Transportation Engineering Technology

BRIDGE SAFETY INSPECTION

PROGRAM DETAIL MANUAL

Please check NICET’s website (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.
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:

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

Such changes could affect the requirements for certification. Therefore, if this manual is more than a year old, NICET highly recommends that you check www.nicet.org (or, if you don’t have access to the Internet, call NICET at 888-476-4238) to make sure that you have the current edition of the Program Detail Manual before applying for an examination. The date of publication of this manual is June 1995.

It is the responsibility of all applicants to make sure they are using a current manual.

This fifth edition of the Bridge Safety Inspection program detail manual contains the following substantive change from the fourth edition:

- Work element #71008, “Basic Metric Units and Conversions,” is no longer mandatory for certification at Levels II, III and IV.

Once certified, each certificant will be mailed an annual renewal bill. If the yearly payment is not made for three consecutive calendar years, the certification “expires” (all certification records as well as all previous testing records will be deleted) and active certification can be regained only by reapplying as a new applicant and meeting the current criteria.

Payment of an exam fee does not substitute for payment of the annual renewal fee.
# FIELD OF TRANSPORTATION ENGINEERING TECHNOLOGY

## SUBFIELD OF BRIDGE SAFETY INSPECTION

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GENERAL INFORMATION

This Program Detail Manual contains the information needed to apply for the NICET certification examination in the Bridge Safety Inspection 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).

National Institute for Certification in Engineering Technologies (NICET)
1420 King Street, Alexandria, Virginia 22314-2794
1-888-476-4238 (staff response – 8:30am to 5pm 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 technicians engaged in the safety inspection of existing bridges in order to determine their physical condition, maintenance needs, and potential hazards. (This program is not designed for technicians engaged in the construction and inspection of new bridges.) The program tests knowledge of the physical sciences, the materials and structural elements of common and special bridges, and the analysis, rating, and reporting of bridge inspection results.

This program became operational in 1985. Development of the program was initiated in 1983, with technical guidance from the U.S. Department of Transportation, various state departments of transportation, and various local agencies and entities actively engaged in the bridge inspection process.
WORK ELEMENT DESCRIPTION

The typical job duties and associated responsibilities of bridge safety inspection 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 NICET 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:

7 - Bridge Safety Inspection

(1) Highway Construction  (2) Highway Design
(4) Highway Traffic Operations  (5) Highway Surveys
(8) Highway Materials  (9) Highway Maintenance

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

GENERAL WORK ELEMENTS  SPECIAL WORK ELEMENTS
1 - Level I General  2 - Level I Special
3 - Level II General  4 - Level II Special
5 - Level III General  6 - Level III Special
7 - Level IV General  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 number 001/75005:

Technical Field Code: 001  (Transportation Engineering Technology)
Subfield: 7  (Bridge Safety Inspection)
Level/Type: 5  (Level III General)
Work Element Sequence: 005
Work Element Number: 005/75005  (Field Code Number/5-Digit Work Element ID Number)

This eight-digit identification number is needed when using the application form to request an examination or provide work element verification.
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. We recommend that persons with eighteen or more months of relevant work experience set their initial certification goal at Level II. Certification at a particular level does NOT require prior certification at a lower level. The Examination Requirements Chart on page 5 lists the actual examination requirements for certification at Levels I, II, III, and IV in the subfield of Bridge Safety Inspection.

WORK ELEMENT SELECTION FOR AN INITIAL EXAM

1. Refer to the Examination Requirements Chart on page 5.
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. The General work elements are further divided into Core work elements and Non-Core work elements. Core work elements are those whose successful completion is MANDATORY for certification at Levels II, III and IV. When selecting work elements for testing, it is recommended that Core work elements be given preference; then selection should be based on those remaining work elements most likely to be passed.
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 requirements.
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 highly 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 requirements 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 question. That is, a score of “0” will be assigned to the work element if the questions are not answered and the work element will have one failure marked against it.
8. It is strongly recommended that all applicants keep a copy of their completed application. This will assist in resolving questions over the telephone.
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 website (ww.nicet.org) for ordering information.

