



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

Transportation Engineering Technology

HIGHWAY DESIGN

PROGRAM DETAIL MANUAL

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

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

This manual may be freely copied in its entirety.

Field Code: 001
Subfield Code: 02

Fourth Edition
September 2004

IMPORTANT INFORMATION TO ALL CERTIFICANTS AND APPLICANTS

This fourth edition of the Highway Design program detail manual does not contain any substantive changes from the third edition. Only the following change has been made:

- o There is additional information on the posting of crossover credit.

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 April 1996 (reprint May 1997).

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

Once certified, you will be mailed an annual renewal bill each year (Read "Recertification Policy" below) . If the yearly payment is not made for three consecutive calendar years, the certificate "EXPIRES" (the certification record as well as all testing records applying to that certificate will be deleted) and certification can be regained only by reapplying as a new applicant and meeting the current criteria.

**PAYMENT OF
ANNUAL RENEWAL
BILL**

Payment of an exam fee does not substitute for payment of the annual renewal fee.

All certificants need to read Policy #30, "Continuing Professional Development," which is accessible via our website (www.nicet.org). 1998 will be the last year we will mail an annual renewal invoice. In 1999, all certificants will be subject to the Recertification Policy.

**RECERTIFICATION
POLICY**

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).

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

Individuals who wish to upgrade must satisfy any "new" exam or other certification requirements for the higher level once the deadline has been passed. This 4th edition manual does not inaugurate any program changes.

FIELD OF TRANSPORTATION ENGINEERING TECHNOLOGY

SUBFIELD OF HIGHWAY DESIGN

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GENERAL INFORMATION

This Program Detail Manual contains the information needed to apply for the NICET certification examination in the Highway Design 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).

This certification program was designed for highway design technicians who are engaged in the preparation of plans, specifications, and estimates for proposed highway construction projects.

This program became operational in 1979. Development of the program was initiated in 1976 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 design technicians have been broken down into discrete work elements which form the basis for an evaluation of the candidate's knowledge. Each work element is written in sufficient detail to permit candidates who have the appropriate work experience to make reasonable assumptions about the types of questions likely to be asked.

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

FIELD CODE AND WORK ELEMENT IDENTIFICATION NUMBERS

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

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

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

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

GENERAL WORK ELEMENTS

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

SPECIAL WORK ELEMENTS

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

The third, fourth and fifth digits identify the individual work element within each category. A sample of this numbering system is illustrated below for work element number 25001:

Technical Field Code:	001	(Transportation Engineering Technology)
Subfield:	2	(Highway Design)
Level/Type:	5	(Level III General)
Work Element Number:	001	

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 the 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 any level does **NOT** require prior certification at a lower level. The Examination Requirements Chart on page 3 shows how many work elements must be passed to meet the exam requirement at each level.

WORK ELEMENT SELECTION FOR AN INITIAL EXAM

1. Refer to the Examination Requirements Chart on the following page.
2. Select the appropriate box for the level of certification desired.
3. Note the number/type 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 a particular level. 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. 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 requested 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 candidates keep a copy of their filled out applications. This will assist in resolving questions over the telephone.

EXAMINATION REQUIREMENTS CHART

Subfield: Highway Design

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

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

Level I - General - 6
Level I - Special - 3

TOTAL 9

You must pass this many work elements to complete the **Level II** exam requirement
See Note a below

Level I - General - 8a
Level I - Special - 4
Level II - General - 9
Level II - Special - 3

TOTAL 24

You must pass this many work elements to complete the **Level III** exam requirement
See Notes a and b below

Level I - General - 8a
Level I - Special - 6
Level II - General - 9
Level II - Special - 5
Level III - General - 11
Level III - Special - 2

TOTAL 41

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

Level I - General - 8a
Level I - Special - 8
Level II - General - 9
Level II - Special - 8
Level III - General - 11
Level III - Special - 6
Level IV - General - 4

TOTAL 54

NOTES:

- Work Element #21007, "Basic Metric Units and Conversions", must be passed to achieve certification at Levels II, III, and IV.
- 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.
- Read very carefully the two sections applicable to Level IV certification in this manual before seeking Level IV certification.

