



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

Transportation Engineering Technology  
**HIGHWAY MATERIALS**

**PROGRAM DETAIL MANUAL**

Please check NICET's web site ([www.nicet.org](http://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: 08

Fifth Edition (Reprint)  
March 2009

## IMPORTANT

The Institute occasionally makes changes in its certification programs which 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

**Keep your  
manuals  
current**

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 March 2009.

It is the applicant's responsibility to make sure she/he is using a current manual.

The fifth edition contained two changes from the 4th edition (12/94): updated AASHTO and ASTM references to in the work element listing; and the addition of Level I Special work element 82025. (There were no changes to the examination requirements from the 4th edition.)

The 2005 Reprint included additional ACI information.

The March 2009 Reprint corrected information about the availability of work element 82025 and updated information about testing materials, training organizations, and NICET Policy 20.

### **Deletion of Test Records**

All test records for an individual certification area will be purged from the database after 5 years if no further testing is done in that certification area and you are not certified in that certification area. See Policy #26 on our website ([www.nicet.org](http://www.nicet.org)).

# FIELD OF TRANSPORTATION ENGINEERING TECHNOLOGY

## SUBFIELD OF HIGHWAY MATERIALS

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## **GENERAL INFORMATION**

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

This manual does not contain all of the rules and procedures for obtaining certification. For this, you must refer to our Website ([www.nicet.org](http://www.nicet.org)).

**National Institute for Certification  
in Engineering Technologies (NICET)  
1420 King Street, Alexandria, Virginia 22314-2794  
1-888-476-4238 (staff response - 9am to 4pm Eastern Time)  
(voice mail system at all other times)  
1-703-548-1518 (local number)  
www.nicet.org**

## **PROGRAM DESCRIPTION**

This certification program is for highway technicians involved in laboratory and field testing of highway materials such as aggregates, asphalts, concrete, soils, paints, and metals. This program addresses knowledge of techniques and equipment; recordkeeping and reporting procedures pertaining to materials and quality control; 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 materials 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.

## **CERTIFICATION REQUIREMENTS**

Certification candidates must meet the following criteria:

- ◆ complete the written examination requirement
- ◆ work element verification by the immediate supervisor
- ◆ appropriate employment history
- ◆ technician recommendation by an acceptable recommender (required at Levels III and IV)

Simply passing the examination does not guarantee certification. All other components **MUST** be accepted and approved in order to achieve certification.

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 4 lists the actual examination requirements for certification at Levels I, II, III, and IV in the subfield of Highway Materials.



## WORK ELEMENT SELECTION

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 #81007 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. 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.
7. 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.
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.
9. 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 four months from the last time you failed it before you will be permitted to test that element again. Candidates are limited to testing a work element up to three times within any two-year span. For further information, read Policy #20 ("Retesting of Failed Work Elements") on our website ([www.nicet.org](http://www.nicet.org)).

# EXAMINATION REQUIREMENTS CHART

## (Subfield: Highway Materials)

You must pass the number of work elements shown in each category to achieve certification at that level.

You must pass this many work elements to achieve certification at Level I

Level I - General - 5
Level I - Special - <u>5</u>
TOTAL      10

You must pass this many work elements to achieve certification at Level II

Level I - General - 5a
Level I - Special - 12
Level II - General - 7
Level II - Special - <u>8</u>
TOTAL      32

You must pass this many work elements to achieve certification at Level III  
**Note (b)**

Level I - General - 5a
Level I - Special - 12
Level II - General - 7
Level II - Special - 20
Level III - General - 2
Level III - Special - <u>14</u>
TOTAL      60

You must pass this many work elements to achieve certification at Level IV  
**Notes (b) and (c)**

Level I - General - 5a
Level I - Special - 12
Level II - General - 7
Level II - Special - 20
Level III - General - 2
Level III - Special - 31
Level IV - General - <u>2</u>
TOTAL      79

**NOTES:**

- (a) Work Element #81007, "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 to keep track of the number of work elements you have passed.

## **CREDIT FOR ACI CERTIFICATION**

Technicians who have current technician certification from the American Concrete Institute in select specialty areas will be exempted from meeting the NICET written examination requirement (and possibly the verification requirement) for selected work elements. Details are provided below. To receive credit for these work elements, you must send to NICET a photocopy of the front and back of your current ACI wallet card. Candidates holding ACI certification should turn to the Personal Tally Worksheet (found towards the back of this manual) and mark an "A" next to the work element numbers below from which they are exempted.

### **Concrete Field Testing Technician - Grade I**

**You are exempt from testing and verifying:**

82019 Level I Special  
82020 Level I Special  
82025 Level I Special  
84068 Level II Special  
84069 Level II Special  
84070 Level II Special  
84076 Level II Special

### **Concrete Laboratory Testing Technician - Grade I**

**You are exempt from testing and verifying:**

82006 Level I Special  
82007 Level I Special  
82008 Level I Special  
82010 Level I Special  
83010 Level II General  
84034 Level II Special  
84036 Level II Special  
84072 Level II Special

### **Concrete Laboratory Testing Technician - Grade II**

**You are exempt from testing, but you must provide supervisor verification for the following:**

84033 Level II Special  
84035 Level II Special  
84037 Level II Special  
84039 Level II Special  
84073 Level II Special  
84078 Level II Special  
84077 Level II Special  
84083 Level II Special  
86061 Level III Special

(Continued)

**(Credit for ACI Certification, continued)**

**ACI Concrete Strength Testing Technician**

**You are exempt from testing and verifying:**

- 84072 Level II Special Compressive Strength of Cylinders
- 84078 Level II Special Third-Point Flexural Strength

**ACI Field Aggregate Testing Technician**

**You are exempt from testing and verifying:**

- 83010 Level I Special Sampling/Aggregates
- 82008 Level I Special Sieve Analysis/Aggregates
- 82006 Level I Special Materials Finer Than No. 200 Sieve
- 82010 Level I Special Total Moisture Content/Aggregates
- 84037 Level II Special Clay Lumps and Friable Particles
- 82015 Level II Special Test Sample (Soils) Preparation
- 84044 Level II Special Liquid and Plastic Limits (Soils)

**ACI Laboratory Aggregate Testing Technician**

**You are exempt from testing and verifying:**

- 82007 Level I Special Unit Weight/Aggregates
- 84033 Level II Special Aggregate Lightweight Pieces
- 84034 Level II Special Aggregate Specific Gravity and Absorption
- 84035\* Level II Special Aggregate Resistance to Abrasion
- 84036 Level II Special Organic Impurities in Concrete Sand
- 84039\* Level II Special Sulfate Test for Aggregate Soundness
- 84055 Level II Special Plastic Fines by Sand Equivalent Test (Soils)

**\* verification required**

## **CROSSOVER WORK ELEMENTS**

NICET "Crossover" work elements are identified as identical or nearly identical in topic coverage and test questions to work elements in other selected fields/subfields. Almost all NICET certification programs have "generic" crossover work elements covering communication skills, mathematics, physical science and other basic areas of knowledge. 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 as follows:

- **First Time Testing in New Subfield:** When you test work elements in 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 to previously tested subfields. This assignment of crossover credit will occur every time a new subfield is tested.
- **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.
- No crossover credit will be assigned to a subfield until you **test at least one work element** from that subfield.
- Crossover credit will not be assigned to or from work elements if the certification is in Delinquent or Expired Status.
- The four-month waiting period policy, which applies to, failed work elements also applies to all work elements that have crossover credit to that work element (see Policy #20).
- The following documents are available. Use the Decal and Personal Records Order Form on the Website.
  - **Personal Crossover Evaluation** lists your "potential" crossover credit to a designated **untested** subfield.
  - **Crossover Listing** lists all current crossovers between three specified subfields.
  - **Official Personal Transcript** lists all work elements presently credited to the examinee's testing record (including those passed on an exam and those achieved through crossover) for a designated subfield.

