

Video **S**ecurity **S**ystems **D**esigner NICET

Level I Certification Content Outline

National
Institute for
Certification in
Engineering
Technologies



Introduction

The purpose of this certification program is to recognize the professionalism of qualified designers and provide a way for others to distinguish those designers who have demonstrated job knowledge and work experience. NICET will do this by defining and testing relevant knowledge and evaluating experience.

This document presents the content that is covered in the examination and other criteria for certification as a Video Security Systems Designer at Level I. This program is based on an analysis of the tasks that are performed by a competent designer. The content outline is a listing of tasks that should be performed well by a Level I certified Designer. Also included are knowledge and skills needed to succeed at each task. These tasks are the focus of the test questions that make up the Level I exam.

The tasks are grouped into larger areas of responsibilities, or “domains”. The domains are:

- Identify Customer Needs and Project Objective
- Conduct Site Assessment
- Lay out System
- Prepare Proposals, Contracts, and Documentation
- Plan and Conduct User Training
- Project Management

A general description or profile of a Level I Designer includes the following characteristics:

Education: Formal education not required, but educational experiences equivalent to at least a high school diploma, with coursework or other experiences that develop knowledge of algebra, trigonometry, basic electronics, business and technical English, and published technical and legal standards.

Work Experience: A minimum of two years of related work, one year of which must be specifically involved with plan preparation and related activities for types A and B video systems. Up to one year may be involved with the planning or installation of other low-voltage electronic or optical systems. (An Electronics Associates Degree from an ABET accredited program may be substituted for 18 months of work experience.)

Responsibility: With general supervision, develop plans for types A and B video systems. Interact with installer to assure proper completion of job. Obtain assistance or approvals as needed.

Acquired Competencies: Interface with customer and perform needs assessment and site survey for types A and B video systems. Calculate parameters, prepare plans and other documentation, and select and order components and materials. Insure that the customer is adequately trained in the proper use of the system.

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Tasks Performed by the Level I Designer *(Designs Types A and B Systems)*

1.1 “Identify Customer Needs and Project Objective” Tasks

1.1.1 Determine the applicability of CCTV to the client’s needs.

Knowledge:

CCTV terminology related to the purposes of the system, including deterrence, observation, interdiction, documentation, and communication

Equipment characteristics or parameters that are most important in determining usefulness for various applications

CCTV functions that can trigger, or be triggered by, alarms, HVAC, or intercom

Functions performed by and the capabilities of Types A and B CCTV equipment

Skills:

Communicate clearly.

Propose CCTV applications where appropriate based on client’s description of the situation and concerns.

Keep an accurate record of discussions with clients and suppliers.

1.1.2 Identify the costs and benefits of implementing a CCTV system in a particular situation.

Knowledge:

How each type of CCTV application (deterrence, observation, interdiction, documentation, and/or communication) can save money, reduce risk, or otherwise generate an overt benefit to a client

Skills:

Estimate the cost savings and other benefits from applying CCTV to the client’s situation.

Locate and use business and government information descriptive of problems in particular settings that could be reduced by an appropriate CCTV application.

Estimate the costs of CCTV system equipment, installation, operator training, and maintenance.

Estimate a projected return-on-investment timeline.

Keep an accurate record of discussions with clients and suppliers.

1.2 “Conduct Site Assessment” Tasks

1.2.1 Determine the size, structure, electrical system, and overall layout of the facility.

Knowledge:

Properties of building structural and surface elements and materials relevant to placement of CCTV equipment

Structural and electrical factors that can affect video signals in cables and fiber

Skills:

Recognize relevant building structural supports, surfaces, spaces, and materials (such as steel beams, wood beams, lighting poles, dry wall, cinder block walls, hanging ceilings and the spaces above them, cable trays, size and shape of indoor and outdoor spaces, etc.), and identify their impact on the placement of CCTV equipment.

Read and interpret construction and floor plans.

Identify potential sources of transmission interference.

Identify sources of electrical power.

Identify available existing conduit.