GENERAL NOTES:

- Work elements passed which are in excess of the requirement at a particular level and 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 15 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 two for the initial examination apply to subsequent exams. In addition, the following should be understood:

1. It is not necessary to retest work elements which were failed on an earlier examination if there are other work elements in the appropriate categories which can be selected instead. If you need to retest a failed work element, you must wait 120 days from the last time you failed it before you will be permitted to test that element again. In addition, you will be blocked from signing up for a work element a fourth time **if it has been previously failed three times**. For further information, read Policy #20 ("Retesting of Failed Work Elements") on our website (www.nicet.org).
2. If an adequate number of work elements has been selected to meet the desired 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 field/subfield.

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 a subfield until you **test at least one work element** from that 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 (www.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 cautionary statement printed on the next page.
6. We will print and mail, free of charge, a **"Crossover Listing"** between any two subfields designated. This list is different from #5 above in that it is not printed for a specific examinee, but rather shows all current crossovers between the two specified subfields available to any examinee. See the website (www.nicet.org) for ordering information. The cautionary statement printed below needs to be understood.

7. Crossover credit will not be assigned to or from work elements if the certification is in Delinquent or Expired Status.
8. The same 120-day waiting period policy which applies to failed work elements (see item #1 at the top of page 4) also applies to all work elements which have crossover credit to that work element (read Policy #20 at www.nicet.org).

The work elements in the Highway Design program which provide generic crossover credit to other programs are identified in the Work Element Listing by a circumflex (^) after the work element number.

CAUTION

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

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

VERIFICATION OF WORK ELEMENTS

Verification should be provided by your direct supervisor. The verifier, by signing his or her initials, is signifying 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" situation.

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.

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

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**. The project selected for submission to NICET must show that you had senior-level responsibility on the project and that it included a majority of the various activities usually associated with the certification area. The project must be recent -- started and completed no more than four years prior to submission of the writeup. Do **not** submit the Level IV major project too early in your career in the certification area (after only 5 or 6 years, for example) -- it will not be reviewed.

The writeup for a highway design project should include such information as:

- 1. project type (interstate, primary, secondary, local)**
- 2. project size (length in miles of project, length of time worked on project)**
- 3. your supervisory responsibilities on the project; and**
- 4. the range of your experience on the project as related to geometrics, structures, drainage, pavements, traffic control, cross sections, etc.**

Your writeup 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. 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 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

As the NICET written examinations are designed for the individual who has already performed the work elements associated with the program, it is anticipated that preparation for this examination should be minimal.

SUPPORT MATERIALS FOR TESTING

The exam is open-book; therefore bringing standards, references, or textbooks to the exam is permitted (and encouraged). When appropriate, the work element description is rather specific in mentioning applicable standards or procedures.

When work elements are keyed directly to specific industry-wide standards, they will be identified by a normally-used notation at the end of the work element description. For this program, ASTM or AASHTO followed by a number refer to nationally recognized standards which should be familiar and available to all technicians working in the field. For testing purposes, the current version of standards shall be the most recent edition provided the edition was published at least one

year prior to the date of testing.

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

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

Highway Design

LEVEL I - GENERAL WORK ELEMENTS

(Work at Level I Is Performed Under Direct Supervision)

ID No. Work Element Title and Description

CORE WORK ELEMENT (See Note 1)

21007[^] BASIC METRIC UNITS AND CONVERSIONS
Understand basic metric (SI) units and perform conversions to and from metric units (E-380).