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 website (www.nicet.org) for ordering information. People who obtain this “Personal Crossover Evaluation” need to read and understand the warning statement printed at the bottom of this 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 website (www.nicet.org) for ordering information. The warning 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 three-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 work elements in the Bridge Safety Inspection 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.

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**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.
EXAMINATION REQUIREMENTS CHART

Subfield: Bridge Safety Inspection

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

<table>
<thead>
<tr>
<th>Level I</th>
<th>You must pass this many work elements to complete the Level I exam requirement.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level I - General - 6</td>
<td></td>
</tr>
<tr>
<td>Level I - Special - 4</td>
<td></td>
</tr>
<tr>
<td>TOTAL 10</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level II</th>
<th>You must pass this many work elements to complete the Level II exam requirement.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level I - General - 8c</td>
<td></td>
</tr>
<tr>
<td>Level I - Special - 6</td>
<td></td>
</tr>
<tr>
<td>Level II - General - 7c</td>
<td></td>
</tr>
<tr>
<td>Level II - Special - 4</td>
<td></td>
</tr>
<tr>
<td>TOTAL 25</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level III</th>
<th>You must pass this many work elements to complete the Level III exam requirement.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level I - General - 8c</td>
<td></td>
</tr>
<tr>
<td>Level I - Special - 6</td>
<td></td>
</tr>
<tr>
<td>Level II - General - 7c</td>
<td></td>
</tr>
<tr>
<td>Level II - Special - 8</td>
<td></td>
</tr>
<tr>
<td>Level III - General - 13</td>
<td></td>
</tr>
<tr>
<td>Level III - Special - 4</td>
<td></td>
</tr>
<tr>
<td>TOTAL 46</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level IV</th>
<th>You must pass this many work elements to complete the Level IV exam requirement.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level I - General - 8c</td>
<td></td>
</tr>
<tr>
<td>Level I - Special - 6</td>
<td></td>
</tr>
<tr>
<td>Level II - General - 7c</td>
<td></td>
</tr>
<tr>
<td>Level II - Special - 8</td>
<td></td>
</tr>
<tr>
<td>Level III - General - 13</td>
<td></td>
</tr>
<tr>
<td>Level III - Special - 6</td>
<td></td>
</tr>
<tr>
<td>Level IV - General - 6</td>
<td></td>
</tr>
<tr>
<td>Level IV - Special - 5</td>
<td></td>
</tr>
<tr>
<td>TOTAL 59</td>
<td></td>
</tr>
</tbody>
</table>

NOTES:
(a) 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.
(b) Read very carefully the two sections applicable to Level IV certification in this manual before seeking Level IV certification.
(c) All 6 work elements in this category which are listed as CORE must be passed to complete the exam requirement at this level.

GENERAL NOTES:
(1) Work elements passed which are in excess of the requirement at a particular type and level, but which can be used 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 successfully passed.
WORK ELEMENT SELECTION FOR ALL SUBSEQUENT EXAMS

All the items listed on page 3 for the selection of work elements apply to subsequent exams. In addition, the following should be understood:

1. It is not necessary to retest failed work elements if there are other work elements, in the appropriate categories, which can be selected. If you need to retest a failed work element, you must wait three months 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 four times within a two-year span. For further information, read Policy #20, “Retesting of Failed Work Elements,” available on our website (www.nicet.org).

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.

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 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.

WORK EXPERIENCE REQUIREMENT

A preponderance of the work experience must be acquired while residing in the United States and its territories, employing U.S. standards and practices.

