



NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES®
sponsored by the National Society of Professional Engineers

Transportation Engineering Technology
Highway Construction

PROGRAM DETAIL MANUAL

Please check NICET's web site (www.nicet.org) to make sure you have the most recent edition of this document.

Effective upon issuing a new edition of any program detail manual, all previous editions of that program detail manual become obsolete.

This manual may be freely copied in its entirety.

Field Code: 001
Subfield Code: 01

Sixth Edition
February 2005

IMPORTANT INFORMATION

The Institute occasionally makes changes in its certification programs that will significantly affect the currency of individual program detail manuals. These changes could include any or all of the following:

- o deletion, modification, or addition of work elements
- o modification to the Examination Requirements Chart
- o modification to crossover work element credit
- o changes to the work experience requirement
- o changes to the verification requirement

Since these changes could affect the requirements for certification, it is highly recommended that you contact the Institute before applying for an examination if this manual is more than a year old. The date of publication of this manual is February 2005.

IT IS THE APPLICANT'S RESPONSIBILITY TO MAKE SURE HE/SHE IS USING THE CURRENT EDITION OF THE MANUAL.

**KEEP YOUR
MANUALS
CURRENT**

This sixth edition of the Highway Construction program detail manual does not contain any substantive changes from the fifth edition. Only the following minor changes have been made:

- o Corrections to the personal tally sheet.

Whenever an exam requirement changes, individuals who are already certified and do not intend to upgrade their level of certification do not need to comply with any changes for the level(s) of certification they have already been awarded.

Individuals who wish to upgrade must satisfy any "new" exam or other certification requirements for the higher level once the deadline has been passed. This sixth edition manual does not inaugurate any program changes.

FIELD OF TRANSPORTATION ENGINEERING TECHNOLOGY

SUBFIELD OF HIGHWAY CONSTRUCTION

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GENERAL INFORMATION

This Program Detail Manual contains the information needed to apply for the NICET certification examination in the Highway Construction subfield of Transportation Engineering Technology.

All NICET policies, procedures, rules and forms referenced in this manual can be found on our Website (www.nicet.org).

This certification program is for highway technicians involved in the inspection (monitoring) of highway construction projects. Areas covered are interpretation of contract plans and specifications; project recordkeeping and reporting; construction surveying; field inspection and testing procedures, techniques, and equipment; and supervisory techniques.

This program became operational in 1979 with funding from the Federal Highway Administration and technical guidance from a task force appointed by the American Association of State Highway and Transportation Officials (AASHTO).

WORK ELEMENT DESCRIPTIONS

The typical job duties and associated responsibilities of highway construction technicians have been broken down into discrete work elements which form the basis for an evaluation of the candidate's knowledge. Each work element is written in sufficient detail to permit candidates who have the appropriate work experience to make reasonable assumptions about the types of questions likely to be asked.

In addition, the supervisor verifying the experience of the candidate should be able to interpret the scope of the activities associated with each work element.

FIELD CODE AND WORK ELEMENT IDENTIFICATION NUMBERS

In order for us to prepare individualized examinations for each applicant, identification numbers have been assigned to each technical field and to each work element. Each technical field is represented by a 3-digit number. The technical field code number for Transportation Engineering Technology is 001.

The identification number assigned to each work element is 5 digits long. The first digit identifies the technical subfield within the field of Transportation Engineering Technology:

- (1) Highway Construction
- (2) Highway Design
- (4) Highway Traffic Operations
- (5) Highway Surveys
- (7) Bridge Safety Inspection
- (8) Highway Materials
- (9) Highway Maintenance

The second digit identifies the level (Levels I through IV) and the work element type (General or Special):

GENERAL WORK ELEMENTS

- (1) Level I General
- (3) Level II General
- (5) Level III General
- (7) Level IV General

SPECIAL WORK ELEMENTS

- (2) Level I Special
- (4) Level II Special
- (6) Level III Special
- (8) Level IV Special

The third, fourth and fifth digits identify the individual work element within each category.

A sample of this numbering system is illustrated below for work element 001/15001:

Technical Field Code:	001	(Transportation Engineering Technology)
Subfield:	1	(Highway Construction)
Level/Type:	5	(Level III General)
Work Element Number:	001	

This eight-digit identification number is written on the application form to request a work element on an exam or to provide verification for a work element.

REQUIREMENTS FOR CERTIFICATION AT LEVELS I THROUGH IV

Level I is designed for entry-level technicians with very limited relevant work experience in this technical subfield. The Institute recommends that persons with eighteen or more months of relevant work experience set their initial certification goal at Level II. Certification at Levels II, III, and IV does **NOT** require prior certification at Level I. The Examination Requirements Chart on page 3 lists the actual examination requirements for certification at Levels I, II, III, and IV in the subfield of Highway Construction.

WORK ELEMENT SELECTION FOR AN INITIAL EXAM

1. Refer to the Examination Requirements Chart on the following page.
2. Select the appropriate box for the level of certification desired.
3. Note the number of work elements required for certification, by category, as shown in the selected box.
4. Turn to the Work Element Listing section and carefully select work elements from the required categories, paying attention at each level to whether they are classified as General or Special work elements. Select first those work elements most likely to be passed. Note that work element #11006 is mandatory for certification at Levels II, III and IV.
5. When possible, select a few extra in each category so that failing one or more work elements leaves enough passed work elements to satisfy the examination requirement.
6. If the requirement for the desired level is more than 34, it is advisable to examine first all lower level work elements needed to achieve certification. Save the upper level work elements for a subsequent examination.
7. It is strongly recommended that the maximum number of work elements (34) be selected for each examination taken. Selection of 34 work elements provides the greatest opportunity for successful completion of the examination requirement with the smallest number of subsequent examinations. Recognize, however, that all elements selected on an exam application WILL BE SCORED, even if no attempt is made to answer the questions. That is, a score of "0" will be assigned to the work element even if the questions are not answered and the work element will have one failure marked against it.
8. It is suggested that all examination applicants keep a copy of their filled-out applications. This will assist in resolving questions over the telephone.