NON-CORE WORK ELEMENTS

- 21001* STANDARD PLANS AND SPECIFICATIONS
Use plans and specifications of standard jobs to determine dimensions, types of materials, elevations, slopes, densities, locations and other information. Calculate required information from dimensions, curves, angles and other data on plans and specifications.
- 21002 SYMBOLS AND NOTATIONS
Interpret standard map and drafting symbols; convert from ground to map or plan distances and dimensions, and vice versa; place station numbers and offsets; and use standard conversion equations effectively.
- 21003 TERMINOLOGY AND NOMENCLATURE
Know the standard terms and definitions used in specifications and in highway and road design.
- 21004 SIMPLE DESIGNS AND TRACINGS
Trace and draw simple designs using standard practice line widths and lettering, including standard title and location sheets, standard summary sheets, plans, profiles and survey notes, and estimated quantities. Perform mathematical computations necessary to provide quantity estimates and materials lists.
- 21005[^] BASIC DRAFTING
Recognize and describe standard manual drafting techniques. Describe the characteristics and proper usage of standard drafting equipment. (See basic technical drawing textbooks.)
- 21006* TOPOGRAPHIC MAPS
Read and use topographic maps. Determine ground distances and areas from maps. Determine elevations, differences of elevations and slopes. Determine direction of drainage from maps.
- 21008[^] BASIC COMMUNICATIONS SKILLS
Use proper punctuation, vocabulary, spelling, and sentence structure. Follow written instructions. (See basic grammar references.)
- 21009[^] BASIC MATHEMATICS
Solve mathematical problems requiring simple addition, subtraction, multiplication, 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.)

Note 1: General work elements can be categorized as either Core or Non-Core Work Elements. Work element #21007, "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 (pgs . 4 & 5).

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

21010^ 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

NOTE: The requirement for "Draft" or "Design Draft" at Levels I and II calls for combining sketches, plans and other information provided by supervisor and developing the drawings for the designated project. Except as specifically noted, calculation of engineering information is not required.

22001 HIGHWAY RAIL GRADE CROSSING

Draft a simple plan for construction or improvement of a rail grade crossing on a highway two or more lanes in width. Use information from sketches, survey notes, existing plans and specifications, instructions from supervisor or engineer, and from railroad sources.

22002 SIMPLE FENCE PROJECT

Design draft a plan for a simple fence project, including hardware. Use information from sketches, survey notes, property descriptions, existing plans and specifications, and instructions from supervisor or engineer.

22003 SIMPLE BOX CULVERT OR SLAB STRUCTURE

Design draft a plan for a box culvert, PC concrete slab, bituminous pavement or similar simple structure. Use information from sketches, survey notes, existing plans and specifications, manufacturers' data, and instructions from supervisor or engineer.

22004 PLOT CROSS SECTIONS

Plot and check basic cross sections from field book notes. Determine volumes of cut and fill and draft appropriate information properly.

22005 EARTHWORK QUANTITIES

Compute cut and fill and total borrow or spoil for a project. Use field book notes, cut and fill diagrams, or plan and profile sheets showing original and final grades and cross sections.

22006 SIMPLE STEEL BRIDGE MATERIALS LIST

Prepare and consolidate simple steel bridge materials lists by grades, sizes, and lengths. Use information from plans and specifications, instructions from supervisor or engineer, and lists of standard sections from an appropriate manual.

22007 SIMPLE REINFORCED CONCRETE BRIDGE MATERIALS LIST

Prepare and consolidate materials lists of concrete, steel reinforcing, dowels, joint materials, and curing compound for simple reinforced concrete bridge or box culvert. Use information from plans and specifications, instructions from supervisor or engineer, and manuals of concrete and reinforcing steel practice.

22008 SIMPLE BUILDING MATERIALS LIST

Prepare and consolidate lists of materials for a simple building. Use information from plans and specifications, instructions from supervisor or engineer, manufacturers' data, and architectural manuals and data.

22009 PLANS FOR A GUARDRAIL

Design draft plans for a simple guardrail. Use survey notes, existing plans and specifications, instructions from supervisor or engineer, and manufacturers' data.