### **WARNING**

Revisions to certification programs can occasionally eliminate previous crossovers relationships or create new ones. Thus, crossover credit shown on the "Personal Crossover Evaluation" and on any "Crossover Listing" cannot be assumed to be permanent.

The Personal Crossover Evaluation is a "potential" list. Only when a new subfield is tested and the crossover credit is posted to the test record does it become permanent. The Official Personal Transcript shows the crossover credit actually awarded.

## **VERIFICATION OF WORK ELEMENTS**

Verification should be provided by your immediate supervisor. The verifier, by signing his or her initials, is indicating that you have actually performed **at least** the operations indicated in the work element description and that the verifier is confident that you have performed the specific job tasks **repeatedly and satisfactorily**. Exposure to a job task through demonstrations by others or through **partial involvement** should not be a basis for your supervisor to verify that the task can be performed correctly under a variety of conditions. Verification cannot be provided by a subordinate employee since this could be interpreted as a "conflict of interest."

### **WARNING**

***NICET takes 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 NICET determines 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. The NICET 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.

## **TECHNICIAN PERSONAL RECOMMENDATION**

A valid Technician Personal Recommendation form **MUST** be on file for the applicant before NICET can award certification at Level III. The recommendation is valid for one year from the date shown next to the recommender's signature.

The recommendation form is available on NICET's website. It must be completed by a person who is familiar with the applicant's technical capabilities and background.

## **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 practices.

## **LEVEL IV MAJOR PROJECT REQUIREMENT**

It must be understood that 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 involvement in a major project which is **directly related to the subfield in which Level IV certification is sought**. This major project must have taken place well into your career in the certification area. We will not review your project if you have less than 6 years of experience in the certification area.

The project you select for submission must be completed and it must be recent (started no more than four years prior to submission of the writeup). It must indicate that you had senior-level responsibility on the project and it must include a majority of the various activities usually associated with the certification area.

**The writeup on your highway materials project should include such information as:**

- 1. type of project (including testing and monitoring services performed);**
- 2. scope of project (project time period, amount of daily services performed);**
- 3. your supervisory responsibilities and/or laboratory or on-site authority on each project; and**
- 4. the range of your experiences on the project as related to such various components as recordkeeping, testing, inspection, observation, mixture design, quality control, etc. If all of these components cannot be documented for a single project, they may be accumulated via several narrowly-focused projects.**

**IF YOUR EXPERIENCE IS VERY NARROWLY FOCUSED ON MOST OF YOUR PROJECTS, YOU SHOULD DESCRIBE SEVERAL ASSIGNMENTS WHICH COLLECTIVELY CAN BE USED TO MEET THE EXPERIENCE REQUIREMENT.**

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 NICET does permit testing of Level IV work elements prior to satisfying the work experience requirement, the Institute reserves 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, NICET 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, NICET reserves 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**

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.

## **TRAINING COURSES**

NICET does not endorse, certify, or accredit training programs; any claims to that effect should be viewed with caution. NICET does, however, provide information on its certification procedures and objectives so that training courses can be developed specifically to help persons planning to take a NICET certification exam.

## **EXPIRATION OF CERTIFICATE**

The first certificate(s) awarded will have 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. A certificate that 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.

Upgrading the certificate or adding a certificate in a different technical area does not change your 3-year expiration date.

## **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 MATERIALS

### LEVEL I - GENERAL WORK ELEMENTS

(Work at Level I Is Performed Under Direct Supervision)

**ID #    Work Element Title and Description**

**CORE WORK ELEMENT (See Note 1)**

81007^ BASIC METRIC UNITS AND CONVERSIONS  
Perform conversions to and from basic metric (SI) units. (IEEE/ASTM SI 10)

**NON-CORE WORK ELEMENTS**

81001^ SIMPLE PLANS AND SPECS  
Use simple plans and specifications to determine material types and characteristics; sampling locations, spacings, depths; elevations, slopes, distances; testing requirements; etc.

81002\* STANDARD LAB EQUIPMENT  
Understand uses of commonly used equipment, devices, scales, ovens, moisture chambers, strain gauges, etc.

81003^ 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.)

81004 **WORK ELEMENT NO LONGER AVAILABLE FOR TESTING.** Credit retained if previously passed.

81005^ BASIC COMMUNICATION SKILLS  
Use proper punctuation, vocabulary, spelling, and sentence structure. Follow written instructions. (See basic grammar references.)

81006^ 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.)

81008^ FIRST AID PROCEDURES  
Understand the basic rules and procedures of first aid. (See general handbooks on first aid.)

**Note 1:** General work elements can be categorized as either Core or Non-Core. Work element #81007, "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 – page 7.

(\* ) Crossover credit exists in selected other fields/subfields for this work element. Read information on crossover work elements – page 7.

## **LEVEL I - SPECIAL WORK ELEMENTS**

### **MISCELLANEOUS**

- 82001\* TEXTURE DEPTH OF CONCRETE  
Measure texture depth of fresh or hardened portland cement concrete by use of a tire tread depth gauge. (T261)
- 82002 SHEET METAL AND WIRE SIZE DETERMINATION  
Use standard gauges to determine weight, thickness, and width of sheet metal and wire to assure compliance with established specs.
- 82003 ZINC-COATED CORRUGATED IRON OR STEEL CULVERTS  
Inspect and determine the physical measurements of underdrain pipe as required by standard specs. (M36)

### **HYDRAULIC CEMENT**

- 82004 SAMPLING HYDRAULIC CEMENT  
Know the correct procedures for sampling hydraulic cement. (T127, C183)
- 82005 FINENESS OF HYDRAULIC CEMENT  
Determine the fineness of hydraulic cement by the No. 100, No. 200, and No. 325 sieves. (T128, T192, C184, C430)

### **AGGREGATE**

- 82006\* MATERIALS FINER THAN NO. 200 SIEVE  
Use wash tests to determine the amount of material finer than a No. 200 sieve in mineral aggregates. (C117, T11)
- 82007\* UNIT WEIGHT/AGGREGATES  
Determine unit weight of and voids in a fine, coarse, or mixed aggregate sample. (T19, C29)
- 82008\* SIEVE ANALYSIS/AGGREGATES  
Determine and record the particle size distribution of fine and coarse aggregate by sieving or screening. (C136, T27)
- 82009\* WIRE CLOTH SIEVES  
Check wire-cloth sieves for conformance with requirements for such sieves. (E11, M92)
- 82010\* TOTAL MOISTURE CONTENT/AGGREGATES  
Determine the percentage of evaporative moisture in a sample of aggregate by drying. (T255, C566)
- 82011\* SIEVE ANALYSIS OF EXTRACTED AGGREGATE  
Determine the particle size distribution of fine and coarse aggregates extracted from bituminous mixtures, using sieves with square openings. (T30)

(LEVEL I - SPECIAL WORK ELEMENTS continued on the next page)

(LEVEL I - SPECIAL WORK ELEMENTS continued)

**SOILS**

82012 CORE TESTS

Participate in core drilling to secure intact samples of rock and/or soils for testing. Participate in drilling of cores from concrete structures (particularly pavement). Determine the length of the latter core. (C42, C174, T24, T148, T207, T225, D1587)

82013\* SOIL AND ROCK TERMINOLOGY

Understand standard definitions of terms relating to soils and rocks. (D653)

82014\* SOILS AND ROCKS

Perform soil and rock investigation and sampling for engineering purposes. (R13, D420)

82015\* TEST SAMPLE (SOIL) PREPARATION

Know the proper techniques for preparing soil samples for testing to include adequate sample size, splitting techniques, and moisture conditioning. (D421, D2217)

82016\* WASH TEST FOR SOILS

Use wash test to determine the amount finer than No. 200 sieve in a soil sample. (D1140)

82017\* SAMPLE HYDRATED LIME

Know the proper techniques for sampling hydrated lime. (T218)

82018 CALCIUM CARBIDE GAS

Determine the moisture content of soils by means of a calcium carbide gas pressure moisture tester. (T217)

