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# NFPA 1402 Building Fire Service Training Centers 1992 Edition

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The Board of Directors reaffirms that the National Fire Protection Association recognizes that the toxicity of the products of combustion is an important factor in the loss of life from fire. NFPA has dealt with that subject in its technical committee documents for many years.

There is a concern that the growing use of synthetic materials may produce more or additional toxic products of combustion in a fire environment. The Board has, therefore, asked all NFPA technical committees to review the documents for which they are responsible to be sure that the documents respond to this current concern. To assist the committees in meeting this request, the Board has appointed an advisory committee to provide specific guidance to the technical committees on questions relating to assessing the hazards of the products of combustion.

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# NFPA 1402

## Guide to

# Building Fire Service Training Centers

## 1992 Edition

This edition of NFPA 1402, *Guide to Building Fire Service Training Centers*, was prepared by the Technical Committee on Fire Service Training and acted on by the National Fire Protection Association, Inc. at its Fall Meeting held November 18-20, 1991 in Montréal, Québec, Canada. It was issued by the Standards Council on January 17, 1992, with an effective date of February 10, 1992, and supersedes all previous editions.

The 1992 edition of this document has been approved by the American National Standards Institute.

## Origin and Development of NFPA 1402

In 1963 a subcommittee of the Fire Service Training Committee developed a document titled *How to Build Firemen's Training Centers*. This informative report was published and circulated as a guide and served to improve the scope and efficiency of fire fighter training.

The developments in training in the past few years indicate that more facilities will be needed to accommodate the hundreds of thousands of career and volunteer fire fighters throughout North America. This report describes some of the modern training centers now available for fire fighters seeking instruction in up-to-date techniques of fire extinguishment and fire loss control.

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## Contents

# NFPA 1402

## Guide to

# Building Fire Service Training Centers

## 1992 Edition

Information on referenced publications can be found in Chapter 13.

## Chapter 1 Introduction

**1-1 Scope.** This guide addresses the design and construction of training facilities for fire service personnel. An attempt has been made to cover the aspects that should be considered when planning a facility. It should be understood that it is impractical to list every single item that may be included in a training center or every type of specialty training facility that could be constructed. Therefore, the main components of a training center necessary to accomplish general fire fighter training effectively, efficiently, and safely are presented here.

**1-2 Purpose.** This document provides guidance for the planning of fire fighting training facilities. Whether a particular situation requires inclusion of all the items listed or not, they are here for the stimulation of thought. This guide is intended to assist in the identification of those elements that will be of greatest benefit(s) to those involved in planning such a facility.

**1-3 General.**

**1-3.1** The construction of a fire fighter training facility, regardless of its size, will involve planning, design, and the expenditure of funds. In order to derive the maximum benefits from the resources available, a comprehensive assessment of current and future needs should be made. This needs assessment should consider the following:

(a) Current and future training needs;

(b) Facilities currently available;

(c) Organizations or department using the facility; and

(d) Viable alternatives to new construction.

**1-3.2** The resources available are a major constraint to facility development and construction. These resources include money, land, governmental support, and private support. Questions concerning the availability of resources should be answered during the planning of a facility.

## Chapter 2 Cost-Effective Analysis and Considerations

**2-1 General.** Is a fire service training facility necessary in your community? If the answer is yes, then the initial step is to develop a statement on the broad purpose of the facility. For example:

"Everchanging technologies in fire suppression and fire prevention require that today's fire fighter be knowledgeable and well trained. A proper environment for obtaining this knowledge and training is equally important. This facility will provide the physical requirements of a modern fire department training center and will enhance the community's well-being through better fire protection and fire prevention."

**2-2 Alternative Facilities.** If your fire department is going to request a training facility, be prepared to justify its existence. Explore the use of existing facilities at the state or regional level. If you are located in an industrial area, consider the fire training facilities of the local plants. You may be able to use their facilities, or they may be willing to contribute to some of the cost of building a new facility.

**2-3 New Facilities.** If a new facility is decided upon, certain factors need to be considered.

**2-3.1 Cost Considerations.** Who will assume the cost? Both initial and on-going costs need to be identified such as site acquisition, legal and architectural fees, staffing, building costs, apparatus and equipment, maintenance, utilities (water, electricity, gas), and roadway systems.

**2-3.2 Cost-Effectiveness Analysis.**

**2-3.2.1** A cost-benefit analysis should be conducted to enable a community to determine if the investment is cost-effective and if it is feasible to contribute to long-range financial support. This analysis should include those departments and agencies that will use the facility. State, county, and regional training agencies may wish to sponsor their programs at the facility. As an example, local police share a need for driver training, physical fitness, and classroom space. Combining the training facility with an in-service fire station can satisfy two needs and reduce the total impact of separate facilities.

**2-3.2.2** Consideration should be given to modular construction as a cost-effective means of procuring the necessary structures. This type of construction may be particularly advantageous for administration or classroom facilities.

**2-3.3 Advisory Groups.** If the community accepts the purpose of the facility, criteria then need to be established to judge how the purpose is being fulfilled. It may be beneficial to organize a commission or advisory group, if one has not already been established, to interface between governing bodies and the fire department. The group should include representatives of the agencies, organizations, and departments that will use the facility. Such a group can weigh the importance of the following potential benefits:

(a) Reduced injuries and deaths of civilians and fire fighters;

(b) Reduced number of fires and property damage;

(c) Increased efficiency and morale of the fire fighting force; and

(d) Improved training capability and improved public image of fire department.

## Chapter 3 Components and Considerations

### 3-1 General.

**3-1.1** This chapter lists general components that could be placed in a training facility. There are other components that may be unique to a particular area of industry and that are not included. For the purpose of this guide, the buildings are discussed separately; however, combinations may be necessary or advantageous. As long as the goal of an individual component is not compromised, each component can be placed in any location that is conducive to effective training and safety. The installation of all components is not necessary for an efficient training facility. The following lists of components should be considered:

**3-1.2** Administration and support facilities:

(a) Offices

(b) Conference areas

(c) Library

(d) Photo laboratory/dark room

(e) Printing/copying area

(f) Graphics/audiovisual aid preparation area

(g) Student housing, dormitories

(h) Food service facilities/kitchen, cafeteria

(i) Restroom and locker facilities

(j) Apparatus maintenance and repair center

(k) Equipment and supply facility

(l) Storage space for various materials

(m) Communications needs

(n) Data processing requirements

(o) Medical area/infirmary.

**3-1.3** Indoor instructional facilities:

(a) Classrooms

(b) Auditorium

(c) Gymnasium

(d) Water rescue training pool

(e) Special training laboratories:
1. Simulators
2. Automatic sprinklers
3. Computer
4. Pumps
5. EMS and rescue
6. Fire alarm systems
7. Arson laboratory.

(f) Storage space for equipment and props.

**3-1.4** Outside facilities:

(a) Drill tower

(b) Drafting pit

(c) Burn building

(d) Motor vehicle driving range

(e) Flammable liquids and gases/fuel distribution area

(f) Hazardous materials area

(g) Outside classroom areas

(h) Helicopter landing site

(i) Smoke building

(j) Storage space for equipment and props

(k) Bleachers for outdoor classes or observation of drill tower activities

(l) Fire station

(m) Outside rest/refreshment areas.

**3-1.5** Site/exterior facilities:

(a) Water distribution, sewer, and other utilities

(b) Parking facilities (open and covered)

(c) Site maintenance equipment and facilities

(d) Environmental cleanup activities.

