quantities.
2. Do not undercut excavation except when footing area requires treatment.
3. Provide for bypass of drainage.
4. Suitable material should be stored to prevent loss or saturation. Free haul limit except Class 24 is 100 feet; Class 24 is 500 feet.

Forming

1. Form lumber must be in good condition.
2. Formed dimensions must be checked.
3. Headwall forms must be well built, with tight joints and smooth surfaces.
4. Forms must be oiled before use.

Mixing and Placing Concrete

1. Concrete must be accurately batched.
2. If mixed at site, batching equipment and mixer must be calibrated and approved.
3. Ready-mixed concrete plants and equipment must be checked out by materials engineer.
4. Adequate delivery must be assured.
5. Required finishing tools must be on hand.

6. Reinforcing steel must be secured in proper position before concrete placement.
7. Use chairs for steel when warranted.
8. Be sure all wood spacers are removed.
9. Finish concrete to neat lines. Avoid use of free water on concrete.
10. Heat concrete and protect if necessary. If insulation is used, see that it is properly applied and maintained.
11. Make and store test beams if backfilling before 14 days is contemplated.

Curing

1. Burlap must be wet when applied and kept wet.
2. All patching must be done before applying curing compound.
3. If curing compound is used, be sure it is uniformly mixed and properly applied.

Removal of Forms

1. Patch tie-bar holes and honeycomb as soon as possible after form removal.
2. Observe specifications in regard to time of form removal.
3. Rub areas if Class 2 finish not acceptable. Whole panel must be rubbed if rubbing is necessary.

Backfilling

1. Use suitable material at proper moisture content.
2. Place in 8-inch loose layers.
3. Compact each layer thoroughly.
4. No backfilling in less than 14 days, except 7 days if test beam passes.
5. Backfill both sides of culvert or arch at same time.
6. No rolling within 3 feet of retaining wall or wings.
7. Follow specifications regarding backfilling spandrel filled arches.

8. Dispose of surplus material in embankment if suitable, or as directed by engineer.
9. See that site is cleaned up for grader.

Reports

1. Keep accurate records of materials used and concrete placed.
2. Keep accurate diary.
3. Forward required reports promptly.

BRIDGES

Storage of Materials

1. Insist on good housekeeping on project.
2. See that beams, reinforcing steel, cement, aggregates and other material are safely and adequately stored. Special care must be given to storage of concrete beams and piles.

Location of Structure

1. Inspector must personally check pier and abutment stakes for lines indicated.
2. Check measurements for layout and excavation quantities.
3. Double check span distances during construction.
4. Check plan quantities, elevations, etc.

Foundations

1. If on rock, be sure founding material meets design requirements.
2. Examine piling for visible defects. If any are found, notify district materials engineer for disposition.
3. Check pile layout before driving.
4. Determine energy requirements of hammer. See Article 2020.02.
5. Cap must fit pile heads.
6. Use plumb bob and batter board.
7. Use proper precaution in driving piles and determining bearing.

8. Measure penetration along axis of pile.
9. Use care in determining cutoff elevation.
10. Treat tops of treated wood piles with hot creosote.
11. Drive an interior vertical pile first and log bearing every five feet.
12. Show pay quantities on pile log.
13. Statement on pile log regarding salvage value of cutoffs.

Forming

1. All footings must be formed, except portion keyed into rock.
2. All forms must be checked for accuracy of dimensions.
3. Forms and falsework must be adequate as to strength and bracing. Battered forms must be well anchored down.
4. Forms for exposed concrete must be in good condition, with tight joints, and oiled before use.
5. Champfer strips on corners 90 degrees or sharper.

Mixing, Placing and Finishing Concrete

1. See Mixing and Placing of Concrete for Culverts.
2. Bridge floors not to be heated without approval of district engineer.
3. Use retarder above 65 degrees F if continuous pour, and above 85 degrees for sectional pours.
4. Use workable concrete, checking on slump, air content and retarder.
5. Use finishing machine if required.
6. Straightedge floor concrete.
7. Check bridge seat elevations carefully.
8. Floor may be thickened over low joint a maximum of 3/4 inch. Thinning should be avoided but over a high spot must be limited to 1/4 inch.
9. Be sure all floor steel is placed so as to have specified cover. Spacing of steel must comply with plans.

10. Attach temporary clearance block to screed and check steel for clearance.
11. Tie reinforcing steel to shear lugs as required.
12. See Instruction No. 26, Section VIII.
13. Follow instructions regarding floor placement sequence.
14. All materials must be approved and properly stored.
15. Check bridge seat elevations while still plastic.

Setting Beams

1. Beams may be set on diaphragm piers after 24 hours.
2. No beams on T, P-10 or pedestal piers under 7 days.
3. Steel beams on abutments after 24 hours.
4. No concrete beams on abutments under 7 days.
5. Use temporary supports or other approved means for erecting steel.