**CONCRETE**

82019\* SAMPLE FRESH CONCRETE

Know the procedures for obtaining representative samples of fresh concrete delivered to a project site. (C172, T141)

82020\* SLUMP TEST

Determine the slump of concrete in the laboratory and in the field. (C143, T119)

82021\* CONCRETE AND CONCRETE AGGREGATE TERMINOLOGY

Understand standard definitions of terms relating to concrete and concrete aggregates as defined by ASTM. (C125)

82025 TEMPERATURE OF FRESH CONCRETE

Determine the temperature of freshly mixed portland cement concrete. Calibrate equipment. Report results. (C1064)

**ASPHALT**

82022\* SAMPLE BITUMINOUS MATERIALS

Sample liquid, semi-solid, or solid bituminous materials at the point of manufacture, supply terminal, or at the point of shipment delivery. (T40, T168, D140, D979)

82023\* SAMPLE CREOSOTE

Sample creosote. (T60)

82024 SAMPLE BITUMINOUS CONCRETE

Know the procedures for obtaining representative samples of bituminous concrete. (T168, D979)

## **LEVEL II - GENERAL WORK ELEMENTS**

(Work at Level II Is Performed under General Supervision)

- 83001<sup>^</sup> STANDARD PLANS AND SPECS  
Use plans and specs of standard jobs to determine dimensions, types of materials, elevations, slopes, depths at which samples are required, locations, spacing of sample sites, etc.
- 83002\* EQUIPMENT AND INSTRUMENTS  
Care for, clean, perform basic calibrations and safeguard standard lab and field equipment and instruments.
- 83003 LOCATE AND PLOT SAMPLE LOCATIONS  
Perform and understand simple planimetric surveys. Locate sample sites with regard to recognizable features. Draft simple plans and location diagrams in accordance with standard practice to permit clear understanding of sampling locations. Key work to topographic maps or plans used on projects.
- 83004\* SAMPLE IDENTIFICATION  
Identify samples properly in accordance with standard practices. Note and record information on samples and on plans. Map or log the site from which samples were obtained and the types of tests required to produce the desired information.
- 83005<sup>^</sup> 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.)
- 83006<sup>^</sup> 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.)
- 83007<sup>^</sup> INTERMEDIATE PHYSICAL SCIENCE  
Solve problems in mechanics, electricity, heat, and inorganic chemistry. (Solutions may involve algebra and trigonometry.)
- 83008 SAMPLING FOR FUTURE TESTING  
Know the proper methods to collect, identify, and store samples, retaining their characteristics, to be tested at a later date. (Refer to provisions in individual standards in AASHTO, Part II Tests, C192)
- 83009\* REAGENTS  
Know the reagents used for commonly performed field and lab tests. Know limitations on use of reagents and how results are affected.
- 83010\* SAMPLING/AGGREGATES  
Know field sampling procedures and prepare sample for testing. (T2, T248, D75, C702)
- 83011\* BASIC INDIVIDUAL SAFETY  
Follow standard safety practices in performing job tasks. Recognize and call attention to improper safety practices at the work site. (OSHA Parts 1910 and 1926)

## **LEVEL II - SPECIAL WORK ELEMENTS**

### **MISCELLANEOUS**

- 84001\* BRICK  
Sample and test brick for modulus of rupture, compressive strength, absorption, saturation coefficient, effect of freezing and thawing, initial rate of absorption, efflorescence, measurement of size, and measurement of warpage. (T32, C67)
- 84002\* PREFORMED EXPANSION JOINT FILLER  
Perform the tests to determine absorption, brittleness, distortion, expansion in boiling water, recovery, compression, extrusion, boiling in hydrochloric acid, weathering, and weight per cubic foot of preformed expansion joint filler for concrete. (T42, D1752, D545)
- 84003\* CONCRETE JOINT SEALERS  
Perform the tests to determine pour point, safe heating temperature, cone penetration, flow, and bond at low temperatures for all types of concrete joint sealers. (T187, D1191)
- 84004 pH TEST  
Determine pH of soils, water or construction materials (acidity or alkalinity). (T200, E70)
- 84005 COLLECT AND PRESERVE WATER  
Know the proper procedures for collection and preservation of water samples for testing. (T264)

### **METALS**

- 84006 LIQUID PENETRANT INSPECTION OF WELDS  
Investigate metals or welds for defects by use of liquid penetrating dyes. (E165)
- 84007 MAGNETIC PARTICLE INSPECTION OF WELDS  
Perform magnetic particle testing to determine defects in metal or welds. (E709)
- 84008 HARDNESS OF METALLIC MATERIALS  
Determine the hardness of metallic materials by the Brinell and/or Rockwell tests. (T70, T80, T244, E10, E18, A370)
- 84009 MECHANICAL TESTING OF STEEL PRODUCTS  
Determine the tensile strength, yield strength, yield point, percent elongation, and reduction in area of steel products. (T68, T244, E8, A370)
- 84010 WEIGHT OF COATINGS ON IRON  
Determine the weight (thickness) of zinc or aluminum coatings on iron or steel products. (T65, T213, A90, A428)
- 84011 HELICAL CORRUGATE STEEL PIPE  
Test and inspect helical, continuously welded seam, corrugated steel pipe and helical lock seam corrugated pipe. (T241, T249)
- 84012 MECHANICAL BEND TESTING  
Determine the various physical test requirements for bending deformed and plain billet steel bars. Be familiar with proper testing equipment and techniques. (M31, T244)
- 84013\* STRUCTURAL PLATE FOR PIPE, PIPE ARCHES AND ARCHES  
Determine the various physical test requirements and measurements for this drainage product. (M167, T244)
- 84016 WELDED WIRE FABRIC  
Use standard specs to determine the physical and mechanical test results for welded steel wire fabric for concrete reinforcement. (M32, M55)
- 84017 WELDED SEAMS ON IRON OR STEEL CULVERTS  
Determine various mechanical properties of welded seams for zinc-coated corrugated iron or steel culverts and underdrains. (M36)

(LEVEL II - SPECIAL WORK ELEMENTS continued on the next page)

(LEVEL II - SPECIAL WORK ELEMENTS continued)

- 84018 MECHANICAL TESTING OF STEEL REINFORCING BARS  
Using standard testing procedures, determine various measurements and physical properties of steel reinforcing bars. (M31, T244, A370, A615)
- 84019 MECHANICAL TESTING OF COLD DRAWN STEEL WIRE  
Using standard specs for cold drawn steel wire for concrete reinforcement, determine various physical and mechanical properties. (M32, T244)
- 84020 MECHANICAL TESTING OF GUARDRAIL BEAMS  
Using standard specs for corrugated sheet steel beams for highway guardrails, determine various physical and mechanical properties. (M180, A653)
- 84021 ALUMINUM ALLOY STRUCTURAL PLATE  
Using standard specs, determine for pipe, pipe arches, and arches the proper alloy, sampling frequency, bolt size, chemical requirements for bolts, and specs for bolts. (M219)