NICET certification is only conferred upon persons performing engineering technician level work. NICET will not certify persons performing higher level work (such as engineering) or lower level work (such as craft).
LEVEL IV WORK EXPERIENCE REQUIREMENT

In addition to the normal work experience information requested on the technician application form, all candidates for certification at Level IV, Senior Engineering Technician, in Bridge Safety Inspection must establish, in writing, that they have occupied a senior position of responsibility on several major bridge inspection projects. It must be remembered that ten years or more of employment in the technical area, by itself, is not sufficient for the granting of a Level IV certification.

The write-up sent to NICET must provide detailed, concise descriptions of several bridge inspection projects which show the candidate’s involvement in a majority of the various aspects of the process. The pertinent work experience must be described in depth by the candidate personally -- official job descriptions or testimonials from others will not be evaluated.

The write-up on each of the projects should include such information as:
1. bridge type (concrete, steel, timber, beam, truss, arch, moveable, etc.);
2. bridge size (overall length, span, traffic load);
3. your supervisory responsibilities on each project; and
4. the range of your experiences on each project as related to organizing, conducting, and reporting inspections.

IF YOU HAVE BEEN ASSIGNED TO PROJECTS WHICH RESULT IN NARROWLY-FOCUSED EXPERIENCES, YOU SHOULD DESCRIBE SEVERAL ASSIGNMENTS WHICH CAN BE USED COLLECTIVELY TO MEET THE EXPERIENCE REQUIREMENT.

Your write-up must address the Level IV requirement that your level of responsibility demonstrates independent engineering technician work, including delegated responsibilities and duties for which engineering precedent exists.

In order to avoid lengthy delays in processing your Level IV certification, this documentation should be sent with the Level IV examination application.

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 only three years experience passes Level IV work elements, NICET may require documentation of how this higher level knowledge was obtained without accumulating the requisite work experience.

If documentation is inadequate, 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 three years prior to the time of the Level IV certification decision.
PREPARATION FOR TESTING

The NICET written examinations are designed by the individual who has performed the work elements associated with the program. Preparation for this examination should be minimal.

When appropriate, the work element description specifies the applicable standards or procedures. The standards and other references cited in the work element descriptions are permitted (and encouraged) at the test site.

TRAINING COURSES

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

Bridge Safety Inspection

LEVEL I - GENERAL WORK ELEMENTS

(Work at Level I Is Performed Under Direct Supervision)

CORE WORK ELEMENTS (See Note 1)

<table>
<thead>
<tr>
<th>ID #</th>
<th>Work Element Title and Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>71001*</td>
<td>SIMPLE BRIDGE PLANS &amp; SPECS</td>
</tr>
<tr>
<td></td>
<td>Use simple plans and specifications to determine basic dimensions, types and descriptions of component materials, and component locations.</td>
</tr>
<tr>
<td>71004</td>
<td>BASIC BRIDGE TYPES</td>
</tr>
<tr>
<td></td>
<td>Know the basic bridge types, such as arch, beam, cantilever, girder, movable, suspension, truss, etc.</td>
</tr>
<tr>
<td>71005</td>
<td>BASIC BRIDGE COMPONENTS</td>
</tr>
<tr>
<td></td>
<td>Recognize basic bridge components and structural members such as decks, parapets, wing walls, abutments, stringers, girders, diaphragms, bearings, etc.</td>
</tr>
<tr>
<td>71006</td>
<td>FIELD SKETCHING</td>
</tr>
<tr>
<td></td>
<td>Draw free-hand sketches describing bridge component configurations and illustrating condition of components.</td>
</tr>
<tr>
<td>71007</td>
<td>BASIC FIELD MEASUREMENTS</td>
</tr>
<tr>
<td></td>
<td>Assist in making measurements of basic dimensions such as span lengths, overall length, roadway width, abutment widths, truss depth, etc.</td>
</tr>
</tbody>
</table>