Bolting and Riveting

1. Joints must be supported at proper elevation before bolting or riveting.
2. For bolting main splices, torque wrench must be calibrated at Ames Laboratory.
3. High tensile strength bolts may be used as fitting-up bolts.
4. Riveters must be experienced.
5. Rivets must not be overheated or burned.
6. Heads must be properly formed.
7. Loose or burned rivets must be removed and replaced.
8. Run profile on beams to determine floor grades.

Miscellaneous

1. Check plans for proper installation of posts and handrail.
2. Curb should be poured after all floor is placed.
3. Shape berm slopes according to plan.

4. Backwalls should not be poured before floor is on.
5. Site must be cleaned up before project is accepted.
6. Remove temporary bolts in expansion device as soon as concrete hardens.
7. Remove forms and begin rubbing on Class 3 finish areas. Patch honeycomb.
8. Mark outlet of drain tile to prevent damage during cleanup.
9. Welders must be certified.

Painting

1. No painting when temperature is below 40 degrees F.
2. Paint must be kept thoroughly stirred.
3. Painting should be neat and free of runs or sags.
4. Coverage must be adequate.
5. Surfaces must be clean and dry when paint is applied.
6. No thinning of paint is to be permitted.
7. First field coat must be thoroughly dry before application of second field coat.
8. Check thickness of paint coat with gage if available.

Backfilling

1. Backfill behind abutments must be placed in 6-inch layers and thoroughly tamped. All loose dirt to be removed before placing granular backfill material. Wet down, if necessary, to get good compaction. Drain tile must be in place.
2. Excavation need not be flattened before backfilling except to remove loose material.
3. Granular material paid for on contract quantity basis.

Reports and Records

1. Keep accurate and complete diary.
2. Keep records regarding pay quantities.
3. Make out and send in promptly all required reports.

FLEXIBLE PAVEMENTS AND
RESURFACING OF OLD PAVEMENTS

Preparation for Hot-Mix Resurfacing

1. Review carefully all of the Construction Instructions in Section XI.
2. Check for station markers to compute yield percentages. Should be at least every 500 feet.
3. Ride the highway at moderate speed. Stake locations which need leveling.
4. Remove all fat or loose material. See Construction Instruction No. 27, Section XI.
5. Place full depth patches.
6. Surface patches should be finished to same level as surrounding pavement.
7. Don't apply tack coat unless sand truck is in good repair, and present.
8. Place leveling, strengthening and wedge courses. See Construction Instruction No. 7, Section XI, for wedge courses.
9. To determine length of fillets for driveways and intersecting roads, drive with car. Set stakes. Don't make them too short.
10. Have area for guideline string properly prepared by mowing grass along edge, if old pavement is concrete.

Flexible Bases

1. If base is asphalt treated base, refer to the check list for asphaltic concrete.
2. Set alignment stakes and grade stakes if required. See Construction Instruction No. 8, Section XI, for grade stakes.
3. Subgrade firm and hard? If not, see Construction Instruction No. 18, Section XI, and its supplement.
4. Calculate the quantities to see if the plan quantities are correct.
5. Make a simple and accurate spread chart. See Construction Instruction No. 15, Section XI.
6. Check moisture content of base material frequently.

7. Check platform scales. See Construction Instructions No. 6, Section XIX, and No. 1, Section IX.
8. Stockpiling and truckloading operations must minimize segregation.
9. Make initial edge trim early during compaction.
10. Frequent light applications of water will maintain proper moisture content.
11. Waste the few coarse segregated particles which remain after finish blading.
12. Make final edge trim to insure plan dimension.
13. Density test holes. See Construction Instruction No. 26, Section XI.
14. Daily thickness checks to insure design thickness.
15. Report density tests on Form 387-A.
16. Broom before priming.
17. Adjust prime rate downward if it is too heavy.

Asphalt Plant

1. Pyrometer at dryer must work properly.
2. Thermometer in asphalt line must work properly.
3. Segregation must be minimized. See Construction Instruction No. 16, Section XI.
4. Check scales. See Construction Instructions No. 6, Section XII, and No. 1, Section IX.
5. Haul trucks must be equipped with and use canvas covers at all times.
6. Stockpiling operations should minimize segregation.
7. Adjust temperature to insure coating.
8. Restrict the use of kerosene in truck boxes till after work has ceased for day.
9. Batch trucks should be weighed empty at least once and preferably twice a day.
10. Record the temperature of mixture, A.C. and aggregate every two hours.
11. Check all aggregate gate settings and pump setting every hour.