EXAMINATION REQUIREMENTS CHART

(Subfield: Highway Construction)

You must pass the number of work elements shown in each box to complete the exam requirement for certification at that level.

You must pass this many work elements to complete the **Level I** exam requirement

Level I - General - 5
Level I - Special - <u>4</u>
TOTAL 9

You must pass this many work elements to complete the **Level II** exam requirement
Read Note (a)

Level I - General - 6a
Level I - Special - 6
Level II - General - 6
Level II - Special - <u>7</u>
TOTAL 25

You must pass this many work elements to complete the **Level III** exam requirement
Read Notes (a) and (b)

Level I - General - 6a
Level I - Special - 8
Level II - General - 6
Level II - Special - 14
Level III - General - 10
Level III - Special - <u>3</u>
TOTAL 47

You must pass this many work elements to complete the **Level IV** exam requirement
Read Notes (a), (b) and (c)

Level I - General - 6a
Level I - Special - 8
Level II - General - 6
Level II - Special - 18
Level III - General - 10
Level III - Special - 6
Level IV - General - <u>8</u>
TOTAL 62c

NOTES:

- (a) Work Element #11006, "Basic Metric Units and Conversions", must be passed to achieve certification at Levels II, III, and IV.
- (b) Time restrictions dictate that no more than 34 work elements can be scheduled for any single examination sitting. Therefore, at least two examination sittings will be needed in order to complete this requirement.
- (c) Read very carefully the two sections applicable to Level IV in this manual before seeking Level IV certification.

GENERAL NOTES:

- (1) Work elements passed which are in excess of the requirement for a particular type and level, but which are needed to meet the requirement at the next higher level are automatically applied to that higher level requirement.
- (2) Use the Personal Tally Worksheet on page 17 of this manual to keep track of the number of work elements you have passed.

WORK ELEMENT SELECTION FOR ALL SUBSEQUENT EXAMS

All the items listed on page 2 for the initial examination apply to subsequent exams. In addition, the following should be understood:

1. It is not necessary to retest work elements which were failed on an earlier exam if there are other work elements in the appropriate categories which can be selected instead. If you need to retest a failed work element, you must wait 120 days from the last time you failed it before you will be permitted to test that element again. In addition, you will be blocked from signing up for a work element a fourth time if it has been previously failed three times. For further information, read Policy #20 ("Retesting of Failed Work Elements").
2. If an adequate number of work elements has been selected to meet the certification requirement (with a few extra selected to provide a cushion), and there is room on the exam application to add more elements, it is appropriate to include work elements that will satisfy the examination requirement of the next level of certification or to include work elements from another subfield or another field.

CROSSOVER WORK ELEMENTS

"Crossover" work elements are those which we have identified as being identical or nearly identical in topic coverage and test questions to work elements in selected other fields/subfields. In addition, almost all of the certification programs have "generic" crossover work elements covering communication skills, mathematics, physical science and other basic areas of knowledge which should be known by all engineering technicians. Once a crossover work element is passed on an examination, it does not normally have to be taken again on any other examinations. Crossover credit for the passed elements will be assigned to an examinee's record according to items 1-8 below.

1. **First Time Testing in New Subfield:** As soon as you test work elements from a new subfield (at least one element), any crossover credit from previously-tested subfields will automatically be assigned to the new subfield. At the same time, any crossover credit from the new subfield will automatically be assigned back to previously-tested subfields. This assignment of crossover credit will occur every time a new subfield is tested.
2. **Additional Testing in Previously-Tested Subfield:** When you test new work elements or retest failed work elements from a previously-tested subfield, any crossover credit from the newly-passed work elements will automatically be assigned to all previously-tested subfields.
3. No crossover credit will be assigned to your testing record for a subfield until you test at least one work element from that new subfield.
4. We will print and mail, for a nominal fee, an **"Official Personal Transcript"** which will list all work elements presently credited to your testing record (including those passed on an exam and those achieved through crossover) for a designated subfield. See the "Personal Records Order Form."
5. We will print and mail, for a nominal fee, a **"Personal Crossover Evaluation"** which will list your "potential" crossover credit to a designated UNTESTED subfield. This will enable you to see how close (or how far) you are from passing an exam requirement. See the "Personal Records Order Form." People who obtain this "Personal Crossover Evaluation" need to read and understand the cautionary statement printed on the next page.
6. We will print and mail, free of charge, a **"Crossover Listing"** between any two subfields designated. This list is different from #5 above in that it is not printed for a specific examinee, but rather shows all current crossovers between the two specified subfields available to any examinee. See the "Personal Records Order Form" or this may be ordered by phone. The cautionary statement below needs to be understood.
7. Crossover credit will not be assigned to or from work elements if the certification is in Delinquent or Expired Status.
8. The same 120-day waiting period policy which applies to failed work elements (see item #1 on page 4) also applies to all

work elements which have crossover credit to that work element (see Policy #20).

The work elements in the Highway Construction program which provide crossover credit to other programs are identified in the Work Element Listing in this manual by an asterisk (*) after the work element number. The "generic" crossover work elements are identified by a circumflex (^) after the work element number.

CAUTION

Crossover credit shown on the "Personal Crossover Evaluation" (item #5 above) and on any Crossover Listing (item #6 above) cannot be assumed to be permanent since revisions to certification programs can occasionally eliminate previous crossovers relationships or create new ones. For this reason, crossover credit is permanently assigned only when new testing (as described in item #3 above) takes place. Only those crossover relationships in existence at that point in time are credited.