LEVEL II - GENERAL WORK ELEMENTS

(Work at Level II Is Performed Under General Supervision)

- 23001* **COMPLEX PLANS AND SPECIFICATIONS**
Use complex plans and specifications to determine dimensions, types of materials, grades, slopes, cut and fill, surfaces, densities, and quantities.
- 23002 **DRAINAGE AREAS**
Determine drainage areas from survey data or topographic maps. Understand how to use contours. Prepare contoured section from survey notes. Outline drainage areas, determine areas in square feet, meters, or acres by grids, measurements with geometric figures or with planimeter.
- 23003 **LOAD AND CLEARANCE FACTORS**
Use federal, state and AASHTO load and clearance factors applicable to pavements and structures. Use specifications and standards issued by the agencies noted in conjunction with local requirements to identify the appropriate loadings and clearance factors to be used in designs of pavements and structures.
- 23004* **SAFE SPEEDS ON HORIZONTAL CURVES**
Calculate safe speeds for various horizontal curve situations. Determine curve data from designs and specifications.
- 23005* **SIGHT DISTANCES**
Calculate safe stopping sight distances and safe passing sight distances for traffic moving at designated speeds on vertical curves and screened horizontal curves.
- 23006 **COST AND MATERIALS ESTIMATING**
Utilizing plans drafted or prepared by others, prepare, check and present in proper format detailed cost estimates and bills of material.
- 23007 **LOCATION AND PROPERTY SURVEYS**
Utilizing plans, legal property maps, descriptions, and land surveys, review and check location and property surveys to be sure that plans correspond to property lines and that encroachments are noted.
- 23008 **COMPUTER APPLICATIONS FOR DESIGN AND ESTIMATING**
Know the capabilities and limitations of computers used for design and estimating. Prepare input in proper format for processing and use computer output and listings in the design and estimating process.
- 23009 **AS-BUILT PLANS**
Utilizing marked-up field plans from field inspections or results of personal inspection, prepare as-built plans with proper notations and in good standard format.
- 23010 **FUNDAMENTALS OF PHOTOGRAMMETRY**
Know how photogrammetry can be used in design. Understand the capabilities and limitations of photogrammetry and know how to obtain photo coverage from appropriate sources. Know photo scales and understand scale variations in aerial and terrestrial photos.
- 23011^**INTERMEDIATE MATHEMATICS**
Perform mathematical calculations using basic algebra (fundamental laws, algebraic expressions), geometry, and the trigonometric functions of right triangles. (See basic textbooks on algebra and trigonometry.)

LEVEL II - SPECIAL WORK ELEMENTS

NOTE: The requirement for "Draft" or "Design Draft" calls for combining sketches, plans and other information provided by supervisor and developing the drawings for the designated project. Except as specifically noted, calculation of engineering information is not required.

- 24001 INTERSECTION OF UNDIVIDED HIGHWAYS
Design draft an at-grade intersection of two-lane or wider highways. Accommodate free vision areas, traffic signs, and signals by utilizing information from survey notes, property surveys, existing plans and specifications, local governments, traffic specialists, and instructions from supervisor or engineer.
- 24002 RIGID PAVEMENT HIGHWAY SECTION
Design draft a plan for construction of a section of rigid pavement highway. Use information from survey notes, property surveys, existing plans and specifications, and instructions from supervisor or engineer. Also use results of soil tests, information on types of mixes and reinforcing, and subgrade information.
- 24003 FLEXIBLE PAVEMENT HIGHWAY SECTION
Design draft a plan for construction of a section of flexible pavement highway. Use information from survey notes, property surveys, existing plans and specifications, and instructions from supervisor or engineer. Also use results of soil tests, information on types of mixes, and subgrade information.
- 24004 CONCRETE MEDIAN BARRIER
Design draft a plan for construction of a standard median barrier of reinforced concrete with necessary provisions for glare shields and, if appropriate, provisions for slip-forming. Use information from survey notes, property surveys, existing plans and specifications, local governments, traffic specialists, and instructions from supervisor or engineer.
- 24005 NOISE BARRIER
Design draft a plan for construction of a noise barrier per dimensions and type specified by the engineer to include depth and type of supports, anchors, etc. Use information from survey notes, property surveys, existing plans and specifications, local governments, traffic specialists, and instructions from supervisor or engineer.
- 24006 SINGLE-SPAN STEEL GIRDER BRIDGE
Design draft plans for construction of a single-span steel girder bridge. Use information from survey notes, property surveys, existing plans and specifications, and instructions from supervisor or engineer. Also use information on types and dimensions of steel, fastenings, seatings, falsework (if specified in plans), deck, etc.
- 24007 SINGLE-SPAN REINFORCED CONCRETE BRIDGE
Design draft plans for construction of a single-span reinforced concrete bridge. Use information from survey notes, property surveys, existing plans and specifications, and instructions from supervisor or engineer. Also use information on types of mixes and reinforcing, diaphragms, joints, surface finishing, forming requirements, deck surface, curing, etc.
- 24008 DRAINAGE DITCH AND DRAINAGE STRUCTURE
Design draft plans for construction of a drainage ditch and drainage structure. Use information from survey notes, property surveys, existing plans and specifications, instructions from supervisor or engineer. Also use results of soil tests and information on slopes, gradient, lining, bedding of structure, backfill, etc.
- 24009* FIELD SURVEY REQUEST
Draft a survey request in sufficient detail to permit a field survey party to obtain the required information.
- 24010 SOIL BORINGS REQUEST
Draft a soil borings request in sufficient detail to permit a field boring party and subsequent laboratory personnel to obtain and provide the required information.