**3-2 Planning Considerations.** Because a training facility is a specialized facility, there are a number of specific features to be considered. Also, since a fire department will probably only build one such facility to serve for some 40 or 50 years, it is desirable to call on the experience gained by others. The remaining chapters provide some specific areas of guidance. A few general comments follow:

(a) Avoid occupancy problems in the locale — check the area masterplan

(b) Investigate possible joint use with other agencies

(c) Explore available grant funds

(d) Develop an environmental impact statement

(e) Visit existing facilities for ideas and experience; new facilities may show state-of-the-art features, while older facilities may identify operational/maintenance problems to be avoided

(f) Consider weather-related problems and the effects of seasonal use

(g) Determine which part of the facility, if any, will have night use

(h) Provide ample space between buildings/outdoor facilities to enable simultaneous use

(i) Provide ample, secured storage space for each segment of the facility

(j) Select site landscaping that complements the training activities with minimum upkeep

(k) Choose interior/exterior finishes that require a minimum of maintenance

(l) Locate heating and air conditioning equipment where regular maintenance can be easily performed, but avoid the installation of individual units in classroom areas

(m) Provide separate locker and restroom facilities for male and female occupants and separate facilities for staff and students

(n) Identify space needed for guests and visitors, staff, and future users

(o) Specify slip-resistant surfaces for all stairs and well-traveled paths

(p) Specify automatic sprinklers/smoke detectors for all appropriate areas

(q) Provide facilities for storage of fuel used in training

(r) Provide facilities for refueling apparatus

(s) Provide communications between structures and training areas

(t) Provide storage for apparatus, especially during cold weather

(u) Provide drinking water facilities at all drill areas including those outdoors

(v) Provide emergency shower and eye wash station(s)

(w) Provide lighting in all areas of the structure to assist in locating personnel

(x) Install an intercom system throughout the structure.

**3-3 Usage Guidelines.** Rules should be developed regarding the use of the facility. The various components of the facility should be in use as much as possible. The needs of the prospective users will be fulfilled by proper scheduling. Insurance coverage of users should be verified before any use is authorized.

## Chapter 4 Considerations in Locating the Facility

**4-1 General.** Some aspects to consider in determining the placement of the training facility in the community are site, water supply, environment, security, support services, and access to utilities.

**4-2 Site Considerations.**

**4-2.1** What land is available? Does the municipality own land that could be considered for this purpose? Are there abandoned properties available? The cost of the land has to be within the parameter of the community's budget. A progression of spending might allow for the purchase of the necessary land one year and the construction of certain buildings in the future. This sequential plan would enable the community to realize its objective over an extended span of time rather than placing pressure on present resources for immediate large expenditures. On the other hand, using a bond issue to build at this year's rate and paying off with future dollars may be more favorable. Financial consultation would be desirable.

**4-2.2** There always is a possibility of a ledge formation or a high water table posing hidden problems; therefore, a geological expert should be consulted during the planning stages, especially to determine if borings are necessary to test subsoil consistency.

**4-2.3** The area masterplan, if one exists, needs to be taken into consideration. The site of the training facility should be located away from the center of community life to minimize negative impact on adjacent land use. If the site has many positive factors and a plan variance is necessary, all the facts should be gathered and a presentation made to the community's planning board. If possible, the area masterplan should be used to the fire department's advantage. The voting public should be made to understand the advantages of the training facility, and every effort should be made to have them as allies in this endeavor.

**4-2.4** The title to the property should be clear. Further expansion is often a possibility, so the surrounding land should be surveyed. A land priority for fire department use would be beneficial to obtain. This would require the municipality to check with the fire department before allowing other usage. If possible, the site should be marked prominently on land maps with a nonresidential area around it. A lawyer's guidance would be advantageous in these endeavors.

**4-2.5** Traffic patterns should be studied, and the least detrimental route to the training facility should be chosen. Heavy, noise-producing apparatus should avoid residential areas. Travel time to the facility for the users should be taken into consideration. On-duty personnel who are receiving in-service training at the facility may be required to respond to emergency incidents. The facility should be located so that it is accessible to appropriate emergency response routes.

**4-2.6** The size of the site should be ample for planned buildings, parking, and future expansion. Adequate separation should be allowed between buildings for safety, vehicular movement, and instructional purposes. It is better to conserve on structures than to overcrowd limited land.

**4-2.7** Site pavement should be such that the facility can be used in all kinds of weather. Any pavement will deteriorate, especially when hydrocarbons or hot exhausts impinge on them. Concrete (cement) pavement seems to withstand training facility usage with minimum maintenance.

Landscaping and site layout should take into consideration local climatic conditions. Consideration should be given to rain, snow, wind, heat, and other adverse elements that may affect facility operations. Site layout can incorporate a roadway system that is typical of the community. This is helpful in the training of apparatus operators.

**4-3 Water Supply.**

**4-3.1** The maximum water supply required should be estimated so that an adequate system can be installed to deliver the necessary volume and pressure of water for training activities, facility fire protection systems, and domestic water needs. Water supply estimates should include the amount of water used in attack lines, back-up lines, drafting and pumping exercises, and an additional 100 percent as a safety factor. A loop or grid system with properly placed valves would help to ensure an adequate water delivery. If possible, dead-end mains should be avoided; if not, compensators (surge chambers) should be considered. Valves should be placed to segregate sections of the water system to allow for repairs without complete shutdown.

**4-3.2** The type of hydrant(s) installed at the training center should be representative of the types found in the community. Where more than one community uses the training center and the hose threads are not uniform, a variety of fittings with appropriate threads will be needed.

**4-3.3** Many fire departments' only source of water is drafting. Even where there is a hydrant system, drafting is always a good additional source. During times of water emergency, drafting may be necessary. Lakes or ponds, flowing streams, manmade containers, and dry hydrants are potential drafting sources. Consideration should be given to supplying water from the water distribution system to maintain the water level in the drafting pit.

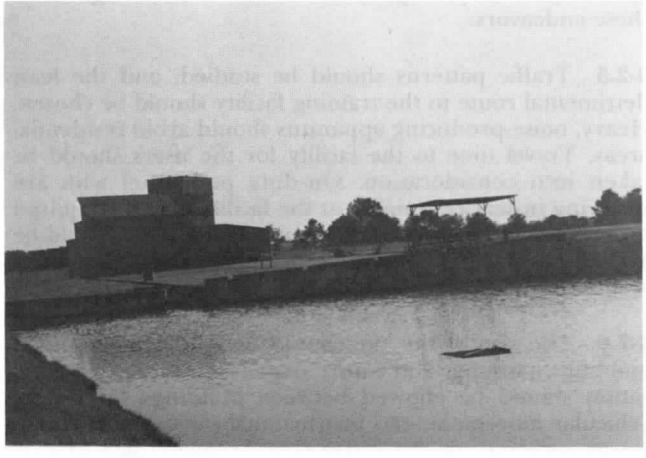


**Figure 4-3.3 Pump testing area. Pump test can vary drafting height from 3 to 8 ft (10 cm to 240 cm). Note splash wall, pump test stand and protective cover area for students. Mississippi Fire Academy.**

**4-3.4** On-site water supply needs should be determined and storage containers constructed if necessary. Either elevated, surface, or underground storage may be used. Pumps could also be used to move the water at the desired pressure.

**4-3.5** For durability, the water main should be constructed with bolted flanges or steel-rodded joints [see Figure 4-3.5(a)]. If severe turns have to be engineered into piping, consideration should be given to thrust blocks. Both of these features will help overcome the effect of water hammer. To keep a steady pressure in the water main, a compensator (surge chamber) should be installed [see Figure 4-3.5(b)]. (*See NFPA 24, Private Fire Service Mains and Their Appurtenances.*)

**4-3.6** Tank trucks or long relays could be used to provide some water for training. This will increase the number of vehicles and personnel needed to accomplish basic evolutions, and it will further increase the vehicular accident potential and maintenance cost.

**4-4 Security.**

**4-4.1** The training facility should be secure. The site should be fenced and well lighted, and, if necessary, a guard should be provided. Local police can make the training facility a part of their rounds. Security could be augmented by alarm systems with connection to appropriate monitoring stations. Buildings, elevator shafts, drafting pits, underground utility covers, and all exterior valves and cabinets should be locked.