If you receive a "Personal Crossover Evaluation", you must understand that the crossovers listed have not been posted to your record; therefore, it is a "potential" list. Only when a new subfield is tested and the crossover credit is posted to your record does it become permanent. Only the "Official Personal Transcript (item #4 above) shows the crossover credit actually awarded.

VERIFICATION OF WORK ELEMENTS

Verification should be provided by the applicant's immediate supervisor. The verifier, by signing his or her initials, is signifying that the applicant has actually performed at least the operations indicated in the work element description and that the verifier is confident that the applicant has performed the specific job tasks **repeatedly and satisfactorily**. Exposure to a job task through demonstrations by others or through partial involvement by the applicant should not be a basis for a supervisor to verify that the task can be performed correctly by the candidate under a variety of conditions.

WARNING

We take very seriously the role of the verifier. All certification candidates and their verifiers must understand that verification is an important component of the certification process.

NICET's Policy #2, "Handling of Certification Process Irregularities" says, in part, that if we determine that any verification was obtained from a non-qualified verifier or was given for tasks not actually performed, the NICET action against the candidate can be to permanently deny the certification sought or revoke the certification(s) held. Our action against the verifier can be to terminate the privilege of serving as a verifier. If the verifier is NICET-certified, the certification(s) could be revoked.

Lack of verification on any (or all) work elements does not prevent an applicant from testing those work elements. Certification, however, will not be awarded until all work elements counted toward certification are verified.

WORK EXPERIENCE REQUIREMENT

Your work experience will not be evaluated until after a written exam requirement has been met. We suggest that you carefully consider your actual work history before testing in areas where you have limited or no experience -- **meeting an exam requirement does not guarantee certification**. NICET certification is only conferred upon persons performing engineering **technician** level work. We will not certify persons performing higher level work (such as engineering) or lower level work (such as craft).

In order to be awarded certification, a preponderance of the work experience must have been acquired while residing in the United States and its territories, employing U.S. standards and work practices.

LEVEL IV MAJOR PROJECT

Ten years or more of employment in the certification area, by itself, is **not** sufficient for the granting of Level IV. An absolute requirement for certification at Level IV is senior-level involvement in a major project which is **directly related to the subfield in which Level IV certification is sought**. The major project selected must be completed, must be recent (within the past 3-4 years), and must have taken place well into your career in the certification area. A writeup submitted too early (for example, after only 5 or 6 years in the certification area) will not be reviewed.

The project writeup should include such information as:

- 1. type of project (urban or rural: interstate, primary, secondary, local);**
- 2. size of project (length of project, project time period, dates of your involvement);**
- 3. your supervisory responsibilities and/or on-site authority on the project; and**
- 4. the range of your experiences on each project as related to such components as recordkeeping, paving, drainage, landscaping, roadside hardware, structures, new construction, rehabilitation, etc.. If all of these components cannot be documented for a single project, they may be accumulated via several more narrowly focused, but concurrent, projects.**

Your writeup must address the Level IV requirement that your level of responsibility demonstrates independent senior engineering technician work, including delegated responsibilities and duties for which engineering precedent exists. The pertinent work experience must be described in depth by you personally -- official job descriptions or testimonials from others will not be evaluated.

EARLY TESTING OF LEVEL IV WORK ELEMENTS

Although we permit testing of Level IV work elements prior to satisfying the work experience requirement, we reserve the right to question the validity of Level IV work elements passed by, and verified for, persons with little work experience. If, for example, a technician with a total of 3 years of experience passes Level IV work elements, we may require documentation of how this higher level knowledge was obtained without accumulating the requisite work experience. NICET may require specific work elements to be tested and passed again, at the candidate's expense, at the time of the Level IV certification decision.

In addition, we reserve the right to require reverification of work elements designated for meeting the Level IV examination requirement if the verifications were signed more than three years prior to the time of the Level IV certification decision.

PREPARATION FOR TESTING

Since the NICET written exams are designed for individuals who have already performed the work elements associated with the program on a routine basis, it is anticipated that preparation for these exams should be minimal.

SUPPORT MATERIALS FOR TESTING

Our exams are "open-book"; therefore bringing standards, references, or textbooks to the exam session is permitted (and encouraged). When appropriate, the work element descriptions are rather specific in mentioning applicable standards or procedures.

When work elements are keyed directly to specific industry-wide standards, they will be identified by a normally-used notation at the end of the work element description. For testing purposes, the current version of standards shall be the most recently published edition, provided that edition was published **at least one year prior to the exam date**.

Additionally, when a specific publication is used as an authoritative source in writing the work element questions, the title will be listed at the end of the work element. Refer to the "Selected General References" in this manual for publisher information.

EXPIRATION OF CERTIFICATE

The first certificate(s) awarded to all new NICET certificants will be given an expiration date of three years from the date of award. The certificate(s) will expire at the end of that three-year period unless renewed through recertification.

Upgrading the certificate or adding a certificate in a different technical area does not change your 3-year expiration date. A certificate which is not renewed at the end of three-year period will expire. A consequence of the certificate going into Expired Status will be deletion of all records, including test history.

PAYMENT OF REGISTRY FEE

During the first 3-year certification period, each certificant will be mailed 2 registry invoices -- at the end of year 1 and at the end of year 2. If both invoices are not paid within the prescribed time period, the certification(s) will become delinquent. Certifications in Delinquent Status are not published in the NICET Directory nor are they listed in the NICET Registry. Individuals who are in Delinquent Status will not be mailed the NICET Newsletter until all fees are paid.

Payment of an exam fee does not substitute for payment of the registry fee. The registry fee is only due during the first 3 years of certification. After that period, only the recertification application fee is due.