1.2.2 Identify potential locations for cameras.

Knowledge:

Spatial, support/mechanical, and electrical requirements of various components of cameras and housings

Relationships between camera sensitivity, lens functions, and requirements for illumination

Mathematical relationship that determines the field of view dimensions (width, height) from the imager format (horizontal, vertical), distance to the target, and focal length of the lens

Horizontal and vertical formats of common camera formats (1/4", 1/3", 1/2", 2/3", and 1")

Day/night and seasonal variances in lighting and temperature and how they can affect camera function

Meaning of each of the following terms and, where appropriate, how each is measured:

- Manual and auto iris
- f-stop
- Object distance
- Depth of field
- Focal Length
- Field of view
- Lens and imager format
- Resolution
- Lux
- Backlight

Skills:

Read and interpret construction and floor plans.

Identify ways in which the site environment can affect camera function.

Determine the type of lighting (point v. diffuse, direction) at the site and use a light meter to determine light levels.

Use an optical viewfinder to check field of view.

Use a lens field-of-view calculator.

1.2.3 Identify potential locations for CCTV video, alarm, and data transmission/distribution equipment.

Knowledge:

Spatial, environmental, mechanical, and electrical requirements of various CCTV video, alarm, and data components

Skills:

Recognize relevant building structural supports, surfaces, spaces, and materials (such as steel beams, wood beams, lighting poles, dry wall, cinder block walls, hanging ceilings and the spaces above them, cable trays, size and shape of indoor and outdoor spaces, etc.), and identify their impact on the placement of equipment.

Recognize equipment locations appropriate for the application.

Read and interpret construction and floor plans.

Identify potential sources of problems with candidate sites.

1.2.4 Identify potential locations for head-end equipment.

Knowledge:

Spatial, environmental, ergonomic, mechanical, and electrical requirements of various CCTV head-end components

Skills:

Recognize relevant building structural supports, surfaces, spaces, and materials (such as steel beams, wood beams, lighting poles, dry wall, cinder block walls, hanging ceilings and the spaces above them, cable trays, size and shape of indoor and outdoor spaces, etc.), and identify their impact on the placement of CCTV head-end equipment.

Identify closets for cable termination and related equipment.

Identify appropriate space for cabinets to house head-end equipment.

Read and interpret construction and floor plans.

Identify potential sources of problems with candidate sites.

1.2.5 Identify cable path options between potential equipment locations.

Knowledge:

Cabling considerations and limitations of wire ways, conduit, and ducts

Situations that require trenching or burying of cables

NFPA/NEC code requirements for CCTV

Types of wiring that may be used for CCTV installations, how each may be bundled, and when each should be shielded or grounded

Skills:

Use measuring wheel and other measuring tools to estimate distances.

Determine local jurisdiction requirements for cable placement.

Identify specific requirements for NFPA/NEC codes as they relate to cable installations for CCTV.

1.2.6 Prepare site assessment notes.

Knowledge:

What site observations need to be recorded

Skills:

Communicate clearly in writing and graphically.

Document on a floor plan and riser diagrams the potential locations for transmission equipment and cable paths, head-end devices, and cameras.

Record site information relevant to system planning, installation, and equipment.

1.3 “Lay out System” Tasks

1.3.1 Determine which features of the facility impact this project.

Knowledge:

Characteristics of Types A and B system components that best suit them to particular applications and environments

Configuration of building and site structures as related to cable routing requirements and equipment mounting

Lighting characteristics as they apply to equipment selection and placement

NFPA/NEC

How the usage of the facility impacts the project design

Skills:

Evaluate how building structures, spaces, and usage together with lighting and other relevant aspects of the facility are likely to affect the design of a system to meet the client’s purpose or purposes.

Determine space requirements for operator consoles and/or control equipment.

Read and interpret technical specifications.

Determine whether system objectives can be achieved with given technical limitations and identify specific shortcomings.

Develop elements of design that will overcome technical limitations in selected components.