LEVEL III - GENERAL WORK ELEMENTS

- 25001 **BID PROPOSAL FOR A STANDARD PROJECT**
Coordinate a complete bid proposal for a standard project, including adequate provisions for compliance with all federal, state, local and AASHTO requirements, cost estimates, time estimates and bidding procedures. Compile all pertinent information from appropriate sections, use standard specifications and special provisions pertaining to project. Obtain approval of engineer-in-charge and make changes and modifications as directed.
- 25002 **BID REVIEWS**
Receive bids generated by competitive or negotiated bidding procedures. Check for prequalifications in required operations; accuracy of unit cost extensions; compliance with contractual provisions; past record of compliance and performance by bidders; and validity of signatures and certificates. If no prequalification exists, check financial stability; experience of key personnel; reputation on previous work; adequacy of equipment and supply sources. Prepare summary of findings for further review by the engineer-in-charge, after coordination with other sections.
- 25003 **COORDINATE FINAL PLANS PREPARATION**
Coordinate all activities in preparation of final plans and specifications for a complex project. Activities include assignment of an adequate number of properly skilled personnel and assurance that materials are prepared properly (are reproducible, have required number of copies, have proper signatures, have any necessary addenda attached) and are delivered to the proper distributing agency. The quality of drafting, compliance with deadlines, completeness of detail, and inclusion of standard provisions should be assured.
- 25004 **CONTRACTS, BONDING, AND LEGAL PROVISIONS**
Understand consultant and construction contracts, contractor bonding requirements and requirements for inclusion of EEO, Davis-Bacon and OSHA provisions. Check amounts of required bonds; know special conditions surrounding consultant contracts; know appropriate area and tables for Davis-Bacon rates.
- 25005 **PLANS-IN-HAND INSPECTION**
Assist designated engineer in performance of plans-in-hand inspection of a project. Check feasibility of contractual requirements, utility agreements and locations of utilities, and items covered by guarantees or maintenance bonds. Note and record changes.
- 25006 **CONSULTANT-PREPARED PLANS**
Assist in determining full compliance with consultant agreement and agency requirements on plans and specifications prepared by consultants. Work with consultant representative to assure inclusion of all needed information, certificates, bonding requirements, and special programs, in final plans and specifications.
- 25007 **RELOCATION OF UTILITIES AND RAILROADS**
Assist in complying with agency requirements and law in development of the required ownership agreements and worksheets. Work with representatives of utilities or railroads to insure safety, compliance with bonding and special programs requirements, and adequacy of final agreements. Check costs to assure adherence to existing procedure and validity.
- 25008 **AERIAL PHOTOGRAPHIC COVERAGE**
Use topographic maps to lay out proposed flight lines needed to permit adequate aerial photographic coverage for preparation of plans. Be familiar with flight altitudes, focal lengths of cameras, overlap and side-lap, average scales of photography. Provide for adequate width of coverage to permit flexibility in corridor location and route alignment.
- 25009 **PERMIT APPLICATIONS**
Review and process permit applications from utilities or land developers. Determine compliance with requirements for safety, load limits, clearance limitations, interruption of traffic, payment of costs involved, free vision, limited access and local, state or federal laws or regulations. Prepare permit with full information for signature by designated authority.