NON-CORE WORK ELEMENTS

<table>
<thead>
<tr>
<th>ID #</th>
<th>Work Element Title and Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>71002^</td>
<td>BASIC MATHEMATICS</td>
</tr>
<tr>
<td></td>
<td>Solve mathematical problems requiring simple addition, subtraction, multiplication, and division. Round to the correct number of significant figures, calculate percentages, read graphs, and use simple geometric definitions and formulas. (See general mathematics textbooks.)</td>
</tr>
<tr>
<td>71003^</td>
<td>BASIC COMMUNICATION SKILLS</td>
</tr>
<tr>
<td></td>
<td>Use proper punctuation, vocabulary, spelling, and sentence structure. Follow written instructions. (See basic grammar references.)</td>
</tr>
<tr>
<td>71008^</td>
<td>BASIC METRIC UNITS AND CONVERSIONS</td>
</tr>
<tr>
<td></td>
<td>Perform conversions to and from basic metric (SI) units. (ASTM E-380)</td>
</tr>
<tr>
<td>71009*</td>
<td>TOPOGRAPHIC MAPS &amp; SITE PLANS</td>
</tr>
<tr>
<td></td>
<td>Use topographic maps and site plan drawings to determine elevations, stationing, grid coordinates, and general drainage features.</td>
</tr>
</tbody>
</table>

NOTE 1: All Level I and Level II General Work Elements are classified as either Core or Non-Core. All Level I and II Core Work Elements must be passed in order to achieve a Level II certification – this is a mandatory requirement.

(*) Crossover credit exists in other fields/subfields for this work element. Read information on crossover work elements on page 4.
(^)Generic crossover credit exists in other fields/subfields for this work element. Read information on crossover work elements on page 4.
71010^ BASIC PHYSICAL SCIENCE
Apply terms, definitions, and concepts from mechanics, electricity, heat, and chemistry. (Solutions may involve simple formulas found in basic physics textbooks, but will not involve algebraic manipulation or trigonometry.)

LEVEL I - SPECIAL WORK ELEMENTS

72001 INSPECTION AT HEIGHTS
Obtain access to remote inspection areas and perform required tasks safely at heights necessary in bridge inspection. Use appropriate safety devices such as hard hats, safety belts, safety lines, harnesses.

72002* TEMPORARY TRAFFIC CONTROL
Understand basic arrangements for protecting inspection crews from traffic and for maintaining flow of traffic. (MUTCD - Part VI, FHWA)

72003^ FIRST AID PROCEDURES
Understand the basic rules and procedures of first aid. (See general handbooks on first aid.)

72004^ BASIC DRAFTING
Recognize and describe standard manual drafting techniques. Describe the characteristics and proper usage of standard drafting equipment. (See basic technical drawing textbooks.)

72005 INSPECTION EQUIPMENT
Know the name, function and care of basic bridge inspection equipment.

72006^ BASIC INDIVIDUAL SAFETY
Follow standard safety practices in performing job tasks. Recognize and call attention to improper safety practices at the work site. (Construction Industry Standards - OSHA 2202)

72007 PHOTOGRAPHY
Have sufficient rudimentary knowledge of photography to obtain usable photographs. Know the appropriate equipment necessary, and understand appropriate picture-taking techniques.

72008 STRUCTURAL STEEL SHAPES
Identify common structural steel shapes.

LEVEL II - GENERAL WORK ELEMENTS
(Work at Level II Is Performed Under General Supervision)

CORE WORK ELEMENTS (See Note 2)

73001 BRIDGE PLANS AND SPECS
Understand and use standard plans (shop and as-built) and specifications to determine dimensions, types of materials, and member make-up, shape, and size.

73002 WRITTEN DOCUMENTATION
Prepare accurate, comprehensive written reports of the conditions observed when participating in the inspection of bridges.

NOTE 2: All Level I and Level II General Work Elements are classified as either Core or Non-Core Work Elements. All Level I and II Core Work Elements must be passed in order to achieve a Level II certification -- this is a mandatory requirement.