**HYDRAULIC CEMENT**

- 84022 FINENESS BY THE TURBIDIMETER  
Determine the fineness of portland cement as represented by a calculated measure of specific surface expressed as square area per gram of cement, using the Wagner Turbidimeter. (T98, C115)
- 84023 FINENESS BY AIR PERMEABILITY APPARATUS  
Determine the fineness of portland cement, using the Blaine air permeability apparatus, in terms of the specific surface expressed as total surface area in square centimeters per gram of cement. (T153, C204)
- 84024\* COMPRESSIVE STRENGTH  
Determine the compressive strength of hydraulic cement mortars using 2-inch cube specimens. (T106, C109)
- 84025 TENSILE STRENGTH  
Determine the tensile strength of hydraulic cement mortars employing the briquet specimen. (T132)
- 84026 NORMAL CONSISTENCY AND TIME  
Determine the normal consistency and time of setting of hydraulic cement using the Vicat Needle apparatus. (T129, T131, C187, C191)
- 84027 TIME OF SETTING BY GILLMORE NEEDLES  
Determine the time of setting of hydraulic cement using the Gillmore Needles. (T154, C266)
- 84028 SPECIFIC GRAVITY-HYDRAULIC CEMENT  
Determine the specific gravity of hydraulic cement. (T133, C188)
- 84029 AIR CONTENT  
Determine the air content of hydraulic cement. (T137, C185)
- 84030 FALSE SET  
Determine the false set of portland cement by the mortar method and the paste method. (T185, T186, C359, C451)
- 84031 MECHANICAL MIXING  
Understand process of mechanical mixing of hydraulic cement pastes and mortars of plastic consistency. (T162, C305)
- 84089 AUTOCLAVE TEST  
Determine probable delayed expansion of cement by the use of the autoclave test on a neat cement specimen. (T107, C151)

(LEVEL II - SPECIAL WORK ELEMENTS continued on the next page)

(LEVEL II - SPECIAL WORK ELEMENTS continued)

**AGGREGATE**

- 84032 PARTICLE SHAPE  
Determine the index of aggregate particle shape and texture. (D3398)
- 84033\* LIGHTWEIGHT PIECES  
Determine the approximate percentage of lightweight pieces in aggregates by means of sink-float separation in a heavy liquid. (C123, T113)
- 84034\* SPECIFIC GRAVITY AND ABSORPTION  
Determine bulk specific gravity, apparent specific gravity, and absorption of fine and coarse aggregates. (C127, C128, T84, T85)
- 84035 RESISTANCE TO ABRASION  
Determine the resistance to abrasion of large and small-size aggregates by the Los Angeles method. (C535, C131, T96)
- 84036\* ORGANIC IMPURITIES IN CONCRETE SAND  
Know the test procedure to determine the presence of injurious organic compounds in concrete sand. (C40, T21)
- 84037\* CLAY LUMPS AND FRIABLE PARTICLES  
Determine the quantity of clay lumps and friable particles in natural aggregates. (C142, T112)
- 84038\* RESISTANCE TO FREEZING AND THAWING  
Test aggregates to determine their resistance to disintegration by freezing and thawing. (T103)
- 84039\* SULFATE TEST FOR AGGREGATE SOUNDNESS  
Determine the weathering resistance of aggregates to disintegration by application of the sodium or magnesium sulfate test. (T104, C88)
- 84040\* PRODUCTION OF PLASTIC FINES  
Determine the durability index of aggregates by the prescribed mechanical methods of degradation to indicate the relative resistance of an aggregate to produce detrimental claylike fines. (T210, D3744)
- 84041\* SURFACE MOISTURE/AGGREGATES  
Determine the surface moisture content of fine aggregate samples in the laboratory. (C70)

**SOILS**

- 84042\* NUCLEAR METHODS  
Determine the density and moisture content of soil and soil-aggregate in-place using nuclear equipment. Be familiar with safety precautions and all applicable government regulation. (D2922, D3017)
- 84043\* MOISTURE-DENSITY RELATIONS  
Determine the relation between moisture content and density of soils by use of the Standard Proctor and Modified Proctor tests. (D698, T99, D1557, T180, T224)
- 84044\* LIQUID AND PLASTIC LIMITS  
Determine the liquid and plastic limits of soils and derive the Plasticity Index from the data obtained. (T89, T90, D4318)
- 84045 SAMPLING AND RECORDING  
Use standard procedures for sampling soils to determine properties such as plasticity, permeability, unit weight, compressibility, strength and gradation. Record strata and key samples to locations and depths of extraction. (R13, D420)
- 84046\* PARTICLE-SIZE ANALYSIS  
Determine the quantitative distribution of particle sizes in a soil sample. (D422, T88)
- 84047\* SHRINKAGE FACTOR  
Determine the following soil constants: shrinkage limit, shrinkage ratio, volumetric shrinkage, and linear shrinkage. (D427, T92)
- 84048\* SPECIFIC GRAVITY-SOILS  
Determine the specific gravity of a soil sample by means of a pycnometer. (T100, D854)

(LEVEL II - SPECIAL WORK ELEMENTS continued on the next page)

(LEVEL II - SPECIAL WORK ELEMENTS continued)

- 84049\* FIELD DENSITY/SAND CONE METHOD  
Determine the in place moisture content and dry density of soils using the Sand Cone Method. (D1556, T191)
- 84050\* FIELD DENSITY/RUBBER BALLOON METHOD  
Determine the in-place moisture content and dry density of soils using the Rubber Balloon Method. (T205, D2167)
- 84051\* FIELD DENSITY/DRIVE CYLINDER METHOD  
Determine the in-place moisture content and dry density of soils using the Drive Cylinder Method. (D2937, T204)
- 84052 FIELD MOISTURE EQUIVALENT OF SOILS  
Perform test to determine the field moisture equivalent of soils. (T93)
- 84053\* MOISTURE-DENSITY RELATIONS OF SOIL-CEMENT MIXTURES  
Determine the relationship between the moisture content and the density of soil-cement mixtures when compacted before cement hydration. (T134, D558)
- 84054\* COMPACTED SOIL-CEMENT MIXTURES  
Determine the soil-cement loss, moisture changes, and volume changes produced by repeated wetting and drying or freezing and thawing of hardened soil-cement specimens. (T135, T136, D559, D560)
- 84055 PLASTIC FINES BY SAND EQUIVALENT TEST  
Determine the relative proportions of fine dust or claylike materials in soils or graded aggregates by the Sand Equivalent Test. (T176, D2419)
- 84056\* RESISTANCE R-VALUE AND EXPANSION PRESSURE/COMPACTED SOILS  
Test treated and untreated laboratory compacted soils or aggregates with the stabilometer and expansion pressure devices to obtain results indicative of performance when placed in the base, sub-base or sub-grade of a road subject to traffic. (T190, D2844)
- 84057 ORGANIC MATTER IN SOILS BY WET COMBUSTION  
Determine the humus-like, easily-oxidized organic material in a soil to provide information relative to the suitability of the soil for plant growth. (T194)
- 84058 AUGER BORINGS  
Perform soil investigation and sampling by auger borings and hollow-stem auger borings. (T203, T251, D1452)
- 84059 PENETRATION TEST AND SPLIT-BARREL SAMPLING OF SOILS  
Use a split-barrel sampler to obtain representative samples of soil and a measure of the resistance of the soil to penetration of the sampler. (T206)
- 84060 PERMEABILITY OF GRANULAR SOILS (Constant Head)  
Determine the coefficient of permeability by a constant-head method for the laminar flow of water through granular soils. (T215, D2434)
- 84061\* HYDRATED LIME  
Determine the chemical limits of Type I hydrated lime and the particle size requirements of Types I and II hydrated lime. (T219)
- 84062\* STRENGTH OF SOIL-LIME MIXTURES  
Determine the unconfined compressive strength of soil-lime stabilization mixtures. (T220)
- 84063\* LIME CONTENT OF LIME-TREATED MIXTURES  
Determine the percentage of lime in soils or aggregates which have been treated with hydrated lime. (T232, D3155)
- 84064 DENSITY OF SOIL-IN-PLACE BY BLOCK, CHUNK, OR CORE SAMPLING  
Determine the density of cohesive soil in the natural state, compacted cohesive soil, and stabilized soil by measuring the weight and volume of undisturbed samples. (T233)
- 84065 FIELD PERCOLATION TEST  
Determine percolation of soils in field by pit test. Record results to correspond to accepted practice for area. Understand the variables affecting data collected (season, frost, antecedent precipitation, etc.).