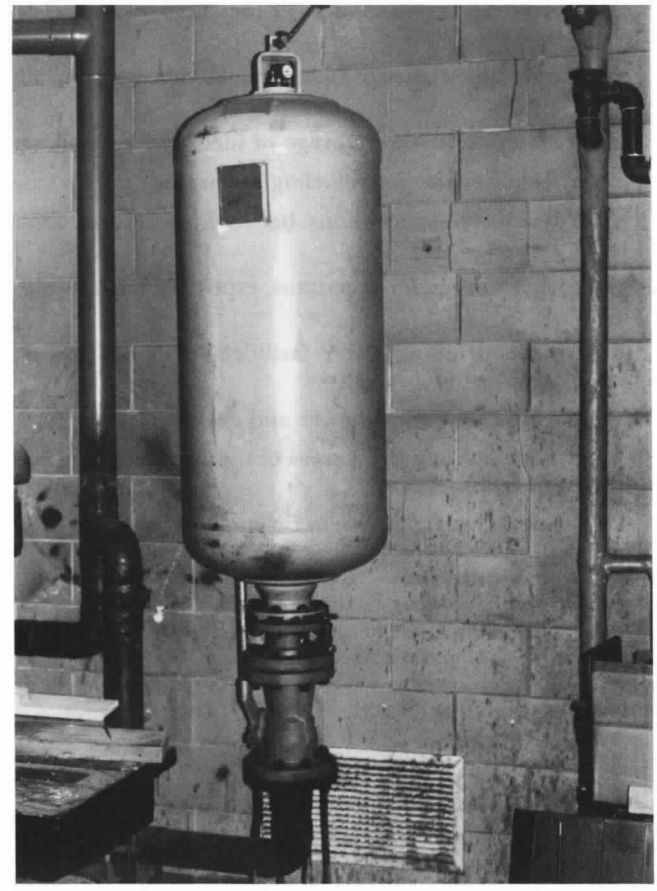


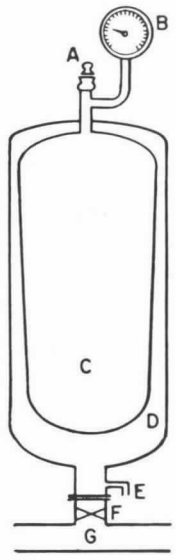
**Figure 4-3.5(a) Bolted and steel-rodded joints under compensator. New York Fire Department Academy, New York, New York.**

**4-4.2** An evacuation signaling system and an automatic fire detection and alarm system should be installed throughout the facility in accordance with NFPA 72. A central station connection should be provided if a 24-hour guard is not posted at the control/monitor center.

**4-5 Environment.**

**4-5.1** Federal, state, and local environmental protection agencies need to be consulted. The results of these consultations should facilitate obtaining the necessary permits and licenses. Also, these consultations should address the problem of waste water (treatment and disposal) and pollution (air, water, and noise). The facts gleaned from these agency contacts may be of use when the architect is consulted.

**4-5.2** When considering a site for a training facility, there are many environmental factors to consider. It is very important to ensure that the facility is environmentally safe. Factors that should be considered from an environmental aspect are water, air, and the ground (soil).




A. Charging valve — 45 psi
B. Gauge
C. Nitrogen in rubber bladder
D. 80 to 250 gal (304 L to 950 L) of water
E. Drain
F. Shutoff valve
G. Water main.

**Figure 4-3.5(b) Compensator.**

**Figure 4-4.1 Security fence. Omaha Fire Academy, Omaha, Nebraska.**

**4-5.2.1** There are several governmental agencies that will have a jurisdictional interest in the location, design, and construction of a training facility. These include agencies at the federal level such as the Army Corps of Engineers and the Environmental Protection Agency. Each state or municipality or both will also have regulatory agencies from which approval may have to be gained prior to construction of a facility. Most of the regulatory agencies do not have the resources or the staff to assist in planning a facility but will, in most cases, review designs from the professionals described below.

**4-5.2.2** There should be an intensive environmental review by professional engineers, geologists, hydrologists, and environmental scientists. These professionals should develop an environmental impact study to determine what effect, if any, the training facility will have on the environment.

**4-5.2.3** There are several ways in which water should be considered when planning a training facility. The first consideration should be the disposal of waste water from fire fighting operations. This water will have varying degrees of contamination depending upon what evolutions were performed. If evolutions involve flammable or combustible hydrocarbons or other potentially environmentally detrimental chemicals or compounds, then provisions will have to be made for the separating of the contaminants from the runoff. This may be accomplished by several methods including oil separators, ponding, and bacteriological breakdowns. Extreme care should be taken not to affect the groundwater with contaminated runoff. In addition, the facility should be designed to take full advantage of runoff to replenish supplies for training. Proper consideration should also be given to the amount of new pavement created so that excessive velocities and quantities of runoff do not affect surrounding properties. If there are wetlands in the area, then special care should be taken to prevent damage to them.

**4-5.2.4** The second water consideration should be potable water for use of the trainees, visitors, and staff. This water may come from wells or a municipal source. The third water consideration should be fire fighting water, including water for automatic sprinklers for the facility buildings. The use of fresh potable water for training purposes should be discouraged because of the large volumes involved and the waste of a shrinking resource.

**4-5.2.5** The prevalent wind direction and force should be considered both when locating a training facility and when locating buildings at the facility. Smoke generated by the facility should not interfere with the surrounding area or buildings. The residue from extinguishing agents and the products of combustion have been found considerable distances from training sites. A wind sock on the training ground will assist instructors in evaluating the effect of wind on the areas surrounding the training facility. Light generated by the fires, particularly at night, should be considered if the facility is to be located near an airport. Noise is also a factor to be considered at the training facility. Advantage can be taken of the existing terrain to direct noise away from populated areas.

**4-5.2.6** Taking full advantage of the shape and contour of the land to develop runoff patterns and establish locations for various buildings and props such that they do not interfere with the drainage of the water during all seasons and weather conditions should be one of the goals of the designer of the training facility. The type of soil upon which the facility is located is important. The type of soils can affect such things as foundation types, bearing capacity, pavement life, runoff both above and below the surface, and the presence of rock, which is expensive to remove.

### 4-6 Utilities.

**4-6.1** The use of pumps, air compressors, simulators, heat, ventilation, and air conditioning (HVAC) units will greatly increase the power requirements. An on-site total

energy system may be a practical alternative. Such systems consist of a mechanical package on site that provides utility services, e.g., electrical, heat, air, etc., for use in buildings. The largest portion of the electrical needs will be dictated by the number of buildings and their purposes.

**4-6.2** Coincidental with electrical requirements is the possible need for natural gas feed and telephone connections. The distance from these services could be a determining factor in locating the facility.

**4-6.3** Electrical outlets should be installed in sufficient numbers to prevent the use of long extension cords. The electrical outlets should be installed in accordance with NFPA 70, *National Electrical Code*.

**4-7 Support Services.** If housing and food services are to be provided, space will have to be planned for such purposes. Food service may be provided by a private vendor. The transportation of staff and trainees, housekeeping and laundry service, vending machine location, janitorial service, and ground and facility maintenance may have to be considered.

## Chapter 5 Design and Construction

**5-1 General.**

**5-1.1** The objectives the fire department wishes to reach by building a fire service training center need to be written down. Priorities have to be set. A department committee composed of members from all ranks should be formed to assist in design features. A chairperson should be selected for this committee. The chairperson should act as the liaison between the department and the architect. After proper research of this building project, an architect has to be chosen.

**5-1.2** Design features require consideration for providing handicapped access for both staff and visitors.

**5-1.3** All buildings should be provided with fire hose standpipe systems (NFPA 14). Heated buildings should be provided with wet standpipe systems including 1½-in. (38-mm) hose, hose reels, or hose racks.