12. Run A.C. verification, gradation and tank stick measurement daily. Make no changes in plant after a test shows bad until a check has been made to determine why the test was bad and then at least one additional test has been run to verify the first. Notify the resident construction engineer.
13. Check to be sure that only a minimum amount of fuel oil is used to flush out the transfer pump after unloading asphalt into the storage tank.
14. At the beginning of the job learn the detailed procedure to be used on the asphalt pumping system.
15. Use only approved procedures and technique in taking and handling samples.
16. Check daily to see that all information is properly shown on the Daily Plant Report (Form 7).

Hot-Mix Asphaltic Concrete Construction

1. Review carefully all of the Construction Instructions in Section XI.
2. Check the plan quantity of each contract item to insure accuracy.
3. Check for station markers to compute yield percentages. Should be at least every 500 feet.
4. Check the rollers. See Construction Instruction No. 6, Section XI.
5. Check the shovels, rakes and lutes to insure their availability and compliance with the specifications.
6. Set the drag points on the surface checker at the correct elevation in relation to the wheels.
7. Check the finishing machine for proper crown and extension installation. See Construction Instruction No. 20, Section XI.
8. Have the required crown indicator installed.
9. Do not place tack coat on a damp or dirty surface.
10. Don't allow tack coat to get on new curb or bridges, etc.
11. Insist on proper use of guideline string. See Construction Instruction No. 23, Section XI.
12. Require finishing machine speed to be reduced until continuous operations are provided.

13. Avoid casting back. To correct mat texture, correct the cause. See Construction Instruction No. 20, Section XI.
14. If casting back on handwork is necessary, rake out the coarse stone and excess material.
15. Require deviations in true edge alignment to be corrected by handwork immediately. See Construction Instruction No. 23, Section XI.
16. Do not use kerosene or fuel oil.
17. Use correct lane widths. See Construction Instruction No. 13, Section XI.
18. Use correct spread rates and thickness. See Construction Instruction No. 14, Section XI.
19. Keep sufficient thickness at longitudinal joints.
20. Check lap at longitudinal joint. A uniform lap of one inch should be maintained. See Construction Instruction No. 23, Section XI.
21. Check the transverse joints with a straightedge. See Construction Instruction No. 24, Section XI.
22. Adjust manholes and other fixtures just before placing top layer.
23. At curb and gutter units, keep asphalt 1/2 inch above concrete apron after rolling.
24. Adjust crown in leading edge of screed to prevent tearing. See Construction Instruction No. 20, Section XI.
25. If tearing cannot be stopped, issue stop order. See Construction Instruction No. 20, Section XI.
26. Determine length of fillets at driveways and intersecting roads by driving them with a car. Set stakes. Don't make them too short.
27. All rollers must operate with power-driven wheels toward the finishing machine.
28. Density requirements must be met. See Construction Instruction No. 8, Section XI, and its two supplements.
29. Trim edges of handwork just after rolling. See Construction Instruction No. 23, Section XI.

Surface Treatments and Bituminous Seal Coats

Equipment

1. All equipment shall be in good working condition and shall meet the specifications.
2. Equipment requirements:
 - a. Pressure distributor shall have IHC calibration bin number and corresponding calibrated stick.
 - b. Aggregate spreader must be self-propelled.
 - c. Compacting equipment shall be self-powered, pneumatic-tired rollers and steel-tired rollers complying with the specified weights.
 - d. Truck scale for weighing material. See Construction Instructions No. 1, Section IX, and No. 6, Section XIX.
 - e. Miscellaneous equipment--a power broom and all necessary hand tools shall be provided.
3. The distributor shall be equipped with heating facilities and a thermometer for checking the temperature of the bituminous material.
4. Check the spray bar for width and height above road surface. See Construction Instruction No. 10, Section XI.
5. Check all spray bar nozzles for angle and cleanliness.
6. Check width of aggregate spreader.
7. The distributor shall be equipped with an accurate tachometer showing speed in feet per minute.

Material and Design Requirements

8. Check the plans for width of surface and point of beginning and ending of the project.
9. Check the plans and specifications for application rates for the bituminous material and the cover aggregate.
10. The requirements for traffic and the details for controlling traffic should be arranged with the contractor.
11. Be sure that all materials have been approved for use.

Application of Bituminous Material and Cover
Aggregates

12. Plan construction operations with the contractor and determine starting point.
13. Foreign material should be swept off the road surface before bituminous material is applied.
14. Trucks loaded with cover aggregate should be at the site of the work before bituminous material is applied.
15. Check temperature of bituminous material.
16. Have trucks, aggregate spreader and rollers lined up and ready to operate before applying bituminous material.
17. Application of cover aggregate should follow closely behind the application of bituminous material.
18. Rollers should follow closely behind aggregate spreader.
19. Check rate of application of bituminous material and cover aggregate.
20. Compute the yield of bituminous material for each distributor load after the first applications are checked to insure accuracy.
21. Compute the yield of aggregate on the first three loads and have controls on the spreader adjusted for correct yield. Then compute yield periodically afterward.
22. An accurate record of bitumen and aggregate quantities should be kept for pay quantity purposes.
23. Check the placement of paper for joints at stops and starts.