1.3.2 Identify legal, regulatory, and privacy concerns.

Knowledge:

Recommendations contained in the “CCTV for Public Safety Report,” published by SIA

Sources of information on laws, regulations, and guidelines related to video systems

Skills:

Recognize practices that would increase or diminish the likelihood that recorded video would be accepted as evidence in a legal proceeding.

Research and abide by local regulations associated with CCTV systems.

Perform research and communicate with appropriate individuals to formulate and answer legal, regulatory, and privacy questions.

1.3.3 Prepare preliminary plans for types A and B systems, including block diagrams and related information.

Knowledge:

Lighting requirements of cameras and applications

Conventional use of symbols in block diagrams

Power and signal pathways to, from, and between system components that are required for various functions

Skills:

Determine the quantity and types of system components necessary for the application and the critical characteristics of each.

Select locations for equipment placement.

Graphically represent these components and the power and signal connections to be made to, from, and between them.

Identify the influence of environmental factors upon equipment selection choices.

Collect product data from various manufacturers for use in design process.

1.3.4 Select cameras, lenses, and housings.

Knowledge:

Terminology associated with Types A and B cameras, lenses, and housings, including power, depth of field, focus, sensitivity, resolution, and PTZ controls, power and signal connections, components of composite video signals, and purposes/functions

Device characteristics best suited to various applications

Skills:

Recognize factors in either the client’s requirements or in the built or natural environment that place limitations or specific requirements on cameras and housings.

Select the optimal equipment for the application, quality requirements, facility, environment, system compatibility and interface requirements, and cost limitations, using manufacturers’ specifications and other resources.

Plan for future expansion requirements.

1.3.5 Select video cables, fiber, connectors, transmission devices, and surge/lightning protection devices.

Knowledge:

Terminology associated with cables, fiber, and transmission devices for Types A and B systems, and their purposes and functions

Capabilities and limitations of various transmission methods

Surge and lightning protection requirements

NFPA/NEC

Skills:

Recognize system characteristics that create limitations or specific requirements for transmission.

Select the optimal cables and transmission equipment for the application, facility, environment, system compatibility and interface requirements, NEC requirements, and cost limitations, using manufacturers' specifications and other resources.

Calculate proper coax and power wire sizes.

Select proper surge/lightning protection capacities for the equipment and the environment.

Plan for future expansion requirements.

1.3.6 Select head-end devices including monitors, recording devices, and controllers.

Knowledge:

Terminology associated with Types A and B head-end devices, controls, power and signal connections, and their purposes and functions

Device characteristics best suited to various applications

Skills:

Plan for future expansion requirements.

Recognize factors in either the client's requirements or in the built or natural environment that place limitations or specific requirements on head-end devices.

Estimate storage time on recording media for VCRs and DVRs.

Select the optimal equipment for the application, quality requirements, facility, environment, system compatibility and interface requirements, and cost limitations, using manufacturers' specifications and other resources.

1.3.7 Review preliminary plan against objective, budgets, and limitations.

Knowledge:

Plan elements to be reviewed, and how each type of CCTV application (deterrence, observation, interdiction, documentation, and/or communication) can save money, reduce risk, or otherwise generate an overt benefit to a client

Skills:

Compare the preliminary plan with the customer's or specifier's needs and objectives and the site assessment.

Formulate and consider alternate methods.

1.3.8 Lay out video, power, and control paths and conduits.

Knowledge:

Technical requirements for power, control, and video signal transmission

Capabilities of various transmission media in terms of bandwidth, path loss and distance limitations, and shielding and grounding requirements

Meanings and applications of the following terms:

- impedance
- loop resistance
- watt
- volt
- ampere
- volt-amp
- ohm
- decibel
- hertz

Conduit fill schedules, bend radii, and application of NEC

Basic applications of multi-mode fiber optic equipment as related to CCTV

Wiring specifications

Skills:

Use Ohm's Law to calculate voltage, current, and resistance, and perform power calculations.

Calculate path losses in coax cable, fiber, and RF modulated systems, including connectors.

Calculate circular cross-sections and conduit fill percentages.

Read and interpret manufacturer's specification materials.