RECERTIFICATION POLICY

All certificants should read Policy #30, "Continuing Professional Development." At the end of each 3-year period, all certificants must demonstrate that they have accumulated sufficient Continuing Professional Development (CPD) points within the certification area(s) held to renew the certificate(s) for another 3 years. Once renewed, the certificate is valid for an additional three-year period. The recertification fee must be paid when submitting the recertification application form.

WORK ELEMENT LISTING

Highway Construction

LEVEL I - GENERAL WORK ELEMENTS

(Work at Level I Should Be Performed Under Direct Supervision)

ID # Work Element Title and Description

CORE WORK ELEMENT (See Note 1)

11006^ BASIC METRIC UNITS AND CONVERSIONS
Understand basic metric (SI) units and perform conversions to and from metric units (E-380).

NON-CORE WORK ELEMENTS

- 11001 BASIC SAMPLING AND FIELD TESTING OF MATERIALS
Collect samples in field as directed or per standard practices. Identify samples. Place in containers or protect for laboratory analyses. Preserve "in situ" conditions as required by specifications or by ASTM or AASHTO. Perform basic field control tests to determine density, grading, moisture content, and depth of materials. Determine air entrainment percentage of PC concrete and basic characteristics of bituminous mixtures (temperature, etc.), or other materials used in construction.
- 11002* BASIC SURVEYING
Perform basic surveying, including rodman and chainman duties to required precision. Make corrections for temperature, tension, etc. Reduce and check field book notes of simple survey to detect possible errors. Use approved procedures to correct and compute needed information. Determine, plot and check basic cross sections from field book notes. Proofread computer printout of earthwork computations (if applicable).
- 11003* SIMPLE PLANS AND SPECIFICATIONS
Use simple plans and specifications to determine dimensions, types of materials, elevations, slopes, densities, locations and other information for inspection of work items during and after construction.
- 11004* TOPOGRAPHIC MAPS
Determine ground distances and areas from maps. Determine elevations and differences of elevations and slopes. Determine direction of drainage from maps.
- 11005^ BASIC MATHEMATICS
Solve mathematical problems requiring simple addition, subtraction, multiplication, and division and raising numbers to exponential powers. Round to the correct number of significant figures, calculate percentages, read graphs, and use simple geometric definitions and formulas. (See general math textbooks.)
- 11007^ BASIC COMMUNICATIONS
Use proper punctuation, vocabulary, spelling, and sentence structure. Follow written instructions. (See basic grammar references.)
- 11008^ BASIC PHYSICAL SCIENCE
Apply terms, definitions, and concepts from mechanics, electricity, heat, and chemistry. (Solutions may involve simple formulas found in basic physics texts, but will not involve algebraic manipulation or trigonometry.)

Note 1: General work elements can be categorized as either Core or Non-Core. Work element #11006, "Basic Metric Units and Conversions" is **mandatory** for certification at Levels II, III and IV. It is the **only** Core work element in this program at this time.

General Note: See "Selected General References" page in this manual for information on listed publications.

(^) Generic crossover credit exists in other fields/subfields for this work element. Read information on crossover work elements on pgs. 4 and 5.

(*) Crossover credit exists in selected other fields/subfields for this work element. Read information on crossover work elements on pgs. 4 and 5.

LEVEL I - SPECIAL WORK ELEMENTS

- 12001* **BASE AND SUBBASE MATERIALS**
Determine quantities of base and subbase materials delivered to site. Assure placement as required by specifications and compaction in manner specified in lift depths as approved. Check shaping by eye or straight-edge. Record findings.
- 12002 **CLEARING AND GRUBBING**
Observe clearing and grubbing work to be sure that "save" items are not disturbed, that removals are complete and that work is completed within specified limits. Record findings.
- 12003* **BACKFILLING**
Observe backfilling to assure use of proper materials, moisture content, lift depths and compaction methods. Assure compliance with final grade requirements. Report on quantities of materials used and compliance with specifications on all operations. Assure protection of buried materials to avoid perforation or collapsing of pipes, tanks, etc. Record findings.
- 12004* **FENCING**
Inspect to assure construction as staked out. Check type of fencing used, compliance with specifications for setting of posts, corners, gates, and bracing. Check alignment and work to assure quality. Record findings.
- 12005* **MEDIAN BARRIERS AND GUARDRAILS**
Inspect to assure compliance with specifications, plans and staking. Verify materials used, workmanship, curing (if necessary), and cleanup. Check alignment and grade for compliance with requirements relative to surface tolerance, etc. Record findings.
- 12006 **STRUCTURAL PAINTING**
Inspect to assure compliance with plans and specifications on materials used, application to clean bright surfaces, temperatures of air & surfaces, number of coats, drying time, and complete coverage. Check coating thickness using thickness gauge, and check final appearance. Record findings.
- 12007 **PROTECTIVE TREATMENT OF CONCRETE STRUCTURES**
Inspect to assure compliance with plans and specifications on materials used, application to sound surfaces, proper time of application for maximum effectiveness, temperatures of air and surfaces, drying time and complete coverage. Check on final appearance and quality of work. Record findings.
- 12008 **PROTECTIVE TREATMENT OF CONCRETE PAVEMENT**
Inspect to assure compliance with plans and specifications regarding materials used, application to sound surfaces at proper time to assure maximum effectiveness, rate of application, temperature of air and surfaces, drying and absorption time and complete coverage. Check on final appearance and quality of work. Record findings.
- 12009 **SIMPLE DRAINAGE STRUCTURES**
Inspect to assure use of pipes or approved materials in compliance with size and type specified. Check for identifying marks such as heat numbers or departmental stamps. Assure proper and uniform bedding of structures; proper depth and compaction of backfill and cover; proper slope, approaches and outfall of conduits; and proper construction of headwalls and wingwalls. Check on final appearance and quality of work. Record findings.
- 12010 **AGGREGATE SURFACING**
Inspect to assure compliance with plans and specifications on materials used, depth and compaction of lifts, moisture content at time of placement, uniformity and quality of finish, grading and preservation of drainage and erosion control provisions. Check on final appearance and quality of work and keep proper records of quantities. Record findings.