GENERAL NOTE: See “Selected General References” page in this manual for information on listed standards and publications.
73003 MEASURING DEVICES
Use measuring devices and instruments such as calipers, micrometers, feeler gauges, crack gauges, etc.

73004 BRIDGE NOMENCLATURE
Extension of 71004 and 71005. Know the bridge types and their variations and know their superstructure and substructure components.

73005 MATERIAL DETERIORATION
Recognize basic indications of sound and unsound materials, such as rust, scale, etc. Know the range of non-destructive testing techniques for checking physical condition of in situ materials.

73006 MATERIAL PROPERTIES
Know the elementary physical and mechanical properties of concrete, steel, timber, and other bridge materials.

NON-CORE WORK ELEMENTS

73007 JOB SAFETY
Exercise good safety practices during inspection of bridges from standpoint of type of bridge, access to parts of structure, influence of weather conditions, presence of electrical installations, etc.

73008 AREA, VOLUME, AND WEIGHT CALCULATIONS
Calculate areas, volumes, and weights, including those of standard structural member shapes.

73009^ INTERMEDIATE PHYSICAL SCIENCE
Solve problems in mechanics, electricity, heat, and inorganic chemistry. (Solutions may involve algebra and trigonometry.)

LEVEL II - SPECIAL WORK ELEMENTS

74001 WATER SAFETY
Have a general knowledge of U.S. Coast Guard requirements for use of boats, including familiarity with “Rules of the Road” and proper on-board safety practices. (Navigation Rules, U.S. Coast Guard)

74002^ ELEMENTARY PLANE SURVEYING
Use engineer’s transit and level to conduct simple surveying operations such as measuring horizontal angles and distances; determining the elevation of objects or points; and making appropriate notes in the field notebook.

74003 UNDERWATER INSPECTION
Be familiar with basic underwater inspection equipment used by professional divers. Know the general limitations and safety considerations of the equipment.

74004^ TRAFFIC CONTROL DEVICES
Be familiar with appropriate uses of signs, markings, and signals given in the MUTCD to effectively assist in control of traffic. (MUTCD - Part VI, FHWA)

74005 CONCRETE STRUCTURE INSPECTION
Have a basic knowledge of the behavior of plain, reinforced, and prestressed concrete, particularly in relation to sound and deteriorated concrete, rebars, and prestressing tendons. Note the extent and severity of damage or deterioration in the overall structure.

74006 STEEL STRUCTURE INSPECTION
Have a basic knowledge of the behavior of steel, particularly in relation to sound and unsound common structural steel and steel wire and cable. Note the extent and severity of damage or deterioration in the overall structure, including load repetitions (fatigue) and fire/heat.
TIMBER STRUCTURE INSPECTION
Have a basic knowledge of the behavior of timber, particularly in relation to sound and deteriorated wood. Note the extent and severity of damage or deterioration in the overall structure, including decay and insect damage.

EXPANSION AND CONTRACTION
Have a general knowledge of methods and devices that accommodate expansion and contraction of entire bridges and bridge components such as rollers and rockers, elastomeric pads, sliding plates, roadway joints and joint fillers.

NAVIGATIONAL LIGHTING
Be familiar with exterior bridge lighting requirements needed to satisfy U.S. Coast Guard & Federal Aviation Agency navigational requirements. (“Bridge Inspector’s Manual for Movable Bridges”, FHWA)

INTERMEDIATE MATHEMATICS
Perform mathematical calculations utilizing basic algebra (fundamental laws, algebraic expressions), geometry, and the trigonometric functions of right triangles. (See basic textbooks on algebra and trigonometry.)

WATERWAYS
Observe and report waterway influences such as scour, debris build-up, and alignment.

REPORT INFORMATION
Organize field notes and document photographs. Using good drafting technique, develop drawings from existing plans and field sketches for reports.

LEVEL III - GENERAL WORK ELEMENTS

PLANS AND SPECS
Understand and use complex plans and specifications to determine the dimensions and locations of bridge components, component function, and material specifications.