- 25010 SHOP AND ERECTION DRAWINGS FOR A STEEL STRUCTURE
Review shop drawings to assure compatibility with contract requirements for types of steel, dimensions, fastenings, and finishing.
- 25011 SOIL BORING DATA
Receive reports of soil borings and tests performed as basis for highway design. Assist in determining adequacy of information provided and be certain that information resolves any doubts as to stability of section, bearing capacity, need for borrow and removal of unsuitable soils. Obtain engineer approval of findings and request additional borings or tests if required.
- 25012^ 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.)
- 25013 MATERIALS SPECIFICATIONS
Compile all specifications that pertain to materials on project. Compare specific specifications to certificates and general project plans and specifications. Verify compliance with required strengths, protection, durability and installation standards to assure economical use of proper materials.

LEVEL III - SPECIAL WORK ELEMENTS

NOTE: The requirement for "Draft" or "Design Draft" calls for combining sketches, plans and other information provided by supervisor and developing the drawings for the designated project. Except as specifically noted, calculation of engineering information is not required.

- 26001 SIGNALIZED DIVIDED HIGHWAY INTERSECTION
Design draft a divided highway intersection with signalization in accordance with good standard practice. Use information from survey notes, existing plans and specifications, traffic surveys, manufacturers' specifications and manuals, and instructions from supervisor or engineer.
- 26002 SIMPLE DIAMOND OR CLOVERLEAF INTERCHANGE
Design draft a simple diamond or cloverleaf interchange in accordance with good standard practice. Use information from survey notes, existing plans and specifications, traffic surveys, manufacturers' specifications and manuals, and instructions from supervisor or engineer.
- 26003 MULTI-SPAN STEEL GIRDER BRIDGE
Design draft plans for a multi-span steel girder bridge in accordance with good standard practice. Use information from survey notes, existing plans and specifications, traffic surveys, manufacturers' specifications and manuals, foundation data, stream flow data and standard design practice (normally furnished by engineers or from standard practice manuals), and instructions from supervisor or engineer.
- 26004 MULTI-SPAN REINFORCED CONCRETE BRIDGE
Design draft plans for a multi-span reinforced concrete bridge in accordance with good standard practice. Use information from survey notes, existing plans and specifications, traffic surveys, manufacturers' specifications and manuals, foundation data, stream flow data and standard design practice (normally furnished by engineers or from standard practice manuals), and instructions from supervisor or engineer.
- 26005 REST AREA
Design draft a rest area in accordance with good standard practice. Use information from survey notes, existing plans and specifications, traffic surveys and manufacturers' specifications and manuals, and instructions from supervisor or engineer, plus information on grading, water and waste systems, sodding and seeding, and structural data on buildings.

- 26006 EARTHWORK BALANCES/MASS DIAGRAM
Prepare necessary input data for delivery to computer programmers and processors. Use data from field surveys; soils tests and borings; alignment, slopes, grade and density requirements; instructions from supervisors; standard practice manuals; and weight limit requirements. Receive output from computer and determine adequacy for design of the required project
- 26007 DRAINAGE STRUCTURES AND SEWERS
Prepare necessary data for delivery to computer programmers and processors. Use data from field surveys, topographic maps, rainfall records, runoff estimates, size of drainage basin, and hydraulic characteristics of structures (with full coordination with the engineer). Receive output from computer and determine adequacy for design of the required project.
- 26008 MULTI-SPAN BRIDGE SAFETY RATING
Evaluate the safety rating for a multi-span bridge (for engineer review and approval). Use results of field inspection, proper tables and references, plans of structure, and personal investigation of bridge condition.

LEVEL IV - GENERAL WORK ELEMENTS

NOTE: Certification at Level IV requires that you have occupied a senior position of responsibility throughout the duration of at least one major highway design project. There are no exceptions to this requirement.