LEVEL II - GENERAL WORK ELEMENTS

(Work at Level II Is Performed Under General Supervision)

- 13001 **STANDARD SAMPLING AND FIELD TESTING OF MATERIALS**
Assure compliance with specifications through actual performance of field tests on portland cement, concrete, bituminous mixtures, and aggregates using standard methods established by AASHTO, ASTM or other agency and adopted by authority under which work is being performed. If sampling is performed for delivery to lab, assure recording of sample locations and proper preparation for delivery. Read and record test results and deliver reports to proper authority for evaluation and project files.
- 13002* **STANDARD CONSTRUCTION SURVEYING**
Perform standard construction surveying, including instrumentman duties. Select appropriate instrument, set up and adjust instrument properly, make and record readings or oversee recorder. Set up field book columns properly; check notes; include all necessary information; correct notes in legal manner in accordance with good practice. Make math checks and balance readings. Confirm staking of ROW per plans and specifications. Provide adequate stakes and monuments. Check with ROW maps. Reduce and check field book notes of standard surveys. Determine, plot and check standard cross sections from field book notes. Compute and balance cut and fill and compute overhaul. Make corrections in approved manner, if required.
- 13003* **STANDARD PLANS AND SPECIFICATIONS**
Use plans and specifications of standard jobs to determine dimensions, types of materials, elevations, slopes, densities, locations and other information. Calculate required information from dimensions, curves, angles and other data on plans and specifications. Utilize designated tech manuals, charts and tables referenced in plans and specifications.
- 13004^ **BASIC INDIVIDUAL SAFETY REQUIREMENTS**
Follow standard safety practices in performing job tasks. Recognize and call attention to improper safety practices at the work site. (OSHA 2202)
- 13005* **TRAFFIC CONTROLS**
Know basic requirements of traffic safety during construction. Practice required controls of traffic and work force during a simple construction project (see MUTCD-Part VI). Assure adequate signs, signals, marking and protective equipment on job. Keep traffic moving safely in effective manner with no danger to work force or to motorists, pedestrians or bystanders. Enforce rigid controls during use of explosives.
- 13006^ **FIRST AID PROCEDURES**
Understand the basic rules and procedures of first aid. (See general handbooks on first aid.)
- 13007* **COMPUTE AND RECORD AREAS, VOLUMES AND COST EXTENSIONS**
Perform math computations to determine areas and volumes of work items. Determine volumes of trucks (loose and compacted or in-place volumes and weights or densities). Compute costs from unit prices.
- 13008^ **INTERMEDIATE MATHEMATICS**
Perform mathematical calculations using basic algebra (fundamental laws, algebraic expressions), geometry, and the trigonometric functions of right triangles. (See basic textbooks on algebra and trigonometry.)

LEVEL II - SPECIAL WORK ELEMENTS

- 14001* **RIGID PAVEMENTS**
Inspect to assure that base upon which pavement is placed complies with plans and specifications. Run portland cement concrete trial mix and adjust for moisture in aggregate stockpile. Assure proper rotation rate of mixer and mixing time. Assure adequacy of forms or slip forming methods, and verify alignment, grade and cross-section. Check placement of reinforcing, dowels and joint materials. Assure proper surface finishing, curing, surface treatment and cleanup. Check and report on final appearance and compliance with plans and specifications. Provide accurate quantity records.
- 14002* **FLEXIBLE PAVEMENTS**
Inspect to assure that base upon which pavement is placed complies with plans and specifications. Adjust prime and tack coat application to provide optimum cover. Adjust application of asphalt and aggregate in chip seals. Assure proper texture, surface, tolerance, thickness and density of ACHM base and surface courses. Check design and control of asphalt mix to assure compliance with specifications. Run extraction and gradation tests; verify temperature at time of placement; verify lift thickness, grade, cross-section, rolling methods, finishing and cleanup. Provide accurate records of quantities placed.
- 14003* **DETOURS AND TEMPORARY ROADS**
Inspect to assure that temporary roads comply with plans and specifications regarding location, alignment, type, width and grade. Check detours to assure adequacy and safety of signing and/or signalling and special provisions for peak traffic and work periods. Maintain appropriate records.
- 14004* **LANDSCAPING AND SLOPE PROTECTION**
Inspect to assure proper preparation of soils for seeding, sodding or planting; proper slopes and drainage provisions; use of specified fertilizer, seeds or plants; installation of required supports or protection. Record areas covered, plants placed, etc. Assure cleanup and provision for watering to establish growth as specified.
- 14005 **TOPSOIL REMOVAL, DEMOLITION AND CLEARING**
Inspect to assure proper separation of topsoil and stockpiling or use; safety practices during demolition; selection of proper demolition items; preservation of features to be retained; and cleanup. Check and report final grades; areas completed; and final appearance of job.
- 14006 **FINAL PROJECT CLEANUP**
Assure compliance with plans and specs on final appearance of job; removal of waste items to properly designated disposal sites; dust control; compliance with environmental standards; and safety to workforce and public.
- 14007 **SURFACE TOLERANCES**
Use approved straight-edging equipment to assure compliance with plans and specifications on surfaces requiring adherence to specified standards.
- 14008 **SMALL BUILDINGS**
Inspect to assure compliance with plans and specifications concerning dimensions of structure and materials used; quality of materials and workmanship by crafts on job; adherence to tolerances and clearances; use of licensed craftsmen as required by laws, plans or specifications; grading around structure to provide drainage with erosion control; and backfilling and compaction as required. Record findings.
- 14009 **PILES**
Inspect to assure placement and batter of piles according to plans and specifications; including proper vertical alignment, hammer selection, penetration, bearing, load testing, and splicing. Record tests observed and indicate types of piles, tip elevations and cut-off elevations.
- 14010 **GUARDRAILS AND/OR MEDIAN BARRIERS**
Inspect to assure compliance with plans and specifications concerning materials used; alignment; length; setting of posts, braces and anchors; end protection; glare shields; finishing and cleanup. Check and report on final appearance.