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.

INSPECTION ARRANGEMENTS
Assist in the review of bridge plans, past inspection reports, and other pertinent information for bridges to be inspected. Arrange for necessary equipment for inspection and for traffic control including, when needed, special access equipment.

LOADINGS AND FORCES ON BRIDGES
Have an elementary working knowledge of internal and external primary and secondary forces acting upon and within a bridge and how they affect the bridge and its components. Understand dead loads, live loads, impact loads, ice loads, wind pressure, water pressure, earth pressure, and thermal stresses.

BRIDGE INVENTORY TERMINOLOGY
Be familiar with all definitions, terms, and explanations required for completion of the SI&A sheet.

BRIDGE INSPECTION BASICS
Be familiar with the definitions, explanations, and procedures in the current AASHTO “Manual for Maintenance Inspection of Bridges”.

BASIC SEQUENCE FOR INSPECTION
Know the proper sequence of steps for a comprehensive and systematic inspection for the type of bridge being inspected and the type of inspection to be performed.
TRAFFIC SAFETY FEATURES
Have a working knowledge of function and present design criteria for vehicular and pedestrian safety features such as bridge railings, transitions, approach guardrails, and approach guardrail ends.

STATICS
Have an elementary working knowledge of forces, force components, resultants, moments, free-body diagrams, principles of equilibrium, two-force members. Analyze reactions of free bodies as they relate to bridges. See applied mechanics (statics) textbooks.

CONDITION OF TRUSS BRIDGES
Identify deterioration and damage to truss bridges and document same in inspection reports. Estimate the significance of damage or deterioration in relation to the overall structure.

CONDITION OF SIMPLE SPAN BRIDGES
Identify deterioration and damage to simple span bridges and document same in inspection reports. Estimate the significance of damage or deterioration in relation to the overall structure.

CONDITION OF CONTINUOUS SPAN BRIDGES
Identify deterioration and damage to continuous span bridges and document same in inspection reports. Estimate the significance of damage or deterioration in relation to the overall structure.

CONDITION OF ARCH BRIDGES
Identify deterioration and damage to arch bridges and document same in inspection reports. Estimate the significance of damage or deterioration in relation to the overall structure.

CONDITION OF CULVERTS
Identify deterioration and damage to culverts and document same in inspection reports. Estimate the significance of damage or deterioration in relation to the overall structure.

CONDITION OF SUBSTRUCTURES
Identify deterioration and damage to substructures and document same in inspection reports. Estimate the significance of damage or deterioration in relation to the overall structure.

CONDITION OF DECKS
Identify deterioration and damage to decks and document same in inspection reports. Estimate the significance of damage or deterioration in relation to the overall structure.

LEVEL III - SPECIAL WORK ELEMENTS

UNDERWATER INVESTIGATIONS
Be familiar with how underwater investigations are conducted by professional divers using scuba equipment and other types of underwater inspection equipment. Understand diving safety and basic underwater physics.

WATERWAY CONDITIONS
Recognize and understand the significance of waterway conditions such as channel stability (pools, shoals, siltation, scour), current velocity, discharge rate, icepacks, ice dam, floods; and protective measures such as embankment protection (dikes, revetments), substructure protection (fenders, dolphins).

MECHANICS OF MATERIALS
Solve problems involving normal and shear stress and strain, Hooke’s law, Poisson’s ratio, shear and moment diagrams, the flexure formula, and torsional stress and strain involving circular members. Locate simple centroids. (See general textbooks on strength of materials.)
MOVABLE BRIDGES
Be familiar with the types of movable bridges and how they function, including electrical and mechanical components. ("Bridge Inspector’s Manual for Movable Bridges”, FHWA)

COLLISION DAMAGE
Have a general knowledge of significance of collision damage to various components of truss and stringer-type bridges. Understand when traffic restrictions may be needed.