(LEVEL II - SPECIAL WORK ELEMENTS continued on the next page)

(LEVEL II - SPECIAL WORK ELEMENTS continued)

84066 THIN-WALLED TUBE SAMPLING

Use a thin-walled tube to recover relatively undisturbed soil samples suitable for laboratory tests. (T207, D1587)

84067\* CBR OF LAB COMPACTED SOILS

Determine the bearing ratio of soil when compacted and tested in the laboratory by comparing the penetration load of the soil to that of a standard material. (D1883, T193)

**CONCRETE**

84068\* AIR CONTENT BY PRESSURE METHOD

Determine the air content of freshly mixed concrete from observation of the change in volume of concrete with a change in pressure. (C231, T152)

84069\* AIR CONTENT BY THE GRAVIMETRIC METHOD

Determine the weight per cubic foot of freshly mixed concrete and calculate the yield, cement content, and air content of concrete. (C138, T121)

84070\* AIR CONTENT BY THE VOLUMETRIC METHOD

Using the Volumetric Method, determine the air content of freshly mixed concrete containing any type of aggregate, whether it be dense, cellular, or lightweight. (C173, T196)

84071\* COMPRESSIVE STRENGTH OF BROKEN BEAM PORTIONS

Determine compressive strength of concrete, using portions of beams broken in flexure for test specimens. (C116, T140)

84072\* COMPRESSIVE STRENGTH OF CYLINDERS

Determine compressive strength of cylindrical concrete specimens such as molded cylinders and drilled cores. (C39, T22)

84073\* LABORATORY PREPARED TEST SPECIMENS

Perform procedures for making and curing test specimens of concrete in the laboratory. (T126, C192).

84074\* READY MIXED CONCRETE

Be familiar with the specifications for the manufacture and delivery of ready mixed concrete, including plant inspection. (C94)

84075\* LENGTH CHANGE OF DRILLED OR SAWED SPECIMENS

Determine length changes of drilled or sawed specimens of cement mortar and concrete. (C341)

84076\* FIELD PREPARED TEST SPECIMENS

Know the procedures for making and curing concrete compressive and flexural strength test specimens in the field. (C31, T23)

84077\* DRILLED CORES AND SAWED BEAMS

Obtain, prepare, and test cores drilled from concrete for length, compressive or splitting tensile strength determination, and beams sawed from concrete for flexural strength determination. (C42, T24)

84078\* THIRD-POINT FLEXURAL STRENGTH

Determine the flexural strength of concrete by use of third-point loading. (C78, T97)

84079\* CENTER-POINT FLEXURAL STRENGTH

Determine the flexural strength of concrete by use of center-point loading. (C293, T177)

84080\* TIME SET OF CONCRETE

Determine the time of setting of concrete by testing mortar sieved from the concrete mixture. (C403, T197)

84081\* UNIT WEIGHT/STRUCTURAL LIGHTWEIGHT CONCRETE

Determine the unit weight of freshly mixed structural lightweight concrete. (C567)

84082\* SPECIFIC GRAVITY, ABSORPTION AND VOIDS/HARDENED CONCRETE

Determine the specific gravity, absorption, and voids in hardened concrete. (C642)

84083\* SPLITTING TENSILE STRENGTH/CONCRETE

Determine the splitting tensile strength of cylindrical concrete specimens. (C496, T198)

(LEVEL II - SPECIAL WORK ELEMENTS continued on the next page)

(LEVEL II - SPECIAL WORK ELEMENTS continued)

- 84084 WATER RETENTION BY CONCRETE CURING MATERIALS  
Participate in tests to determine loss of moisture from portland cement concrete during curing over varying periods of time and under varying environments. Know how to use water retention membranes (liquid and material) to permit proper curing. (T155, C156)
- 84085\* AIR CONTENT BY CHACE INDICATOR  
Determine the air content of freshly mixed concrete using the Chace Indicator. (T199)
- 84086\* REINFORCING STEEL BOND  
Perform test to compare concrete on the basis of the bond developed with reinforcing steel. (T159, C234)
- 84087\* BLEEDING OF CONCRETE  
Determine the relative quantity of mixing water that will bleed from a sample of freshly mixed concrete. (T158, C232)
- 84088\* CONCRETE PIPE  
Determine the physical and chemical properties of culvert pipe, sewer pipe and drain tile. (T280, T281, C76, C301, C412, C497)

**ASPHALT**

- 84014 ASPHALT FIELD TEST  
Determine the amount of bituminous coating on corrugated metal, metal culvert pipe and pipe arches. Be familiar with other aspects of the coating. (M190)
- 84015 ASPHALT IMPERVIOUSNESS TEST  
Using standard specs covering bituminous coated corrugated metal, metal culvert pipe, and pipe arches, be familiar with test procedure, chemical make-up of solutions, test results. (M190)
- 84090\* FLASH POINT TEST  
Determine the flash points of fuel oils, lube oils, suspensions of solids, and liquids that tend to form a surface film by use of the Pensky-Martens Closed Tester, of cutback asphalts by use of the Tag Open Cup apparatus, and asphalt cements by the Cleveland Open Cup apparatus (T48, T73, T79, D92, D93, D3143)
- 84091\* COMPRESSIVE STRENGTH/BITUMINOUS MIXTURES  
Determine unconfined compression strength of compacted bituminous mixtures of the hot-mixed, hot-laid type used in pavement surfaces and base courses. (T167, D1074)
- 84092\* PENETRATION OF BITUMINOUS MATERIALS  
Determine the penetration of asphalt and other bituminous semi-solid and solid materials by use of the Penetration Test. (T49, D5)
- 84093\* COATING AND STRIPPING OF BITUMEN-AGGREGATE MIXTURES  
Determine the retention of a bituminous film by an aggregate in the presence of water by use of a standard test applicable to cutback, emulsified and semi-solid asphalts. (T182)
- 84094 PERCENT VOLATILES/BITUMINOUS MIXTURES  
Determine the percent of moisture or volatile distillates in bituminous paving mixtures. (D1461, T110)
- 84095\* SOFTENING POINT OF BITUMEN  
Determine the softening point of asphalt and tar. (D36, T53)
- 84096\* DUCTILITY TEST/BITUMINOUS MATERIALS  
Determine the ductility of bituminous materials. (T51, D113)
- 84097\* SOLUBILITY TEST/BITUMINOUS MATERIALS  
Determine the degree of solubility of bituminous road materials (such as road tars and petroleum asphalts) in organic solvents. (T44, D2042)

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(LEVEL II - SPECIAL WORK ELEMENTS continued)

- 84098\* TESTING EMULSIFIED ASPHALT  
Perform the series of tests specified for emulsified asphalt. (T59, D244)
- 84099\* PERCENT ASH FROM PETROLEUM PRODUCTS  
Determine percent of ash in asphalt and tars. (D482, T111)
- 84100\* SPECIFIC GRAVITY OF ASPHALT-TYPE MATERIALS  
Determine the specific gravity of asphaltic materials by the hydrometer, glass pycnometer or displacement methods. (D70-71, T228-229)
- 84101\* SPECIFIC GRAVITY/BITUMINOUS MIXTURES  
Determine the specific gravity of bituminous paving mixtures and compacted bituminous mixtures using saturated surface-dry specimens. (D2726, D2041, T166, T209)
- 84102\* DISTILLATION OF BITUMINOUS AND PETROLEUM PRODUCTS  
Distill cut-back asphaltic products, petroleum products and creosote. Dehydrate oil-type preservatives. (T55, T62, T78, T83, T115; D20, D86, D95, D246, D370, D402)
- 84103\* THIN FILM OVEN TEST  
Determine the effect of heat and air on asphalt materials by use of the Thin Film Oven Test and the Rolling Thin Film Oven Test. (T179, T240, D1754, D2872)
- 84104\* DENSITY BY NUCLEAR METHODS/BITUMINOUS MIXTURES  
Determine the nuclear density measurement of in-place bituminous concrete. (D2950)
- 84105\* EFFECT OF WATER ON COHESION/BITUMINOUS MIXTURES  
Determine the effect of water on cohesion of compacted bituminous mixtures. (T165, D1075)
- 84106 TEST CREOSOTE  
Test creosote as outlined in AASHTO (T50, T60, T61, T62, T82, T83).
- 84107 SPECIFIC GRAVITY OF CREOSOTE FRACTIONS AND RESIDUE  
Determine the specific gravity of creosote fractions entirely liquid at 38 C, creosote fractions containing solids at 38 C, and distillation residues. (T74, D369)
- 84108\* DEGREE OF COMPACTION/BITUMINOUS-AGGREGATE MIXTURES  
Determine the degree of pavement compaction of a bituminous-aggregate mixture as related to standard specimens composed of the same materials and with the tolerances of the job mix formula. (T230)
- 84109\* FLOAT TEST  
Perform the float test for bituminous materials. (T50, D139)
- 84110 **WORK ELEMENT NO LONGER AVAILABLE FOR TESTING.** Credit retained if previously passed.
- 84111\* TEST SPECIMENS BY KNEADING COMPACTOR  
Prepare test specimens of bituminous paving mixtures by means of a mechanical kneading compactor. (T247, D1561)