(continued)

- 14011 **STRUCTURAL MATERIALS AND MEMBERS**
 Inspect to assure compliance with plans, specifications and AASHTO or ASTM standards for materials and structural members. Determine adequacy and completeness of shop inspection reports and certificates. Cross-reference standards as required and utilize certificates in project files.
- 14012* **CULVERTS**
 Inspect to assure compliance with plans and specifications on sizing and materials used on culverts; bedding; backfilling (to include lift depths, methods and protection of culverts from damage); cover; approach and outfall slopes; headwalls and wingwalls; finishing and cleanup. Check and report on final work.
- 14013* **TRAFFIC CONTROL DEVICES**
 Inspect to assure compliance with plans and specifications on material delivered for installation (manufacturers' certificates, model numbers, dimensions, hookup hardware and wiring, etc.); locations of installations; work of installers; adequacy of mounting; breakaway requirements of standards; clearances from traffic and pedestrians; painting; etc. Report on final project and include certificates and guarantees in project file.
- 14014 **FINAL MEASUREMENT/RIGID PAVEMENTS**
 Verify all materials and other line item costs included on job. Perform cost extension calculations as required and verify allowable costs. Check inspection reports to be sure work was performed in full compliance with plans and specifications and calculate cost changes due to variances.
- 14015 **FINAL MEASUREMENT/FLEXIBLE PAVEMENTS**
 Same as 14014.
- 14016 **FINAL MEASUREMENT/SMALL BUILDINGS**
 Same as 14014.
- 14017 **FINAL MEASUREMENT/PILES**
 Same as 14014.
- 14018 **FINAL MEASUREMENT/GUARDRAILS AND/OR MEDIAN BARRIERS**
 Same as 14014.
- 14019 **FINAL MEASUREMENT/LANDSCAPING AND SLOPE PROTECTION**
 Same as 14014.
- 14020 **FINAL MEASUREMENT/TOPSOIL REMOVAL, DEMOLITION AND CLEARING**
 Same as 14014.
- 14021 **FINAL MEASUREMENT/CULVERTS AND/OR MINOR DRAINAGE STRUCTURES**
 Same as 14014.
- 14022 **FINAL MEASUREMENT/TRAFFIC CONTROL DEVICES**
 Same as 14014.
- 14023 **OFFICE CHECKS OF AS-BUILT PLANS**
 Verify completion and adequacy of as-built inspection and posting. Confirm certification of dimensions, workmanship and materials by authorized inspector or engineer. Assure conformance to standards or acceptability of modifications to original plans. Obtain engineer sign-off and transmit to files.
- 14024 **OFFICE CHECKS OF PAYROLLS**
 Verify completeness of payrolls and job classifications by checks with project engineer and/or inspectors. Check wages and fringes and insurance payments against Davis Bacon or other requirements. Compute extensions to check accuracy. Include checked payrolls in project files or transmit as required.
- 14025 **OFFICE CHECKS OF MATERIALS**
 Collect certificates on materials inspections (shop, plant and field) and on load or volume counts to assure all required items are covered. Check to be sure that specifications were met and that quantities claimed are accurate and actually received or included in construction. Compute cost extensions from contract unit prices. Include in proper files.

LEVEL III - GENERAL WORK ELEMENTS

- 15001 **MATERIALS TESTING IN FIELD**
Perform, supervise, and coordinate material testing in the field to assure compliance with plans and specifications pertaining to soils, aggregates, portland cement concrete mixes, bituminous mixes, subgrades, bases, structural members, etc. by application of required field tests or by collection, preparation and transmittal of samples to designated laboratories. Verify adequacy of number of samples and locations at which samples are collected to assure representative coverage of sites. Verify use of appropriate, properly calibrated testing equipment. Record the determinations and certificates properly and see that they get to the designated persons.
- 15002* **CONSTRUCTION SURVEYS**
Perform, supervise and coordinate construction surveys to assure compliance with plans and specifications by accurate use of surveys. Act as chief of party. Layout and stake job in accordance with plans and specifications, including drainage, grade, line, earth work, curbs and gutters. Place sufficient stakes to permit accurate work and in locations that will not be knocked down. Use and care for survey instruments and EDM instruments properly; utilize crew effectively; read angles and distances to designated precision; oversee recording in professional manner; check accuracy of notes. Prepare as-built reports and quantity surveys. Verify dimensions and volumes by trigonometric and quantity survey methods. (Example: Determine quantities removed from borrow pits.)
- 15003* **COMPLEX PLANS AND SPECIFICATIONS**
Use complex plans and specifications to assure compliance during and after construction with intent and quality of project. Use plans and specifications to plan inspection program and check stake-outs and preliminary work.
- 15004* **OSHA AND OTHER SAFETY REQUIREMENTS**
Assure compliance with OSHA, organizational, state and local safety requirements. Recognize violations and report violations to project engineer. (OSHA 2207)
- 15005* **FIRST AID AND EMERGENCY SERVICES**
Assure availability of adequate first aid material suited to the type of project and number of persons involved. Set up cyclic review of material to assure continuing availability. Provide means to transport injured persons safely to ambulance pick-up point and arrange for availability of emergency ambulance and hospital service.
- 15006* **TRAFFIC CONTROLS AND DETOURS**
Provide adequate measures to protect workers and the public during all phases of a project. Coordinate activities with other offices and agencies as required. Arrange in advance for detours and traffic maintenance procedures.
- 15007* **COMPLIANCE WITH GOVERNMENTAL PROGRAMS**
Know requirements of federal, state, and local programs (EEO, OJT, Davis-Bacon, Environmental, etc.) and assure compliance on-the-job by scheduled and non-scheduled inspections. Work with contractors, municipalities, other agencies, etc. to set up a workable system of inspection and verification.
- 15008* **ACTIVITY COORDINATION**
Disseminate pertinent information to appropriate groups (utilities, local governments, and citizen interest groups). Arrange work schedules to permit effective accomplishment of work by others. Assure compliance with laws and regulations in area of job. Advise local community and citizens of methods to deal with problems and/or grievances.
- 15009 **BASIC EROSION CONTROLS**
Assure compliance with requirements for controlling erosion and sedimentation during construction.
- 15010 **QUANTITIES AND COSTS OF LINE ITEMS**
Check and verify compliance with plans, specifications and contractual requirements by performing necessary visual and data checks by computing necessary information.