Prepare a floor plan showing device location and cable routing.

Record equipment specifications and note interconnectivity and cable requirements on the block diagram.

1.3.9 Compile a list of Materials.

Knowledge:

Terminology of system components, cables, hardware, and miscellaneous materials

Skills:

Compile a list of video components required to meet the project objectives.

Determine the quantity of items of supporting hardware and miscellaneous materials (including rings, wire mold, conduit, tie-wraps, wire management, connectors, power strips, etc.) required for the system as laid out in the preliminary plan.

1.3.10 Prepare final plans and drawings.

Knowledge:

How to present symbols and scales on floor plans

How to layout a clear system diagram/schematic

Skills:

Prepare sufficiently detailed plans to facilitate an efficient installation, including a complete layout, correctly scaled and dimensioned, including or referencing component information, and a proper legend.

Verify the requirements and limitations of the equipment to properly size wiring and place devices.

1.3.11 Lay out consoles.

Knowledge:

EIA racking standards

Ergonomic and mounting considerations for head-end equipment

Skills:

Read and interpret manufacturers' specification materials to determine component dimensions and view angles for monitors.

Prepare proper console drawings including monitor and controller locations, mounting and power requirements, and cable management.

1.4 “Prepare Proposals, Contracts, and Documentation” Tasks

1.4.1 Prepare a formal bill of materials for a system installation.

Knowledge:

Product information that is required to specify a component for purchasing

Skills:

Given a list of materials for a project, prepare a well-organized and properly formatted bill of materials.

1.4.2 Determine labor and other installation costs.

Knowledge:

Meanings and applications of the following estimating concepts:

- Takeoffs
- Burden
- Profit margin (vs. mark-up)
- Overhead
- Shop supplies

Types of installation methods used for CCTV, coaxial cable, twisted pair, optical fiber, microwave, and wireless, and their impact on labor costs

Impact of factors such as the following upon installation costs:

- Equipment rentals
- Subcontracts
- Hard walls/ceilings or adverse conditions
- Second or third shift work
- New product learning curve
- Programming
- Occupied facilities
- Warranty
- Freight
- Licenses, permits, taxes
- Restrictions on access to premises
- Safety hazards

Skills:

Determine what special factors or circumstances may affect a particular installation and the costs involved.

Determine the labor costs of various installation procedures in various circumstances.

1.4.3 Prepare proposals and complete contracts for system planning and installation.

Knowledge:

Effects of factors such as material pricing, taxes, markups, insurance and bonding requirements, etc., upon the final project price

Elements to be contained in a proposal

Terminology and elements to be contained in a contract

Basic vocabulary and grammar of business English

Skills:

Communicate in writing the functions to be performed by a system, and how it will meet the needs of the client.

Determine the total cost of labor, materials, and other factors such as taxes, markups, insurance and bonding requirements, etc.

Define the scopes of work to be performed by the owner, other trades, and the contractor preparing the proposal.

Work with the client and other company personnel to determine and write-up terms and conditions.

Read and interpret standard contracts.

1.4.4 Prepare contracts with subcontractors and orders with outside vendors.

Knowledge:

What should be covered in a contract with a subcontractor

Terms and conditions that could be placed on an order or subcontract, including payment terms, freight terms, delayed delivery, quantity breaks, back orders, restocking charges, etc.

Skills:

Evaluate the impact of subcontractor/vendor activities and schedules on your project.

State clearly what is to be provided by the subcontractor and/or vendor and a timeline for completion.

Read and interpret standard contracts.

1.4.5 Obtain permits.

Knowledge:

Activities, locations, and types of projects that are likely to require permits

Skills:

Determine specific state and local permit requirements.

Collect the information required for the permits.

Determine and follow the correct procedures for obtaining, displaying, and closing permits.

1.5 “Plan and Conduct User Training” Tasks

1.5.1 Determine training needs of end-user personnel.

Knowledge:

Roles of operators (people who use the system), administrators (who set up or program the system), and maintainers (who perform prescribed periodic maintenance functions) of CCTV systems

ADDIE training model as defined in “Teach SMEs to Design Training” by the American Society for Training and Development

Skills:

Determine existing skills and limitations, including technical knowledge, communication ability, and experience, of site personnel.