**LEVEL III - GENERAL WORK ELEMENTS**

- 85001^ COMPLEX PLANS AND SPECS  
Utilize complex plans and specs to assure compliance with all requirements for sampling and testing, to plan activities for sampling and testing, and to record work accomplished with sample locations clearly noted.
- 85002^ TECHNICAL PRESENTATIONS AND REPORTS  
Organize and deliver oral presentations and prepare detailed technical reports and correspondence.

## **LEVEL III - SPECIAL WORK ELEMENTS**

### **MISCELLANEOUS**

- 86001 CTB MIX DESIGNS  
Determine the composition of an effective and economical CTB (Cement Treated Base) mix through use of experience factors and laboratory testing.
- 86002 REFLECTIVITY TESTS  
Perform tests with light metering equipment to determine the reflectivity of reflectorized materials under varying intensities and angles of light.
- 86003 BENKELMAN BEAM OR OTHER DEFLECTION TESTS  
Determine the resistance to deflection of in-place pavement/base/subbase systems by use of a Benkelman beam device or other acceptable deflection device. Record deflections resulting from loadings appropriate to traffic anticipated in design.
- 86004 AIR SAMPLING EQUIPMENT  
Operate air sampling equipment to determine presence of gasses and suspended particles in free air.
- 86005 ELECTRONIC RESISTIVITY EQUIPMENT  
Operate equipment using the principle of electronic resistivity to determine moisture content of soils, depths and types of rock strata, etc.
- 86006 PROFILOMETER  
Operate an improved Profilometer in accordance with manufacturer's instructions to determine pavement profiles. Operate profile measuring equipment over a specified section of roadway to determine ride characteristics of surface. Prepare necessary reports and recommend determinations as to compliance with established standards.
- 86007 FRICTION MEASUREMENT EQUIPMENT  
Operate approved friction measurement equipment to determine the coefficient of skid resistance of pavement surfaces under varying weather conditions. (E274)
- 86008 PAINTS, COATINGS AND OTHER MATERIALS  
Use appropriate accelerated weathering, aging, and exposure tests on paints, coatings and other materials as specified by AASHTO, ASTM or other organizations. Record results as compared to requirements or to established standards.
- 86009\* TESTING MACHINE VERIFICATION  
Using standard calibrating devices, perform the procedures for the verification of certain testing machines that are designed to measure loads. (T67, E4)
- 86010 DRYING OILS  
Select and test drying oils commonly used in paints, varnishes, and related products. (T151, D555)
- 86011 EPOXY RESIN ADHESIVE  
Perform test of epoxy resin adhesives for use in bonding traffic markers to pavements, cured concrete to cured concrete, and fresh concrete to cured concrete. (T237)
- 86012 THERMOPLASTIC TRAFFIC LINE MATERIAL  
Know the procedures used for testing thermoplastic traffic line material. (T250)
- 86013 L<sub>10</sub> AND L<sub>eq</sub> NOISE DETERMINATION  
Determine the L<sub>10</sub> and L<sub>eq</sub> highway noise levels. (T262)
- 86014 ATOMIC ABSORPTION EQUIPMENT  
Operate approved atomic absorption testing devices to determine characteristics of construction materials. Comply with requirements of EPA, OSHA, and manufacturer for calibration of equipment, readings, and safety.
- 86015 INFRA-RED TESTING EQUIPMENT  
Operate approved infra-red testing equipment to determine characteristics of construction materials. Comply with manufacturer's standards for calibration, readings and safety.

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(LEVEL III - SPECIAL WORK ELEMENTS continued)

- 86016 LIGHT OR ELECTRON MICROSCOPE  
Know how to operate light and/or electron microscope on specimens from construction materials including rock, soils, or organic materials, to determine required information. Comply with manufacturers' requirements for calibration, readings, and safety.
- 86017 PAINT DURABILITY  
Participate in tests to determine the durability of paints and thermoplastic traffic line materials. Observe test traffic and weathering sections and record findings. Perform laboratory tests to provide estimates of probable wearing qualities.
- 86018 DURABILITY OF REFLECTORIZED MATERIALS  
Participate in tests to determine durability of reflectORIZED materials used on signs and painted markings. Observe results in experimental field installations. Record information and take samples to laboratory for reflector evaluation after use.
- 86019\* ACCURACY OF SCALES  
If scales are controlled by a designated authority, inspect certificates and seals to assure that weight accuracy is maintained. If no designated authority exists, check scales with certified weights, require any necessary adjustments and seal adjusting mechanisms to assure continuing maintenance of accuracy standards.
- 86020\* CALCIUM CHLORIDE  
Sample and test calcium chloride for roads and structural applications. (T143, D345)
- 86021 SHEET REFLECTIVE MATERIALS FOR TRAFFIC CONTROL SIGNS  
Examine sheet reflective materials for traffic control signs. (T257)
- 86022 CALIBRATE NUCLEAR TEST EQUIPMENT  
Calibrate and assure safety and accuracy of nuclear test equipment before releasing it for use on the job. Assure compliance with requirements of manufacturers' specs and requirements of EPA, OSHA, NRC and local regulations. Calibrate by testing on samples of known physical qualities. Instruct users of necessary precautions to take during use. (T238, T239, D2922, D3017)
- 86023 **WORK ELEMENT NO LONGER AVAILABLE FOR TESTING.** Credit retained if previously passed.
- 86024 TEST TRAFFIC CONTROL DEVICES  
Perform tests on electrical traffic control devices in the laboratory, using NEMA standards.
- 86070\* COATED DOWEL BARS  
Test the qualifications of the organic coating of corrosion resistant dowel bars to withstand the effects of weathering, de-icing chemicals, and the abrading and loading stresses experienced in field joints. (T253)

**METALS**

- 86025 METALLOGRAPHIC SERIES TESTS  
Perform the series of tests required to determine metallographic characteristics of materials necessary for use on transportation projects. (E112, E807, E1382, G104)
- 86026 RADIOGRAPHIC TESTING  
Operate X-ray or radiographic testing equipment, with full attention to safety requirements, for the purpose of nondestructive evaluation of welds. (E94, E142, American Welding Society D1.1-6B)
- 86027 ULTRASONIC TESTING  
Operate approved ultrasonic testing devices to determine thickness and internal condition of metal and welds. (E164, E114, American Welding Society D1.1-6C)
- 86028 WELD INSPECTION  
Perform weld inspection with full responsibility for qualifying welders and welding procedures, checking weld preparation, welding equipment, welding electrodes, and compliance with welding procedures, visual inspection, and determining and witnessing appropriate non-destructive testing. (AASHTO Standard Specifications for Welding of Structural Steel Highway Bridges)
- 86029 STRUCTURAL STEEL FABRICATION  
Perform shop inspection of fabrication of structural steel members for highway construction. (Does not include weld inspection or non-destructive testing.) (AASHTO Standard Specifications for Highway Bridges - Section 10)