(continued)

15011 STEEL AND CONCRETE STRUCTURES

Inspect and record steel and concrete structures to assure compliance with plans and specifications by verification of the following activities: staking and layout (as required by contract) to assure proper line, grade and dimensions on structure during work and after completion; forming, curing, stripping and finishing concrete structures (in all weather); placement of reinforcing steel for concrete structures; erection and safe removal of falsework for steel structures; and fastenings and seating on steel structures. Check work against appropriate AASHTO, ASTM, and manufacturers' specifications and verify quality of workmanship. Record work and place in files as required.

15012^ BUSINESS COMMUNICATIONS

Use the rules of syntax and style to write clear sentences and paragraphs in preparing routine correspondence and reports. Follow standard business communications procedures. (See basic grammar and writing handbooks.)

15013* MATERIALS AND EQUIPMENT ACCOUNTABILITY

Implement and enforce effective equipment and materials procedures. Comply with requirements for completing property records which are current and reflect location, condition and use of equipment and instruments. Assure proper control of instruments, equipment and supplies. Investigate loss or damage of equipment or instruments and complete necessary report forms.

LEVEL III - SPECIAL WORK ELEMENTS

- 16001 **CONSTRUCTION OF CONCRETE STRUCTURES**
Assure compliance with plans, specifications and safety requirements by supervision, inspection, and recording of the following activities: staking and layout; erection and removal of temporary supports or bracing (verify compliance with standard requirements before permitting forms or braces to be stripped and assure placement of concrete under safe conditions and in temperatures permitted within specifications); forming, curing, stripping, finishing and treating concrete; placing, fastening and covering of reinforcing steel, dowels and joint materials; and conformance to final line, grade, and dimensions. Use correct courses of action to bring errors or inaccuracies to attention of appropriate persons. Prepare complete and accurate reports on proper forms to reflect work accomplished.
- 16002 **CONSTRUCTION OF STEEL STRUCTURES**
Assure compliance with plans, specifications and safety requirements by supervision, inspection and recording of the following activities: staking and layout; erection and removal of falsework; placing, fastening and seating members; conformance to final line, grade, and dimensions. Inspect all structural steel members for proper size, shape and fit. Have working knowledge of radiographic and magnetic particle weld inspection. Check all beams for camber sweep and bearing points. Utilize correct course of action to bring errors or inaccuracies to attention of appropriate persons. Prepare complete and accurate reports on proper forms to reflect work accomplished.
- 16003 **CONSTRUCTION OF COMPOSITE STRUCTURES**
Assure compliance with plans, specifications and safety requirements by supervision, inspection, and recording of the following activities: staking and layout; erection and removal of temporary supports, bracing, or falsework; placing, fastening and seating steel members; forming, curing, stripping, finishing and treating concrete; placing, fastening and covering of reinforcing steel, joint materials and dowels in concrete; and conformance to final line, grade, and dimensions. Utilize correct courses of action to bring errors or inaccuracies to attention of proper persons. Prepare complete and accurate reports on proper forms to reflect work accomplished. Composite structures require a combination of the activities noted in Work Elements 16001 and 16002.
- 16004 **MAJOR PAVING PROJECT**
Compile all reports; verify necessary certificates, shop inspection reports, progress payments and payrolls; and consolidate claims and decisions and furnish all background information concerning possible future claims. Prepare final project report in conformance with required forms; submit to proper authority for review, approval and filing, as necessary.
- 16005 **MAJOR STRUCTURAL PROJECT**
Same as 16004.
- 16006 **REST AREA WITH SANITARY FACILITIES**
Same as 16004.
- 16007 **MAJOR GRADING AND DRAINAGE PROJECT**
Same as 16004.
- 16008 **MAJOR SAFETY IMPROVEMENT PROGRAM**
Same as 16004.
- 16009 **BASIC COST ANALYSIS DATA FOR CONTRACT CHANGES**
Obtain cost data from contractors, manuals and from previous contracts to determine unit prices. Apply factors to recognize conditions and prepare cost analyses of proposed contract changes for review and approval by engineer.
- 16010 **OJT TRAINING PROGRAMS**
Plan and conduct OJT in any of the technical fields covered in this career field.

LEVEL IV - GENERAL WORK ELEMENTS

NOTE: Certification at Level IV requires that the candidate must have occupied a senior-level position of responsibility throughout the duration of one major, comprehensive highway construction project. There are no exceptions to this requirement and documentation must be present in the work history listed on the application form.