- 27001 BID PROPOSAL FOR A COMPLEX PROJECT
Establish effective working relations within unit and with units involved with similar work, as well as with consultants, suppliers, government agencies, and municipalities to insure timely completion of all phases of the project. Assure smooth flow of information and work between units, consultants working on project, and suppliers and testing agencies. Assure incorporation of needs of using agencies and comply with applicable laws pertaining to project and determine special requirements of a complex nature. Obtain approval of engineer-in-charge to make changes and modifications.
- 27002 DESIGN PROJECT RESPONSIBILITY
Assist in establishing an orderly and effective system to perform design projects and to account for costs at each step of operation. Compile cost records to permit analysis of the design function. Maintain running status report and document evaluation of effectiveness and productivity of personnel working on the project. Safeguard and assure good condition of materials and equipment and operate within requirements of agency, state, local and FHWA technical and administrative programs.
- 27003* EFFECTIVE WORKING RELATIONS
Establish effective working relations within unit and with units employed on similar work, as well as with consultants, suppliers, government agencies, and municipalities to assure timely completion of all phases of the project. Assure smooth flow of information and work between units, consultants working on project, and suppliers and testing agencies. Assure needs of using agencies and compliance with regulations and laws.
- 27004 QUALITY ASSURANCE
Assist in assuring the quality of all work performed or supervised. Provide adequate documentation and effective transmittal of information.
- 27005 ENGINEERING AND ENVIRONMENTAL REPORTS
Gather, evaluate, consolidate and collate comprehensive information on the required engineering and environmental matters from all appropriate sources. Consult with persons in agencies or offices pertinent to the matters concerned.

Assist in preparing engineering cost estimates and note alternative courses of action with comparative costs. Provide monitoring and reporting schedules and provide for utilization of computer programs to monitor data base of engineering, fiscal and manpower in effective manner.

PERSONAL TALLY WORKSHEET

Passed Work Elements in Highway Design

- o Put a checkmark next to the appropriate work element number when you receive a passing score on your Examination Score Report.
- o Put a "C" next to the appropriate work element number if you have crossover credit from another subfield.

Level I	Level I	Level II	Level II	Level III	Level III	Level IV
<u>General</u>	<u>Special</u>	<u>General</u>	<u>Special</u>	<u>General</u>	<u>Special</u>	<u>General</u>
__21001	__22001	__23001	__24001	__25001	__26001	__27001
__21002	__22002	__23002	__24002	__25002	__26002	__27002
__21003	__22003	__23003	__24003	__25003	__26003	__27003
__21004	__22004	__23004	__24004	__25004	__26004	__27004
__21005	__22005	__23005	__24005	__25005	__26005	__27005
__21006	__22006	__23006	__24006	__25006	__26006	
__21007(Core)	__22007	__23007	__24007	__25007	__26007	
__21008	__22008	__23008	__24008	__25008	__26008	
__21009	__22009	__23009	__24009	__25009		
__21010		__23010	__24010	__25010		
		__23011		__25011		
				__25012		
				__25013		

SELECTED GENERAL REFERENCES

Annual Book of ASTM Standards. American Society for Testing and Materials. West Conshohocken, PA.

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

A Policy on Geometric Design of Highways and Streets. American Association of State Highway and Transportation Officials. 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.

Standard Specifications for Highway Bridges. American Association of State Highway and Transportation Officials. Washington, D.C.

- o **This listing is not intended to be complete or representative.**
- o **We suggest in all cases that the most current edition of the publication be used.**



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EXAMINATION SCORE REPORT

SAMPLE

Exam No. 99999

Examinee: JOHN EXAMINE

Test Date: 06/17/95

Report Date: 07/11/95

Work Element Number and Title

Score (%) Pass/Fail

HIGHWAY DESIGN

1021001	Standard Plans and Specifications	70	P
1021003	Terminology and Nomenclature	80	P
1021006	Topographic Maps	100	P
1022002	Simple Fence Project	50	F**
1022004	Plot Cross Sections	80	P
1022007	Simple Reinforced Concrete Bridge Mater	100	P
1023003	Load and Clearance Factors	75	P
1023006	Cost and Materials Estimating	20	F***

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

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