**5-2 Architects.**

**5-2.1** Architects who specialize in fire service training facilities are available. Check with the American Institute of Architects (AIA) for references. There are local AIA chapters in many cities. Visit some training facilities and ask about their architect. It is more important to find a cooperative and flexible architect than a specialist in fire training facilities. (*In Canada see provincial architectural associations for assistance.*)

**5-2.2** Consider visiting training facilities that have been in operation for a period of five to ten years to learn of any inherent construction or operational deficiencies. Ask the training personnel at the facility if they are satisfied with the architect's work. How would the training personnel improve the facility?

**5-2.3** Interview the architectural firm before making the final selection. The architect's responsibilities are the design of the facility, the production of working drawings, development of facility specifications, bid documents, and usually the supervision of construction.

**5-2.4** Positive steps should be taken to ensure that the architectural firm will abide by the fire department's wishes and provide for declared needs.

**5-2.5** Contractors build according to approved specifications and blueprints drawn by the architect. A client has little recourse except through change orders. These orders should be approved by the architect and could be very expensive. Therefore, changes after a contract is let should be avoided. Some change orders may be necessary to reduce cost overruns. The procedure for executing a change order should be spelled out in the original contract.

**5-2.6** A pre-bid conference with the architect is necessary to establish the requirements. A fire department representative should be present. A request-for-bids notice normally will follow the pre-bid conference. It is desirable to review the work process at such junctures as: 25 percent, 50 percent, 75 percent, 90 percent, and 100 percent of the project completion.

**5-2.7** As-built drawings should be provided and retained after the project has been completed for use during repairs, alterations, and future expansions.

**5-3 Clerk of the Works — Owner's Project Manager.**

**5-3.1** A clerk of the works may be necessary according to the complexity of the project. The clerk should be able to read blueprints and interpret specifications. The clerk's job is to be on the project daily, checking progress, overseeing the work of the contractors, and ensuring compliance with specifications.

**5-3.2** Such a person is usually compensated by the fire department or the jurisdiction. At times the architect may provide on-site inspectional services.

## Chapter 6 Administration/Classroom Building

**6-1 General.**

**6-1.1** This chapter addresses the many components that should be considered when a jurisdiction is planning an administration/classroom building.

**6-1.2** Certain components are required only if the structure will be used for administrative purposes; others are particular only to a classroom building. However, if the purposes are to be combined, then all of the following items need to be considered. Only those items needed for your particular situation should be included to produce a viable, functioning administration/classroom building.

**6-2 Offices.** Office space should be provided for the officer in charge, assistant administrator, instructors, and clerical personnel. Further office space will be dictated by

Figure 6-1.1(a) Administration building. Dover County Fire Academy, Dover County, New Jersey.

Figure 6-1.1(b) Administration building. Toronto Fire Academy, Toronto, Canada.

agencies housed at the facility. Properly designed open office space can add flexibility. Do not forget to include closet and storage space.

**6-3 Conference Room.** A conference room is desirable for staff meetings, press conferences, and use by the commissioner or the chief of the department. A built-in projection booth increases the versatility of the room.

**6-4 Auditorium.**

**6-4.1** The auditorium can be used for classrooms, seminars, promotional ceremonies, and community activities. Movable chairs would increase the utility of this component. A balcony would add to the seating capacity. Physical fitness classes could be held in the auditorium.

**6-4.2** The floor and the wall coverings could be designed to withstand indoor basic training when inclement weather precludes outside activities. A public address system should be installed. Some of the features discussed in the classroom component should be installed in the auditorium.

Figure 6-1.1(c) Administration building — including: director's office; boardroom; clerical area; instructor offices; A/V storage area; four classrooms with capacity for fifty students in each room, one double classroom with capacity for two hundred students, making a total student capacity of four hundred; dining area; kitchen; and student lockers with restrooms. Mississippi Fire Academy.

**6-5 Classrooms.**

**6-5.1** Classroom size will be dictated by the number of students and the type of training to be conducted. For example, hands-on training may require more space per student than a lecture.

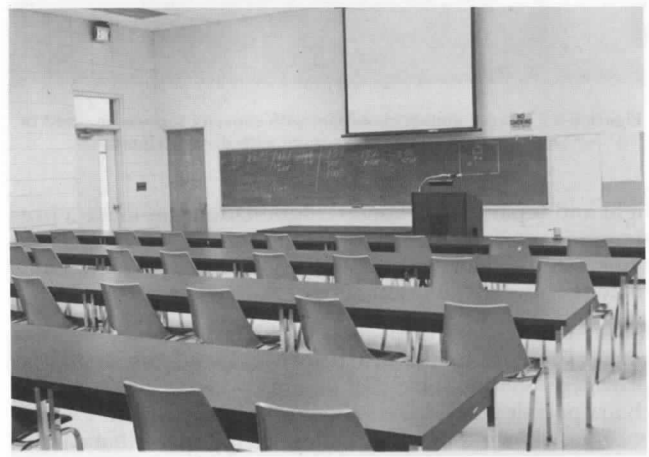


Figure 6-5.1(a) One of four 50-student classrooms. Mississippi Fire Academy.

**6-5.2** Movable soundproof walls can be used to vary classroom size. Adequate aisle space is necessary for proper classroom function. Heavy-duty flooring should be installed to withstand the movement of fire fighters with soiled gear.

**6-5.3** The instructor should be able to control room climate and audiovisual equipment. Good lighting is a must, and the use of both individual controls and rheostats should be considered to vary the illumination. A podium

Figure 6-5.1(b) Alberta Fire School.

Figure 6-5.2 Large double classroom with capacity for two hundred or one hundred students per room with divider closed. Mississippi Fire Academy.

light and separate chalkboard illumination can make a presentation in a darkened room more effective. Electrical outlets in the floor and the walls should be spaced to eliminate the use of extension cords.

**6-5.4** Classroom furniture should be durable. Writing surfaces for use by the instructors and students should be provided. Folding tables, 18 in. (45 cm) wide, and stacking chairs permit greater flexibility in room utilization. Experience has shown that wider tables occupy space that can be better used.

**6-5.5** To lessen classroom disturbance the following features should be considered: doors to the room should open and close quietly, sanitary and refreshment facilities should be close to the room, and ceiling height should permit the hanging of wall screens or the placement of portable screens for good viewing. The ceiling height should be a minimum of 10 ft (300 cm) as dictated by experience.

**6-5.6** Air conditioning and heating units should not be installed in the classroom because of the noise factor.

**6-5.7** There may be a need for a "dirty" room that students can enter with gear that has been exposed to the fire environment.

**6-5.8** An effective sound system should be installed in all classrooms and assembly areas.

### 6-6 Library.

**6-6.1** The library is an essential part of the fire department training program. The library should contain job-related periodicals and technical books. The fire department's regulations, procedures, history, past and present orders, and local, state, and national standards should be on the shelves.

**6-6.2** An index system has to be maintained. Security of library contents has to be considered. The librarian should attempt to motivate retirees or people interested in the fire department to bequeath their fire department books to the library.

**6-6.3** The services of a retired teacher may be secured on a voluntary basis. Most town libraries would be glad to assist the fire department in starting a library and to provide advice.

**6-6.4** If the library is large enough, individual carrels could be provided to allow the student to concentrate without interference. If there is a need, the library hours should include nights and weekends. The library should be located near the parking lot to decrease user travel and prevent classroom disturbance.

### 6-7 Kitchen and Cafeteria.

**6-7.1** Kitchens could have the following appliances available for staff and trainees: refrigerator, stove, table and chairs, sink, vending machine, coffee maker, microwave oven, and dishwasher. If the facility is large enough, a cafeteria service line could be installed. Food service consultants may be necessary to properly design a cafeteria that will efficiently feed large numbers of people.