Determine who will be trained in system set-up and operating functions to ensure that the system can be operated to meet its objectives and to minimize the need for future support.

Determine what end-user maintenance functions are required/recommended for the system.

1.5.2 Plan training session and prepare outline and materials.

Knowledge:

CCTV systems’ operational functions

ADDIE training model as defined in “Teach SMEs to Design Training” by the American Society for Training and Development

Skills:

Determine the system’s capabilities relevant to the customer’s needs.

Determine the contents of manufacturers’ manuals.

Collect manufacturers’ instruction manuals and other reference resources and highlight or tab key elements.

Prepare an outline of the steps involved in each operation.

Adapt training plans to available facility.

Arrange for personnel and facility availability and access to equipment.

Minimize potential distractions.

1.5.3 Conduct training session.

Knowledge:

Common mistakes made when using CCTV systems

Reference sources, including what information is available from system documentation, online help, and telephone support, and how to access each

ADDIE training model as defined in “Teach SMEs to Design Training” by the American Society for Training and Development

Skills:

Explain the meaning of terminology to be used.

Clearly describe the equipment and functions to be learned.

Deliver lecture, demonstration, discussion, on-the-job training, web-based, hands-on, programmed/sequential, simulation, games, group, role-playing, case-study, and exercises/tests as appropriate.

Demonstrate the functions on the equipment utilizing the training outline.

Coach the student while he/she performs the task.

Coach the student in recovering from mistakes.

Clearly describe the indicators of unacceptable performance of the system and the appropriate response.

Review with the student the various references that are available to answer future questions such as manufacturer’s instructions manuals, tech support numbers, web sites, etc.

Respond appropriately and accurately to the student’s expressed concerns and questions.

Provide positive reinforcement and motivational incentives.

1.5.4 Evaluate effectiveness of training.

Knowledge:

Types and level of knowledge required for proper system operation, administration, and end-user maintenance

ADDIE training model as defined in “Teach SMEs to Design Training” by the American Society for Training and Development

Skills:

Recognize and correct errors.

Observe and evaluate student performance to determine what portions of the training should be repeated, restated, or reinforced.

Recognize sufficient mastery of skills as well as the need for additional training.

Report results to appropriate party as needed.

Evaluate the effectiveness of training methods and presentation by noting feedback from students, student performance, and follow-up.

1.6 “Project Management” Tasks

1.6.1 Review and finalize workforce requirements for the project.

Knowledge:

Sequence of tasks required for a typical Type A or B system project

Skills:

Recognize the variations in the tasks and the skills required for a particular Type A or B project.

Select the workforce capable of accomplishing the work required for a particular Type A or B project.

Develop an estimate of the time required for each task and the total labor hours required for the project.

1.6.2 Procure and schedule materials.

Knowledge:

Significance of and how to obtain information for lead time on delivery, tracking and delivery for drop shipments, and documentation required for billing and pay applications for all components needed for the project

Skills:

Obtain proper part numbers and complete the order.

Identify a tracking number.

Utilize shipping information to determine product arrival time.

1.6.3 Supervise and coordinate subcontract agreements.

Knowledge:

How to determine the work expected of all parties under contract to your company

Skills:

Plan the work with the subcontractor.

Use visual inspection during site visits and communication with the installation team to verify that work has been done in an orderly fashion as stated in project documents.

Inform the subcontractor of any shortfalls or changes in expectations.

1.6.4 Coordinate with other trades on project.

Knowledge:

Roles of other trades, and the chain of command on the project

Purposes of project meetings

Skills:

Monitor progress by other trades and determine any impact on your company's work and update schedule.

Effectively plan and conduct project meetings.

Communicate clearly in writing and verbally to determine and record progress.