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(LEVEL III - SPECIAL WORK ELEMENTS continued)

- 86030 CHROMATE TREATMENT OF ALUMINUM  
Using standard specs for the chromate treatment of aluminum, identify many of the requirements and practices of this treatment. (B449)
- 86031 MECHANICAL TESTING OF STEEL FASTENERS  
Be familiar with the various physical properties and test procedures for fasteners. (T244)
- 86032 MECHANICAL TESTING OF TUBULAR PRODUCTS  
Be familiar with the various physical properties and test procedures for tubular products. (T244)
- 86033 CORROSION DETERMINATION TEST  
Participate in tests to determine the actual and potential effects of corrosion of reinforcing and structural steel. Know the agents contributing to corrosion and know methods to inhibit corrosion. (G-15 for definition of terms.)
- 86034 WELD SAMPLE PREPARATION AND BEND TEST  
Determine the ductility of welds in welded butt joints of materials 0.25 inches and over in thickness. Prepare weld samples and conduct bend test. (E190, AWS D1.1)
- 86035 RADIOGRAPHIC INSPECTION OF WELDS  
Verify quality of radiographic testing and interpret radiographic film for weld quality control. (E142, E390, AWS D1.1-6B)
- 86036 IMPACT TESTING OF METALLIC MATERIALS  
Determine the fracture toughness of metallic materials by the Charpy V-Notch Impact test. (E23, A370, T243, T244, A673)
- 86037 HIGH STRENGTH LOW ALLOY STRUCTURAL STEEL  
Using standard specs, determine the mechanical and chemical requirements (yields, tensility, elongation, chemical content, etc.) for high strength low alloy structural steel shapes, plates and bars. (M183, M160, M161, T244)
- 86038 CARBON STEEL  
Using standard specs, determine the mechanical and chemical requirements (yields, tensility, elongation, chemical content, etc.) for carbon steel shapes, plates and bars. (M183, M160, A307)

**HYDRAULIC CEMENT**

- 86039 CHEMICAL ANALYSIS  
Demonstrate knowledge and understanding of the test required for the chemical analysis of hydraulic cement. (T105, C114)

**SOILS**

- 86040\* PLATE BEARING TEST  
Determine the load deflection and residual deflection of subgrade soils and flexible pavement components by application of repetitive and non-repetitive plate load tests. (T221, T222, T235, D1194, D1195, D1196)
- 86041\* PILE LOAD TEST  
Determine the response of a pile or pile group to a static compressive load applied axially to a pile or piles within a group. (D1143)
- 86042\* PETROGRAPHIC ANALYSES  
Perform petrographic analyses of rock samples through thin section microscopy, chemical tests, and other methods to determine composition of rock and suitability for use under designated conditions. (C295)
- 86043 BORINGS DATA  
Use properly preserved core samples and corings logs to determine the characteristics of soils and rock strata in an area. Present an analysis of the subterranean structures to indicate the structural qualities at the various strata, water table level, drainage and action recommended to attain required structural stability.
- 86044 SEISMIC TESTING EQUIPMENT  
Operate approved seismic testing devices to determine characteristics of subsurface conditions. Follow manufacturers' recommendations as to calibration of equipment, readings of results, and safety.
- 86045 TRAVELING TYPE SLOPE INCLINOMETER  
Perform installation, monitoring, and data reduction for the traveling type slope inclinometer for use with guide casing. (T254)

(LEVEL III - SPECIAL WORK ELEMENTS continued on the next page)

(LEVEL III - SPECIAL WORK ELEMENTS continued)

- 86046 EXPANSIVE SOILS AND REMEDIAL ACTIONS  
Determine if a soil is expansive and predict the amount of swell. Control the amount of swell in an expansive soil. (T258)
- 86047 FIELD VANE SHEAR TEST  
Participate in testing of soft, saturated, cohesive soils, by use of the Field Vane Shear test. Know the soil characteristics which permit assessment of the applicability and interpretation of the test. (T223)
- 86048\* SOILS CLASSIFICATION  
Classify soils in accordance with the Unified Soil Classification System and/or the AASHTO Soil Classification System. (D2487, D3282, M145)
- 86049 UNCONFINED COMPRESSIVE STRENGTHS  
Determine the load per unit area at which an unconfined specimen of cohesive soil will fail in a simple compression test. (T208, D2166)
- 86050 DIRECT SHEAR TEST  
Determine the consolidated drained shear strength of a soil material in direct shear. (T236)
- 86051 ONE-DIMENSIONAL CONSOLIDATION  
Determine the rate and magnitude of consolidation of soil when it is restrained laterally and loaded and drained axially. (T216, D2435)
- 86052\* TRIAXIAL TESTING  
Determine the strength parameters of soils by triaxial compression testing. (D2850)
- 86053 DIAMOND CORE DRILLING  
Perform diamond core drilling to secure intact samples of rocks and soils which are too hard to sample by soil sampling methods. (T225)
- 86054\* CEMENT CONTENT OF SOIL-CEMENT AND CEMENT-TREATED AGGREGATE  
Determine by chemical analysis the cement content of hardened soil-cement, and the cement content in cement-treated aggregate by the method of titration. (T144, T211, D806)
- 86055 TRIAXIAL COMPRESSIVE STRENGTH/ROCK  
Determine the strength of cylindrical rock specimens in an undrained state under triaxial loading. (T226, D2664)
- 86056 PORE PRESSURES  
Determine field pore pressures in natural soils.
- 86057 BEARING CAPACITY  
Determine the bearing capacity for static load on spread footings of soil in place by means of field loading tests. (T235, D1194)

**CONCRETE**

- 86058\* ORGANIC IMPURITIES IN FINE AGGREGATE  
Determine the effect of organic impurities on mortar strength (C87, T71)
- 86059\* MEASURING MODULUS OF ELASTICITY  
Determine the modulus of elasticity and Poisson's ratio of molded concrete cylinders and drilled cores. (C469)
- 86060\* FREEZE-THAW TEST  
Evaluate the ability of cement containing an air-entraining agent to produce frost-resistant concrete by use of the Freeze-Thaw test. (T161, T188, C666)
- 86061\* CONCRETE MIXES  
Design (for approval by an engineer) portland cement concrete mixes that economically and efficiently use available materials and meet requirements for anticipated loads and conditions. (ACI 211)
- 86062\* PRECAST/PRESTRESSED CONCRETE PLANT INSPECTION  
Perform in-plant inspection, including performance of all appropriate tests of precast or prestressed concrete structural members for compliance with applicable specs. (Prestressed Concrete Institute MNL-116)

(LEVEL III - SPECIAL WORK ELEMENTS continued on the next page)

(LEVEL III - SPECIAL WORK ELEMENTS continued)

- 86067\* CHLORIDE ION CONTENT  
Determine the total chloride ion content of aggregates, portland cement, mortar or concrete and determine the resistance of concrete, special concrete treatments or concrete overlays to the penetration of chloride ion. (T259, T260)
- 86068\* CEMENT CONTENT OF HARDENED CONCRETE  
Determine the cement content of hardened portland cement concrete. (T178, C1084)
- 86069\* QUALITY MIXING WATER  
Evaluate the quality of water to be used in concrete as prescribed by AASHTO. (T26)
- 86071\* AIR-ENTRAINING ADMIXTURES  
Test materials proposed for use as air-entraining admixtures to be added to concrete mixtures. (C233, T157)