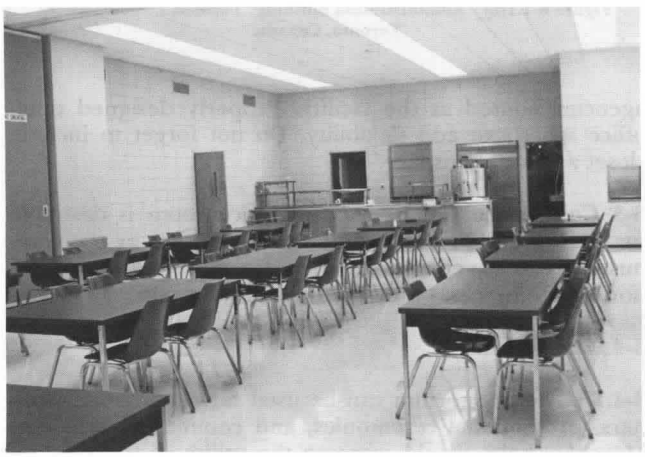


Figure 6-7.1 Dining area — seating capacity about eighty-five. Mississippi Fire Academy.

**6-7.2** Fire protection for cooking equipment should be provided according to standards. It may be desirable to have a separate eating facility for the faculty. The dining area may be turned into a classroom.

**6-7.3** It may be more effective to use an outside vendor to provide meals. Vendors may provide packaged meals that are cooked off site or may cook them at the facility.

**6-8 Audiovisual Area.**

**6-8.1** To allow the instructor to take advantage of various media, the following equipment should be available: chalkboard (liquid chalk is highly desirable), felt board, hook and loop, and magnetic board. Cameras and associated equipment can be big assets in bringing realism to the classroom, and the following could be used efficiently: portable video camera, recorder, and video editing machine. A TV monitor would also be useful.

**6-8.2** Projectors would fall into the following categories: Super 8 movie, 16-mm movie, 35-mm slide with a dissolve unit, and an overhead projector with acetate roll. Cassette tape equipment, sound sync unit, portable wall or ceiling screen, or rear projectors are beneficial adjuncts.

**6-8.3** To make a professional presentation an audio jack should be installed near any equipment use station.

**6-8.4** To aid in the use of audiovisual equipment the following recommendations are made:

(a) Provide an extra electrical switch with a rheostat to control illumination

(b) Protect rearview screen from breakage by covering with chalkboards

(c) Guard against writing on rearview screens

(d) Guard against permanent writing on white boards by providing only water soluble markers in the classrooms

(e) Place projector area near hallway so equipment can be easily moved

(f) Provide adequate distance for front and rear projectors

(g) Avoid stepped-down ceiling if it will interfere with projection or viewing

(h) Provide heating, ventilation, and air conditioning (HVAC) in the projection room to assure comfortable workers' environment and to avoid thermal shock to expensive electrical projector bulbs

(i) Provide audiovisual equipment, lighting, and sound with remote controls

(j) Install electrical receptacles in the floor to eliminate the use of extension cords.

**6-9 Darkroom.**

**6-9.1** The department's photographic needs may include a darkroom facility. Sufficient space should be allowed for the necessary equipment, storage, and future expansion. The storage room could also be used as a projection booth; however, keep in mind the applicable firesafety regulations.

**6-9.2** Taking the cost factor into account, it may be more economical to send material out for processing. Fewer personnel and less space will be needed. The disadvantage of this option is the time required to send material out and to receive the finished product. In addition, it will be necessary to establish a procedure to document every step of the photographic process in order to maintain the chain of evidence of photos involved in legal matters.

**6-10 Printing Room.**

**6-10.1** The facility will need the reproduction of printed materials. Space for the following may be required: copier, mimeograph machine, offset duplicator, collator, binding machine, transparency maker, and computers. This may require special electrical services. This equipment may also be noisy, so location of the printing room should be carefully considered.

**6-10.2** Proper storage for flammables and an exhaust system should be considered during the design stages. Also, space to store supplies and printed materials is essential.

**6-11 Graphic Unit.** A room for the preparation of graphics and other aids should be considered. Place this unit in a quiet area. In addition, space should be planned for instructor preparation of audiovisual programs (slide-tape, video, etc.).

**6-12 Simulator Facility.** If simulation in training is desired, then space will have to be provided. Consideration may be given to the following types: flat board mock-ups, actual equipment, videotape, simple to complex computer arrangements, and rear screen projection.

**6-13 Locker and Shower Facilities.**

**6-13.1** Locker and shower facilities are necessary. Separate areas should be provided for males and females. Included in this area would be a shower room(s), sinks with mirrors, and toilets. Remember to stress ventilation to reduce the water vapor accumulation from the showers.

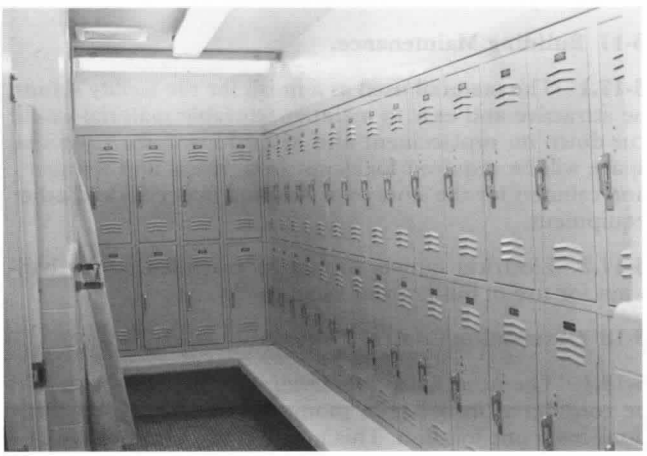


**Figure 6-13.1 One of two student locker rooms with showers and restroom facilities. Mississippi Fire Academy.**

**6-13.2** Locker space will be required for instructors/staff, long-term students (recruits, etc.), short-term students (one to three days), personnel using the fitness room,

and maintenance people. Separate areas are suggested for personnel lockers and turnout gear storage. The instructors' showers and lockers should be separate from the students'.

**6-14 Cleanup/Drying Room.** A cleanup/drying room for turnout gear is a must if students leave their gear at the facility or if turnout gear is maintained at the facility. This area should provide space for the students and instructors to clean their gear with water from a hose or shower. This room should be accessible from the outside and from the locker room. Gear should be stored in a well-ventilated locker that can be locked. Special rust-resistant wire cage-type lockers may be necessary.

**6-15 Arson Lab.** It is recommended that the agency having responsibility for arson investigation be included in the planning stage of the facility. The arson investigation force might want office space; they might want room for sophisticated equipment or just a room to keep some teaching materials. Meetings between the arson group and the fire department planners will be necessary to determine their needs.

**6-16 Emergency Medical Room.**

**6-16.1** Safety should be the foremost consideration in facility design. Accidents and illnesses do occur, however, and one or more properly designed first aid rooms should be provided. Space should be provided so that temporary care can be administered to victims suffering from burns, cuts, cardiac distress, smoke inhalation, heat exhaustion, and other injuries or illnesses.

**6-16.2** A parking area for an ambulance should be provided during major training programs. Transportation for multiple victims should be considered. Communications with a local hospital may help provide resources for design as well as a personnel pool for staffing.

**6-16.3** Physical examinations may be conducted in the emergency medical room.

**6-17 Building Maintenance.**

**6-17.1** The material used as a finish for the facility should be attractive and easy to maintain; durable material would cut down on replacement and refinishing costs. Custodial space will be required for deep sinks, mops and wringers, and cabinets for the storage of cleaning materials and other equipment.