1.6.5 Develop and monitor the timeline for the project.

Knowledge:

Sequence of tasks required for a typical Type A or B system project

Skills:

Assemble a task sequence and a time-driven critical path schedule for a Type A or B project.

Recognize changes in schedules in the tasks required for a particular Type A or B project.

Review the time required for each task and the total labor hours required for the project and possible alternative procedures.

Determine inspection requirements and schedules.

Record, adjust as needed, and communicate the timeline.

1.6.6 Develop budget.

Knowledge:

Know how all the material and labor accounts for the project combine into a total budget.

Know how to allocate costs of the project to various phases of the job, such as rough-in, cable pulling, field device, head-end termination, testing/commissioning, etc.

Skills:

Develop procedures for recording spending on each phase of the project over time.

Organize budget information into a well-formatted spreadsheet, including estimated and actual costs and variances.

Communicate clearly in writing and verbally to gather and present budget information.

1.6.7 Monitor the budget, including labor, material, and funds.

Knowledge:

Source materials for project budget information

Addition, subtraction, multiplication, division, and calculation of percentages

Bookkeeping significance of income and expenses, beginning and current balances, labor hours, materials purchased, funds available, and funds expended

Skills:

Determine expended labor, materials, and other costs and the expenses remaining for the project.

Identify possible cost-savings, including outsourcing, and value-added engineering.

Read and interpret a budget in spreadsheet format.

1.6.8 Confirm that the system has been installed in a professional manner and that operation and performance meet the specifications in the proposal.

Knowledge:

What manufacturers' product information relates to installation requirements for mounting and termination of all equipment

Skills:

Use manufacturers' product information to determine the installation requirements for mounting and terminating the proposed system.

Verify that components are level and that rack-mounted components are secure.

Verify that connectors are secure and that wires are neatly bundled and labeled.

Verify that the system is operational and meets the customer's needs as expressed in the proposal.

1.6.9 Develop a maintenance plan for the system.

Knowledge:

Factors that can reduce the expected or remaining lifetime of CCTV equipment

Skills:

Locate the system contract and subsequent change orders to identify the value of a new installation and the potential liability in providing a maintenance agreement.

Request a survey of an existing system to identify its value and the potential liability in providing a maintenance agreement.

Develop an inventory of the equipment to be covered by the plan, including the cost of each covered component.

Determine all costs involved in having a piece of failed equipment repaired, or in replacing it, and decide upon a preferred strategy.

Estimate other costs related to training, support, troubleshooting, etc.

Estimate the expected total costs over the term of the plan and determine an appropriate maintenance factor and price to offer the client.

Appendix A: System Classification

The following are some of the types of equipment and system characteristics that delineate “Type A,” “Type B,” and “Type C” systems, as they are used in this content outline.

Type A Systems

These are basic systems with standard components, low bandwidth transmission, and menu-driven set-up, such as:

Multiplexer/VCR

Quad/VCR

Digital video recorders with time/date, play/record, and anti-tamper functions

Sequential switch

Single keyboard

Indoor/outdoor

Standard cable runs not requiring repeaters or amplifiers (less than 750 ft. for coaxial; less than 1500 ft. for twisted pair)

Type B Systems

These systems can include specialized components, programmable controls, and high-bandwidth transmission, such as:

PTZ

Multiple keyboards

Matrix interfaced with alarms, A/C, or intercom (GPI or dry contact)

Digital video recorders with programmable, alarm-based resolution and frame rate

Fiber transmission systems

Low light

Long cable runs

Covert or portable systems

RF modulators

Type C Systems

These systems can include PCs, serial communication, and wireless transmission, such as:

Integrated systems/serial communications/GUIs

LANs/WANs

Remote systems

Microwave and IR transmission

Digital video recorders with remote interface

Appendix B: Acronyms and Abbreviations

Codes and Standards

EIA	Electronic Industries Alliance
NEC	National Electrical Code
SIA	Security Industry Association
UL	Underwriters Laboratories

General

DVR	Digital Video Recorder
HVAC	Heating, Ventilation, and Air Conditioning
VCR	Video Cassette Recorder