COASTAL BRIDGES
Have a general knowledge of the special environmental problems associated with bridges located in salt water areas. Detect and assess superstructure and substructure damage and deterioration.

PROPERTY CONTROL
Assure proper control of equipment use and storage to prevent loss or misuse of instruments, supplies, and equipment. Investigate loss or damage of equipment and complete the necessary forms and reports to establish responsibility. Take corrective action if appropriate.

ELEMENTARY STRUCTURAL ANALYSIS
Solve elementary problems required in the analysis of simple beams and tension members.

PROTECTIVE COATINGS
Be familiar with protective coatings on bridge structures, including paints, concrete sealants, and preservatives. Recognize types of coating failures.

BOLTS & FASTENERS
Recognize and document deficiencies found in riveted and bolted connections.

PRESTRESS FUNDAMENTALS
Be familiar with the principles of prestressed concrete.

RAILROAD BRIDGES
Be familiar with the loading conditions of railroad and rail rapid transit bridges.

WORK ELEMENT DELETED
Credit retained by those who have previously passed it.

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 bridge safety inspection projects. There are no exceptions to this requirement and documentation must be present in the work history listed on the application form.

INSPECTION REPORT REVIEW
Review completed inspection reports, forms, and sketches for content, format, accuracy, and clarity. Suggest appropriate corrections.

PREINSPECTION DATA
Review previous inspection reports and, when necessary, available bridge plans and specifications. Note any special items for inspection.

INSPECTION ORGANIZATION
Establish bridge inspection equipment requirements. Define responsibilities, qualifications, and relationships of all concerned parties.
77004 INSPECTION EXPERTISE
Evaluate performance of others participating in inspections by periodically accompanying teams. Provide expertise and leadership on inspection of major structures or in situations of an unusual nature. Assist Bridge Inspection Engineer or assistant in administering the overall bridge inspection program.

77005 AS-BUILT DRAWINGS
Verify that plans, specifications, and shop drawings reflect actual field conditions. Recognize deficiencies and implement corrections.

77006 SPECIAL TRAINING
Prepare, conduct, and evaluate training efforts.

77007 BRIDGE SUFFICIENCY RATING
Understand and calculate bridge sufficiency ratings by the sufficiency rating formula given in FHWA’s “Recording and Coding Guide for the Structure, Inventory and Appraisal of the Nation’s Bridges”.

77008 BRIDGE LOAD CAPACITY
Assist in determining the safe live load capacity of existing simple bridges. (“Manual for Maintenance Inspection of Bridges”, AASHTO)

77009 NONDESTRUCTIVE TESTING
Be familiar with fundamental principles of, uses of, and limitations of nondestructive testing methods such as ultrasonic, radiographic, magnetic particle, penetrants, and Swiss hammer. (“Guide for Nondestructive Inspection of Welds,” AWS, and “Nondestructive Methods of Fatigue Crack Detection in Steel Bridge Members,” TRB”)

78001 SPECIAL BRIDGES
Know the peculiar features and inspection considerations for special bridges, including suspension, segmental, and box girder bridges.

78002 NON-REDUNDANT ELEMENTS
Identify non-redundant elements and fracture-critical members.

78003 ANALYSIS OF COMPRESSION MEMBERS
Solve problems involving stress in the analysis of compression members such as in trusses and piers. (See general textbooks on structural analysis and applied strength of materials.)

78004 ANALYSIS OF TRUSSES
Solve problems required in the analysis of simple trusses. (See standard textbooks on structural analysis.)

78005 FATIGUE-PRONE DETAILS

78006 WELDS
Identify deficiencies in weldments, including rust, cracks and poor welding technique. (“Structural Welding Code for Steel,” AWS).