**6-17.2** Electrical outlets should be provided in the hallways for use of buffers and vacuum cleaners.

**6-18 Observation/Control Tower.**

**6-18.1** The need for an observation/control tower should be considered in order to monitor various training functions from one location. This may include communications systems, fire temperature sensors, remote annunciator panels, and remote cameras. This will allow for overall monitoring of activities and enhance operational safety.

**6-18.2** The observation/control towers work well when located adjacent to the training tower and elevated. Some training centers have designed this feature as the second floor above the administrative area and classroom.

**Figure 6-18.1 Training area control tower. From the control tower the safety officer can observe all field training. The first floor area can be used as a first aid station. Mississippi Fire Academy.**

**6-18.3** Consideration should be given to adequate window space for full observation of the drill area including observations of units responding to the drill building from off site.

**6-19 Sprinkler Laboratory.** The need for a laboratory where sprinkler systems can be operated, demonstrated, and inspected should be considered. An area where small fires can be ignited to fuse sprinkler heads connected to a water supply should be included.

**6-20 Alarm System Laboratory.** Consideration should be given to an area where several different types of operable fire alarm systems can be located.

**6-21 Fire Extinguishing Systems.** Consideration should be given to providing an area that would allow the installation of fire extinguishing systems for demonstration purposes.

**6-22 Miscellaneous.**

**6-22.1** Public telephones should be provided.

**6-22.2** A break area should be provided to allow students an area to congregate between classes.

## Chapter 7 Drill Tower

**7-1 General.**

**7-1.1** The main purpose of the drill tower is to train fire fighters in the basic evolutions using pumper and ladder equipment. Using this tower will instill confidence in the trainees and further their ability to work at various heights in a skilled manner. Some areas have had requests from law enforcement agencies to use the tower to train in rappel or other skills.

**7-1.2** While some training towers are designed for actual training fires, this is not a good practice. It is expensive to build such large structures with sufficient fire resistance to withstand intense heat. Soot and dirt resulting from such fires soon impair the tower for normal use. It is better to

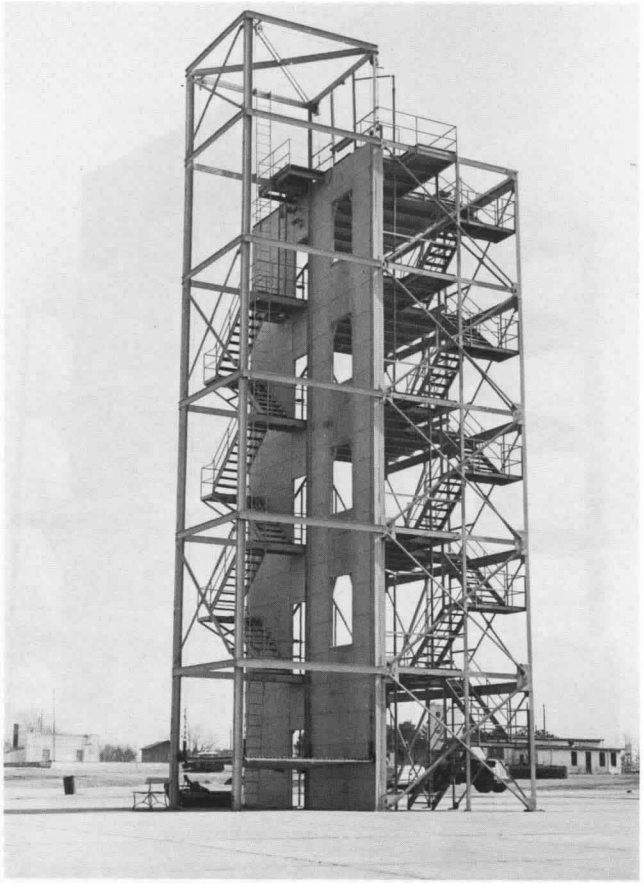


Figure 7-1(a) Drill tower. University of Kansas, Lawrence, Kansas.

Figure 7-1(b) Drill tower. Toronto Fire Academy, Toronto, Canada.

use the tower for training evolutions and conduct interior fires in another building.

**7-2 Height.** The height of the tower should be typical of buildings found in the locale. However, consideration should be given to future community development. A six-story tower would seem optimum when evolutions involving the exterior of the tower are being considered.

**7-3 Construction.** The materials used in the construction of the tower may be wood frame, reinforced concrete, steel, or other durable material. Both interior and exterior walls of the drill tower should be structurally sound; this will provide for the safety of personnel in training and for withstanding the force of master streams.

**7-4 Dimensions.**

**7-4.1** The tower should be at least 20 ft × 20 ft (400 sq ft of floor area) [6m × 6m ($36m^2$)]. This will accommodate interior stairwell openings and allow room for fire companies to maneuver hose lines.

**7-4.2** A square configuration may be easiest to construct, but a rectangular design will allow for an exterior enclosed stairway and a fire escape to provide two means of entrance or egress. The rectangular design will provide more interior floor space for hose stretching practice.

**7-5 Stairways.**

**7-5.1** Stairways in the drill tower may be provided either by interior or exterior means, or both. Stairways provide not only a means of access between floor levels but also should simulate fireground conditions. A variety of types, widths, and situations may be realistically represented. Stairways included in the tower should be located to maximize available interior floor area. All stairway treads in the tower should be slip resistant; open grate treads will prevent water accumulation. The size of all stair landings should be carefully planned to provide for personnel and equipment that must turn the corner. Floor numbers should be indicated on all landings.

**7-5.2** In the case of outside stairways, railings need to be of sufficient height and strength to assure safety during training evolutions.

**7-6 Exterior Openings.**

**7-6.1** All doors and window openings should be fully framed and located to simulate situations existing in the field. If safety net operations are contemplated at the tower, all openings on that side of the structure should have heavy wooden sills installed to accommodate rope and pompier ladder evolutions.

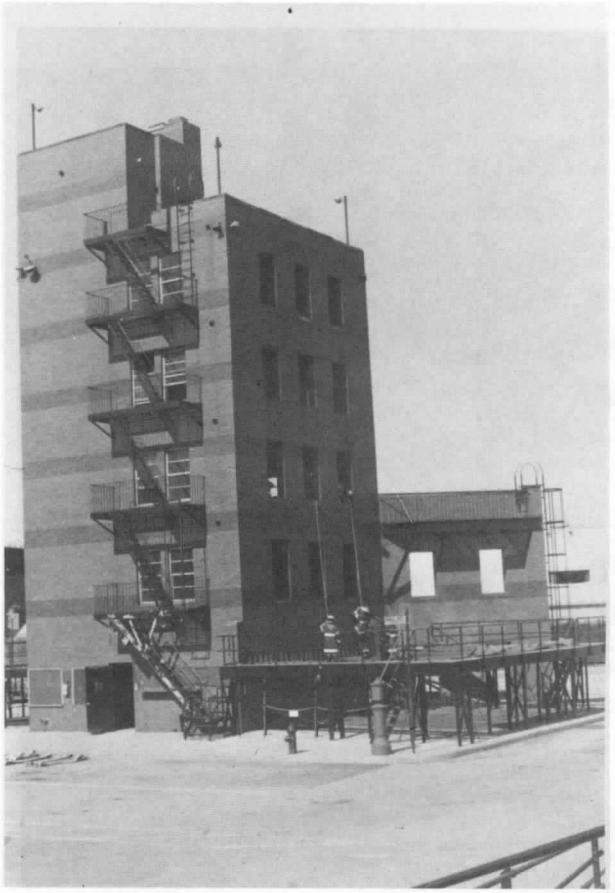


Figure 7-1.2(a) Drill tower. New York Fire Department Academy, New York, New York.