GRAVEL PACK WELLS

1. Read carefully the special provisions and construction details of project.
2. Familiarize yourself with log of well as shown on plans.
3. Compare anticipated log with log of test hole for depth of formations and variation of formation. Significant differences should be brought to the attention of the resident construction engineer.
4. Observe test hole drilling and make visual examination of drilling samples taken for mechanical analysis to determine size of screen slots.
5. Make sure that the resident construction engineer has two copies of manufacturer's recommendation for screen slot size.
6. Guard against unsanitary conditions which would contaminate well.
7. Check strainer for compliance with specifications.
8. Check casing, pitless adapter and gravel for compliance with specifications.
9. Obtain engineer's approval before placing screen. Record length of casing placed and description of placing methods.
10. Check placement of gravel pack and disinfectant.
11. Check of clay backfill.
12. Check concrete grout.
13. During development follow procedures as outlined in 625.06, paragraph 8, regarding well development. THE DATA SHALL BE A PART OF THE PERMANENT WELL PROJECT RECORD.
14. Advise roadside development section before pumping test begins. Chlorination of well may proceed.
15. Make a permanent record of all pump test data.
16. Observe the plugging of the observation and test wells.

A copy of driller's log of well, test pump data and other pertinent data shall be sent to the Design Department, Roadside Development Section.

Rock wells will be listed at a later date as none are anticipated in the next year's construction period.

REST ROOM BUILDINGS

1. Review all plans, specifications and special provisions.
2. Keep field book records up to date. For each item note date of approval, date started and date completed.
3. Check that manufacturer's specifications and brochures as required are supplied by contractor, and proper distribution is made.
4. Compare finish floor elevations with existing or future cross section change to insure drainage away from building, and to provide proper grade elevation between parking curb elevations and building elevation.
5. Check and remove any loose dirt in footing forms.
6. Check forms for depth, width, dimensions and bracing.
7. Check reinforcing steel, mesh, etc., for proper size, length and placing.
8. Determine source of ready-mix concrete and if it is an approved source.
9. Note type and strength of concrete used.
10. Take concrete tests, record air, slump, water used, etc.
11. Use care in depositing concrete and vibrating. Avoid segregation and rehandling.
12. Check the poured concrete footings, walls, floors for proper protection from weather, and curing.
13. Check for openings in concrete walls for utilities.
14. Check all pipes and utilities under floor before it is backfilled. All plumbing to be tested.
15. Take required concrete tests.
16. Floors finished with quarry tile to be depressed to allow setting bed for finished floor.
17. Check all floor drains, support for fixtures, expansion joints, etc., before floor is poured.
18. As material is delivered to job see that it is properly stored and protected.

19. Check to determine that all material meets specifications and is inspected or tested, and reports noted and filed.
20. See that materials meet requirements for color and size.
21. Check wall tees, mortar mix, wall cavity for insulation, sash cord through walls as specified, and that walls are plumb and accurate.
22. Check to see that all door frames, conduit and pipe, sleeves, fixture hangers and boxes are installed at proper height and location.
23. Check to see that all wood members, rafters, windows and roof decking meet specifications for grading, moisture content, discoloration and trueness, and are free of defects.
24. Check construction of roofing for proper installation and procedures.
25. Check finished floors for approval of materials, color and procedures for installation of quarry tile.
26. All surfaces to be painted must be free of foreign material.
27. See that all paint has been approved for color and that proper application is made.
28. See that approvals are received for all facilities in rest rooms and proper installation made.
29. Plumbing to be completed as shown on plan, all codes observed and tests made.
30. Check heaters, ventilators, duct work and grills for workmanship and compliance with specifications.
31. All outside work as shown on plan and specifications to be completed as required on project.

HIGHWAY SIGNING

1. On break-away sign posts, if the fuse plate assembly is fabricated according to Alternate #2, the area beyond the post cut pole shall be examined carefully after erection for damage due to handling.
2. A break-away sign post footing shall always be flush when installed on sloping ground and never more than one inch above ground when installed on a flat slope.
3. The location of signs indicated on the "Summary" sheet may be adjusted according to instructions outlined on the plan sheet entitled "Installation and Erection Details for Type B Signs."
4. Care should be exercised in the locating of the delineators and milepost markers.
5. The camber on overhead structures should be checked after erection. Weights simulating the sign load should be used.
6. Overhead and ground-mounted signs should be level.
7. Verify that ground-mounted signs tilt away from the roadway as specified on the plans.
8. Galvanized structures should be carefully examined for damage and retouched where necessary.

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