**ASPHALT**

- 86063\* BITUMINOUS MIXING PLANT INSPECTION  
Assure compliance with specs covering materials produced by a plant by verifying accuracy of automatic controls on quantities, weights, or other characteristics of final products. Refer to specs or to published standards as necessary. Require test samples on random basis to assure quality control. (D290, T172)
- 86064\* HVEEM APPARATUS  
Determine the resistance to deformation and cohesion of bituminous mixtures by use of the Hveem apparatus. (D1560, T246)
- 86065\* BITUMINOUS MIXES  
Design (for approval by an engineer) bituminous mixes that economically and efficiently use available materials and meet specs.
- 86066\* VISCOSITY TESTS  
Know the basic principles of the Absolute, Kinematic, and Saybolt methods of determining the viscosity of asphalts, petroleum or tar products and participate in the required laboratory tests. (T72, T201-202, D88, D2170, D2171)
- 86072 IMMERSION-COMPRESSION TEST  
Determine the effect of water on cohesion of compacted bituminous mixtures after immersion and compressive testing. (T165, T167)
- 86073\* TEST SPECIMENS BY MARSHALL METHOD  
Prepare test specimens of bituminous mixtures by means of the Marshall Method. (T245, D1559)
- 86074 ASPHALT ADDITIVE IDENTIFICATION  
Understand the types of additives present in asphalt under specific conditions; the effect of additives on asphalt mixes; and the manner in which additives may be detected and controlled.
- 86075\* RECOVERY OF ASPHALT FROM SOLUTION BY ABSON METHOD  
Recover asphalt from solution by the Abson method. (T170, D1856)

**LEVEL IV - GENERAL WORK ELEMENTS**

**NOTE: Certification at Level IV requires that the candidate must have occupied a senior position of responsibility throughout the duration of one or more major highway materials testing projects (field and/or laboratory/office assignment). There are no exceptions to this requirement and documentation must be present in the work history listed on the application form.**

- 87001\* APPLIED STATISTICS  
Apply basic statistical concepts to the sampling and evaluation of materials or component batches. Utilize established standards of develop limits of acceptance which consider the practical variability of sampling procedures. (ASTM E105, E122, E141)
- 87002 LAB OPERATIONS AND FIELD INSPECTIONS  
Responsible for planning and overall operations of laboratory, including supervision of personnel, selection, maintenance, and calibration of test equipment, selection of appropriate tests to be performed, and supervision of sampling, testing and reporting. Coordinate inspection, reporting, and overall operation of construction or fabrication shop with contractor or fabricator.

**PERSONAL TALLY WORKSHEET**  
**Passed Work Elements in Highway Materials**

- o Put a checkmark next to the work element number when you receive a passing score on your Examination Score Report.
- o Put a "C" next to the work element number if you have crossover credit from another subfield. Read page 7 in this manual concerning crossover credit.
- o Put an "A" next to the work element number if you have been awarded credit for your existing ACI certification. Read pages 5 and 6 in this manual concerning ACI credit.

<u>LEVEL I GENERAL</u>	<u>LEVEL I SPECIAL</u>	<u>LEVEL II GENERAL</u>		<u>LEVEL II SPECIAL</u>			
__81001	__82001	__83001	__84001	__84023	__84045	__84067	__84089
__81002	__82002	__83002	__84002	__84024	__84046	__84068	__84090
__81003	__82003	__83003	__84003	__84025	__84047	__84069	__84091
__81004*	__82004	__83004	__84004	__84026	__84048	__84070	__84092
__81005	__82005	__83005	__84005	__84027	__84049	__84071	__84093
__81006	__82006	__83006	__84006	__84028	__84050	__84072	__84094
__81007**	__82007	__83007	__84007	__84029	__84051	__84073	__84095
__81008	__82008	__83008	__84008	__84030	__84052	__84074	__84096
	__82009	__83009	__84009	__84031	__84053	__84075	__84097
	__82010	__83010	__84010	__84032	__84054	__84076	__84098
	__82011	__83011	__84011	__84033	__84055	__84077	__84099
	__82012		__84012	__84034	__84056	__84078	__84100
	__82013		__84013	__84035	__84057	__84079	__84101
	__82014		__84014	__84036	__84058	__84080	__84102
	__82015		__84015	__84037	__84059	__84081	__84103
	__82016		__84016	__84038	__84060	__84082	__84104
	__82017		__84017	__84039	__84061	__84083	__84105
	__82018		__84018	__84040	__84062	__84084	__84106
	__82019		__84019	__84041	__84063	__84085	__84107
	__82020		__84020	__84042	__84064	__84086	__84108
	__82021		__84021	__84043	__84065	__84087	__84109
	__82022		__84022	__84044	__84066	__84088	__84110*
	__82023						__84111
	__82024						
	__82025						

<u>LEVEL III GENERAL</u>		<u>LEVEL III SPECIAL</u>				<u>LEVEL IV SPECIAL</u>
__85001	__86001	__86016	__86031	__86046	__86061	__87001
__85002	__86002	__86017	__86032	__86047	__86062	__87002
	__86003	__86018	__86033	__86048	__86063	
	__86004	__86019	__86034	__86049	__86064	
	__86005	__86020	__86035	__86050	__86065	
	__86006	__86021	__86036	__86051	__86066	
	__86007	__86022	__86037	__86052	__86067	
	__86008	__86023*	__86038	__86053	__86068	
	__86009	__86024	__86039	__86054	__86069	
	__86010	__86025	__86040	__86055	__86070	
	__86011	__86026	__86041	__86056	__86071	
	__86012	__86027	__86042	__86057	__86072	
	__86013	__86028	__86043	__86058	__86073	
	__86014	__86029	__86044	__86059	__86074	
	__86015	__86030	__86045	__86060	__86075	

\*Work element number is no longer available for testing. Credit is retained by those who previously passed it.

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

## SELECTED GENERAL REFERENCES\*

**The following publications are cited in the Work Element descriptions. Candidates may bring these publications to the test center:**

AASHTO Standard Specifications for Highway Bridges. American Association of State Highway and Transportation Officials. Washington, D.C. (202-624-5800)

ACI Manual of Concrete Inspection (SP-2), 8th edition. American Concrete Institute, Detroit, Michigan. (313-532-2600)

Annual Book of ASTM Standards. American Society for Testing and Materials. Philadelphia, Pennsylvania. (215-299-5400)

Construction Industry - OSHA Safety and Health Standards Digest (OSHA 2202). Government Printing Office. Washington, D.C. (202-783-3238)

Feltz, W., Dudley, S., Dykstra, T. Concrete Technician Manual. Ohio Ready Mixed Concrete Association. Columbus, Ohio. (614-891-0210)

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. (202-624-5800)

### **Other useful publications may be obtained from the following organizations\*:**

American Welding Society. Publications Department. Miami, Florida. 1-800-443-9353. (For work elements 86026, 86027, 86034, and 86035)

The Asphalt Institute. Publications Department. Lexington, Kentucky. 606-288-4960.

National Electrical Manufacturer's Association. Washington D.C. 202-457-8400 (For work element 86024)

Portland Cement Association. Publications Department. Skokie, Illinois. 708-966-6200.

Precast/Prestressed Concrete Institute. Publications Department. Chicago, Illinois. 312-786-0300.

### **\*Important Note:**

**References that are cited in work element descriptions are permitted in NICET's paper-and-pencil test centers. All other publications must be pre-approved by NICET for entry into test centers.**



NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES

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1420 King Street, Alexandria, Virginia 22314 (888) 476-4238

EXAMINATION SCORE REPORT

SAMPLE

Exam No. 99999  
Examinee: JOHN EXAMINE

Test Date: 06/17/2008  
Report Date: 07/11/2008

Work Element Number and Title

Score (%) Pass/Fail

HIGHWAY MATERIALS

1084001	Brick	65.00	P
1084002	Preformed Expansion Joint Filler	80.00	P
1084003	Concrete Joint Sealers	35.00	F*
1084005	Collect and Preserve Water	65.00	P
1084006	Liquid Penetrant Inspection of Welds	80.00	P
1084007	Magnetic Particle Inspection of Welds	100.0	P
1084010	Weight of Coatings on Iron	20.00	F**
1084017	Welded Seams on Iron or Steel Culverts	90.00	P
1084022	Fineness by the Turbidimeter	45.00	F***

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

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

\*\*\* This is your third failure of 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 22314-2715