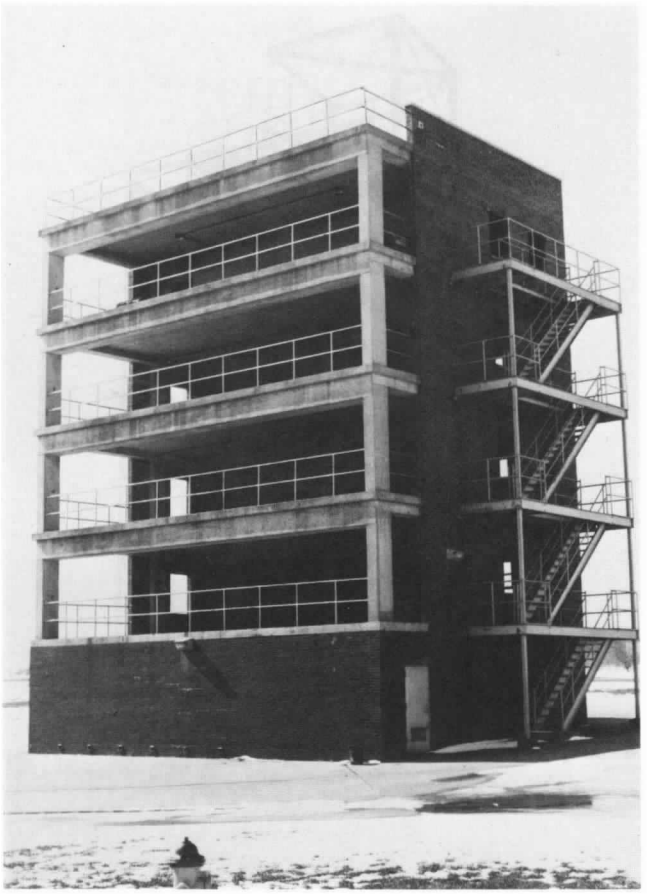


Figure 7-1.2(b) Drill tower. Burlington County Fire Academy, Burlington County, New Jersey.

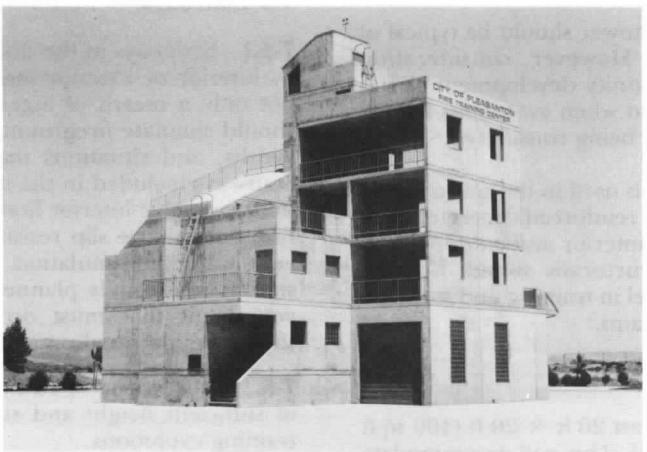


Figure 7-1.2(c) Pleasanton, Calif., fire department training facility. It is used by 10 departments weekly for mutual aid training. Other departments can use it by renting it at a reasonable price.

**Figure 7-3 Ladder training tower. Dover Township Fire Academy, Ocean County, New Jersey.**

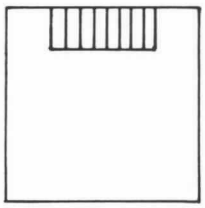


**Figure 7-4.2(a) Square drill tower.**

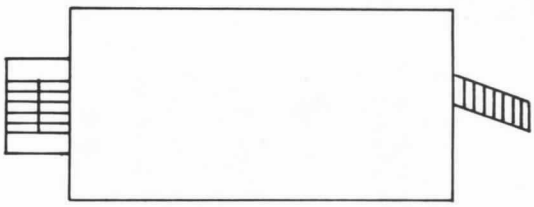


**Figure 7-4.2(b) Rectangular drill tower.**

**7-6.2** If the tower cannot include various types of doors and windows, then a separate display mock-up including an example of each should be constructed. For those areas near ocean or river shipping facilities, take into consideration doors/hatches found on ships.

**7-7 Fire Escapes.** Various fire escape configurations can be placed on the building. Railings should be high enough to safeguard a fire fighter who may be operating a charged hose line on the fire escape. The bottom of the fire escape can terminate in a straight ladder or a counter balanced ladder. The top of the fire escape could end at the top floor or go over the roof by means of a gooseneck ladder. Caged vertical ladders may also be desirable to have installed if they are representative of community construction.

**7-8 Sprinkler and Standpipe Connections.** The drill tower should include provisions for standpipe connections at all floor levels of the facility. These connections will not only provide the opportunity to develop the proper routine of connecting to and providing a water supply for the system but also may be utilized for simulated fire attack by fire forces operating in a high-rise building. Siamese connections should be installed and identified at ground level to accommodate auxiliary water supplies. Section valves should be installed in systems at each floor, or selected locations, to enable the instructor to shut down only sections, not entire systems, for training purposes. See NFPA 13, *Standard for the Installation of Sprinkler Systems*, and NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, regarding the proper installation of sprinkler and standpipe siamese connections.

**7-9 Roof Openings.** Roof openings should be provided for practice of ventilation procedures. Various size openings on both flat and sloped roof surfaces should be designed into the structure so various situations and types of roof conditions can be simulated. Normally, these practice sessions are best conducted at lower levels of the building because of the safety factor. In all cases, safety railings should be considered for roof operations.

**7-10 Coping.** If not covered by the roof, the topmost section of the walls should have a coping. Heavy wood bolted into the structure is best for rope work and evolutions. Stone, concrete, or other material may break away in pieces or abrade equipment and personnel.

**7-11 Nets.** Consideration should be given to the provision of a temporary or permanent safety net on at least one exterior side of the building, especially if rappelling is contemplated. A safe distance should be provided between the ground and the net to allow for movement upon impact.

(a) A temporary, removable net will allow full access to the tower

(b) Removal and proper storage will prolong the serviceability of the net

(c) Springs installed between the net and the perimeter frame will increase the life of the net by lessening direct impact on the net

(d) A ladder affixed to the tower for mounting the net should be considered

(e) For a permanent net, a catwalk around the perimeter frame with a ladder to the ground can provide a standby area for instructor and trainees.

Figure 7-9 Safety railing roof of smoke building. Burlington County Fire Academy, Burlington County, New Jersey.

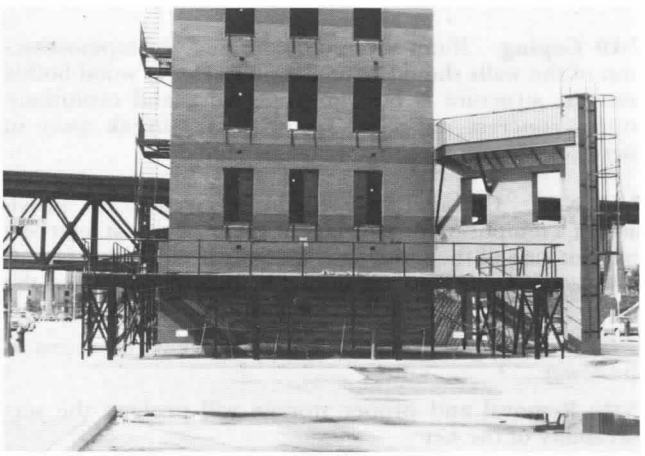


Figure 7-11(a) Frame of the net. New York Fire Department Fire Academy, New York, New York.

Figure 7-11(b) Springs anchored into the side of the drill tower. New York Fire Department Fire Academy, New York, New York.