78007 STRUCTURAL PLATE PIPES & PIPE ARCHES
Recognize problems with soil-metal interaction systems such as deformations, joint slippage, settlements, and absence of connectors.
78008  DECK CONDITION SURVEYS  
Be familiar with tests required for concrete deck condition surveys, including chloride test and half-cell meter readings. Also know the type and use of instruments for determining deck lamination, locating rebars, and applicable nondestructive testing.

78009  MAINTENANCE-PRONE DETAILS  
Identify bridge details which accelerate maintenance needs.

78010  REQUIRED REPAIRS  
Be familiar with conventional repairs required to correct deficiencies found during inspections.

78011  CATASTROPHIC COLLISIONS & FIRE DAMAGE  
Recognize serious and hazardous effects of collision or fire damage.

78012  ADVANCED REPORT PREPARATION  
Review and organize inspection reports, drawings and exhibits. Review repair details and develop cost estimates.
**PERSONAL TALLY WORKSHEET**

Passed Work Elements in Bridge Safety Inspection

- Put a checkmark next to the appropriate work element number when you receive a passing score on your Examination Score Report.
- Put a “C” next to the appropriate work element number if you have crossover credit from another subfield. Read page 4 in this manual concerning crossover credit.
- Refer to the Examination Requirements Chart on page 5 to determine whether you have passed an exam requirement.

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*Those persons who passed work element number 76013 prior to its deletion in August 1990 will retain credit for it.*
SELECTED GENERAL REFERENCES

Primary References


Additional References

American Association of State Highway and Transportation Officials. Washington, DC.

American Concrete Institute. Detroit, MI
   o ACI Manual of Concrete Practice. 1993
      “Causes, Evaluation, and Repairs of Cracks in Concrete Structures” (ACI 224.1R-89).
      “Guide for Making a Condition Survey of Concrete in Service” (ACI 201.1R-92).
      “Guide for Repair of Concrete Bridge Superstructures” (ACI 546.1R-88).

American Institute of Steel Construction. Chicago, IL.
   o Iron and Steel Beams 1873 to 1952. 1981.

American Railway Engineering Association. Washington, DC.

American Red Cross. Washington, DC.

American Society of Civil Engineers. New York, NY.
American Welding Society. Miami, FL.

Federal Highway Administration. Washington, DC.
  o Inspection of Fracture Critical Bridge Members. 1986

Also, the following topics are covered on a video tape:
  o “Introduction to Inspection of Bridges”
  o “Inspection of Steel Truss Bridges”
  o “Inspection of Timber Bridges”
  o “Prestressed Concrete Bridge Inspection”

Order Video Tape #58 from:
  R&D Reports Center
  Federal Highway Administration
  6300 Georgetown Pike
  McLean VA 22101

Hool and Kinne.

Transportation Research Board. Washington, DC.
United States Coast Guard. Washington, DC.
  o Navigation Rules (GPO #050-012-00-205-3). 1983.

United States Department of Agriculture. Washington, DC.

United States Department of Labor. Washington, DC.

Zisher, J.W.

WARNING
On its website, NICET maintains a complete listing of references that are allowed in the paper-and-pencil testing centers. Please view the document “Reference Material Allowed in NICET Paper and Pencil Test Centers” at www.nicet.org/candidates/allowable_reference_material.pdf.

NICET does not stock these publications. You must contact the publisher directly for purchasing information.

This listing is not intended to be complete or representative.

We suggest in all cases that the most current edition of the publication be used.
**SAMPLE SCORE REPORT**

Exam No. 99999  
Examinee: JOHN EXAMINE

Test Date: 06/17/94  
Report Date: 07/11/94

### TRANSPORTATION ENGINEERING TECHNOLOGY

#### BRIDGE SAFETY INSPECTION

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Asterisks (*,**,***,***) indicate the number of times a work element has been failed. Additional information can be found on our website: [http://www.nicet.org/about/policies.cfm#policy20](http://www.nicet.org/about/policies.cfm#policy20).

**JOHN EXAMINE**  
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Alexandria, Virginia 22314-2714