- 17001 MAJOR CONSTRUCTION PROJECT
Act as chief inspector or assistant to project engineer on all aspects of a major construction project for at least one season in duration. Supervise inspectors, survey parties, soils and materials samplers and testers, and other technicians and workers on job. Assure full compliance with plans, specifications and contract provisions. Supervise and coordinate safety and traffic movement. Supervise submittal of required reports, certificates, payrolls, etc., and maintain project files in good order. Keep current records of work to permit ready preparation of as-built plans and records. Have all data in shape to permit acceptance of job by designated authority.
- 17002* EXTERNAL WORKING RELATIONS
Establish effective and safe working relations with contractors, sub-contractors, suppliers, consultants, utility companies, government agencies, municipalities, property owners, design personnel and the public.
- 17003 REGULATORY REQUIREMENTS
Knowledge of, and on-the-job implementation of OSHA, EEO, OJT, environmental protection, erosion control, traffic maintenance and Davis-Bacon laws and application of management and judgmental factors in bringing projects to successful completion.
- 17004 EQUIPMENT REPORTS
Utilize designated forms (or in absence of forms, establish effective reporting system) to assure effective and economical utilization of equipment in good operating order. Assure required cyclic maintenance, lubrication and fuel availability.
- 17005 AC AND PC CONCRETE MIX DESIGN
Know design of portland cement and bituminous concrete mixes that fit the specialized criteria for various types of service using aggregates, additives and cold or hot weather provisions to fit required conditions. Understand influence of cost and availability of local materials.
- 17006 STRUCTURAL STEEL SHOP INSPECTION
Comply with plans and specifications by review of certificates from manufacturers, fabricators, private laboratories of inspectors representing using agency. Verify size, type of steel, weld quality, fastening data, etc. If possible, perform shop inspection.
- 17007 ALTERATIONS TO DESIGN
Review plans and specifications to determine applicability to specific jobs. Recognize design deficiencies and/or mistakes or changed conditions in plans and specifications; analyze needs of job to determine appropriate corrective action, and to prepare detailed recommendations for delivery to appropriate authority.
- 17008 CHANGE ORDERS
Gather information from subordinates or from personal inspection and review. Prepare, in final format, complete contract change order with clear justifications and cost estimates for approval of a contracting officer.
- 17009 SPECIAL TRAINING NEEDS
Use experience and knowledge of performance factors to determine performance of subordinates. Evaluate need for training programs to increase the skills of workers performing special duties. If program is needed, get approval; select subject matter; recruit and supervise instructors; and work with instructor on course program. Evaluate OJT and other training programs.
- 17010^ TECHNICAL PRESENTATIONS AND REPORTS
Organize and deliver oral presentations and prepare detailed technical reports and correspondence.

PERSONAL TALLY SHEET

PASSED WORK ELEMENTS IN HIGHWAY CONSTRUCTION

- o Put a checkmark next to the appropriate work element number when you receive a passing score on your Examination Score Report.
- o Put a "C" next to the appropriate work element number if you have crossover credit from another subfield. Read pages 4 and 5 in this manual concerning crossover credit.

Level I General	Level II General	Level II Special	Level III General	Level III Special	Level IV General
_11001	_13001	_14001	_15001	_16001	_17001
_11002	_13002	_14002	_15002	_16002	_17002
_11003	_13003	_14003	_15003	_16003	_17003
_11004	_13004	_14004	_15004	_16004	_17004
_11005	_13005	_14005	_15005	_16005	_17005
_11006**	_13006	_14006	_15006	_16006	_17006
_11007	_13007	_14007	_15007	_16007	_17007
_11008	_13008	_14008	_15008	_16008	_17008
		_14009	_15009	_16009	_17009
		_14010	_15010	_16010	_17010
		_14011	_15011		
		_14012	_15012		
		_14013	_15013		
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		_14016			
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		_14019			
		_14020			
		_14021			
		_14022			
		_14023			
		_14024			
		_14025			
Level I Special					
_12001					
_12002					
_12003					
_12004					
_12005					
_12006					
_12007					
_12008					
_12009					
_12010					

****This is a Core Work Element and is mandatory for achieving certification at Levels II, III and IV.**

SELECTED GENERAL REFERENCES*

Annual Book of ASTM Standards. American Society for Testing and Materials. Philadelphia, Pennsylvania.

Construction Industry Standards (29 CFR/1926, OSHA 2207). U.S. Department of Labor. Washington, D.C.

Guide Specifications for Highway Construction. American Association of State Highway and Transportation Officials. Washington, D.C.

Manual on Uniform Traffic Control Devices for Streets and Highways. Federal Highway Administration. U.S. Department of Transportation. Washington, D.C.

Standard First Aid and Personal Safety. American Red Cross. Washington, D.C.

Standard Specifications for Transportation Materials and Methods of Sampling and Testing. American Association of State Highway and Transportation Officials. Washington, D.C.

*This listing is not intended to be complete or representative.



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EXAMINATION SCORE REPORT

SAMPLE

Exam No. 99999
Examinee: JOHN EXAMINE

Test Date: 06/17/97
Report Date: 07/11/97

Work Element Number and Title	Score (%)	Pass/Fail
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HIGHWAY CONSTRUCTION

1011001 Basic Sampling and Field Testing of Materials	75.00	P
1011002 Simple Plans and Specifications	80.00	P
1011004 Topographic Maps	35.00	F*
1011005 Basic Mathematics	65.00	P
1011006 Basic Metric Units and Conversions	20.00	F**
1012004 Fencing	90.00	P
1012006 Structural Painting	0.00	F***

* This failed work element cannot be retested prior to 120 days after the test date shown on this score report.

** This is your second failure for this work element. It cannot be retested prior to 120 days after the test date shown on this score report.

*** This is your third failure for this work element. A request to retest it will not be considered until you have complied with NICET Policy #20.

JOHN DOE
1420 King Street
Alexandria, Virginia 22314-2714