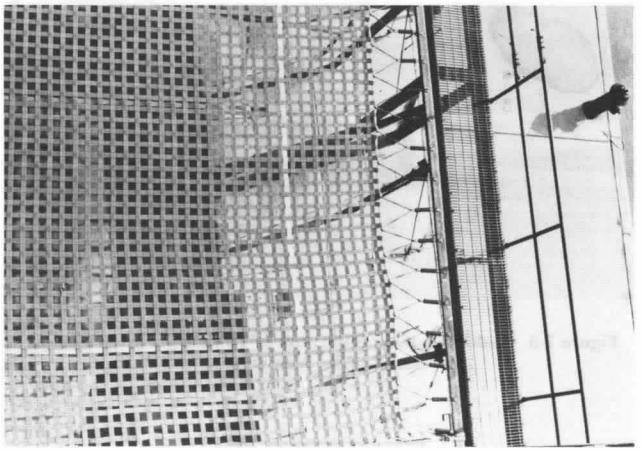


Figure 7-11(c) Texture of net and catwalk around net. New York Fire Department Fire Academy, New York, New York.

Figure 7-12 Scuppers at work on multiple dwelling. New York Fire Department Fire Academy, New York, New York.

**7-12 Drains.** Each floor of the building should be equipped with floor drains or scuppers. In areas subject to freezing temperatures, conventional floor drains may not be effective. Where scuppers are used, the water discharge should be directed to areas that will not interfere with activities below the openings. Regardless of the types of drains that are selected, their installation should ensure quick runoff of water.

**7-13 Special Training Features.** Special features can be included in the tower to accommodate local area needs. For example, a 36-in. (90-cm) diameter pipe may connect two floors for caisson and mine shaft rescue simulation. An elevator could be installed to be used in simulation of elevator emergencies and for the movement of personnel and equipment.

## Chapter 8 Burn Building

### 8-1 General.

**8-1.1** The purpose of the burn building is to safely train fire fighters in methods of interior fire suppression. Every room should have an exterior exit or secondary means of egress. Burn areas below grade are not desirable and should be avoided. In order to provide simulated training for the suppression of basement or cellar fires, a raised open grid walkway can be constructed level with the second floor on the exterior of the building. Fire fighters can then simulate attacking belowgrade fires working on the second floor to the ground floor and are not exposed to the hazards of being below grade.

**Figure 8-1(a) Hot drill building. This building features two buildings in one — residential and commercial. The residential side is two stories with attic, six interior rooms, all masonry. Mississippi Fire Academy.**

**Figure 8-1(b) Burn building consisting of a private dwelling section and a commercial section. Burlington County Fire Academy, Burlington County, New Jersey.**


**Figure 8-1.1 Burn building with raised open grid walkways level with the second floor. New York Fire Department Fire Academy, New York, New York.**

**8-1.2** The building could be designed to take into consideration the following problems: fire spread, rescue, ventilation, and special problems.

**8-1.3** During the design of the facility, consideration should be given to the type of evolutions that will be conducted at the site. It is much easier, and less costly, to incorporate necessary safety features into the design during the construction phase. (*See NFPA 1403 for requirements relating to the use of burn buildings for live fire training exercises.*)

**8-1.4** When designing interior fire-resistant coverings for burn buildings, consideration should be given to the durability of the material and the ease of replacing damaged sections. Fire-resistant materials are available in 4 ft × 8 ft × 1 ft sheets and are rated at 1200°F (649°C). It may be advisable to place a metal edge trim on the panels and to mount them to concrete walls with metal furring strips.

### 8-2 Fire Temperature.

**8-2.1** Walls, floors, ceiling, and other permanent features should have strong resistance to heat generated by Class A materials. Class B materials should not be used for fuel because of their high heat production. High temperature training fires will cause accelerated deterioration of the structure and expose fire fighters in training to unnecessary risk.

**8-2.2** In planning a burn building, the designer, the architect, and the fire chief should consider the problems created by fire temperatures. If unprotected, concrete will spall and steel will distort when exposed to fire temperatures. Even in new burn buildings built with adequate protection, fires should be limited to short duration. To provide high temperature protection to the burn building the following materials may be utilized:

(a) Precast modules made from poured perlite or aluminate concrete form a wall that has high strength and resistance to spalling.

(b) Gunning (the spraying of exposed surfaces with a cementitious concrete) provides a self-adhering joint-free surface whose usefulness can be extended by patching.

(c) Refractory blocks set in refractory mortar.

(d) Panels made from fire-resistive material can be attached to the structure. (Care needs to be taken when choosing materials; some fire-resistive panels may crack or spall below the rated maximum temperature when fire streams are used in the area.)

(e) Panels made of metal can be inserted in tracks on the walls and ceilings. Tack weld one corner of each panel to secure it, but provide for expansion and contraction.

**8-2.3** As an alternative to the high cost of fire-resistant materials, a fire in a heavy gauge metal drum, with metal plates welded above to prevent flame impingement on the structure, can be used as a smoke and heat simulation method. If used, the drum should be raised above the floor and the floor protected with a steel plate. Metal drums or burn containers with steel wheels installed may be made mobile and the bottom lined with fire brick.

**8-3 Instrumentation.** The purpose of the instrumentation is to keep the fire within safe parameters, observe the effect of suppression agent application, and with sophisticated equipment observe and record the products of combustion. Thermocouples and analyzing equipment can be used to attain the first two objectives.

**8-4 Built-in Safeguards.**

**8-4.1** The first step in the safeguarding of both staff and trainees is the proper design of the building. Emergency ventilation can be provided by manual control of the roof openings, doors, and exterior shuttered windows.

**8-4.2** Open sprinklers are not reliable in a burn room because of repeated heat exposure. Other methods of applying water should be provided and coordinated with proper ventilation procedures.

**8-5 Cutouts.**

**8-5.1** In order to perform rescue and ventilation evolutions, parts of the building should be designed to be destroyed and replaced. These expendable sections (cutouts or chopouts) can be located in walls, ceilings, or roofs.

**8-5.2** The cutout openings should have a safety device installed to prevent personnel or tools from falling through. Take into consideration that the cutouts can catch on fire and cost money to replace, and manpower will be needed to reconstruct them.

**8-6 Gas Fire Burn Building.** The U.S. Navy has successfully used gas fired burn buildings for several years. The specifications for these sophisticated installations are in the public domain. Several vendors manufacture and install these very safe and environmentally clean simulators.

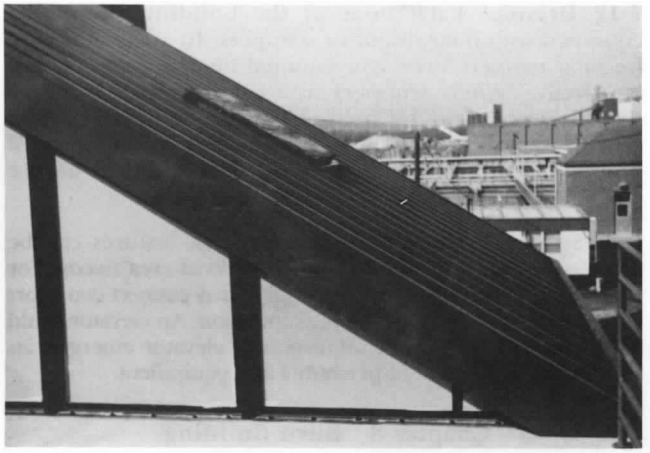


**Figure 8-5.1 Pitched roof with chopout. Alexandria Fire Department, Alexandria, Virginia.**

**8-7 Miscellaneous.** Door stops to hold doors open should not be mounted on the floor but on the wall behind the doors to prevent hose lines from catching on them and causing damage to hose and stops.

## Chapter 9 Smoke Building

**9-1 General.**

**9-1.1** The purpose of the smoke building is to acquaint the trainees with the skills and abilities necessary for survival in smoke laden atmospheres through simulation.

**9-1.2** The building should be designed to allow for constant surveillance of the trainees by the instructor. This may be accomplished by accompanying the trainee, by observing the trainee through windows, or by using closed circuit television (CCTV). CCTV can only be used when the smoke concentration is light or nonexistent.

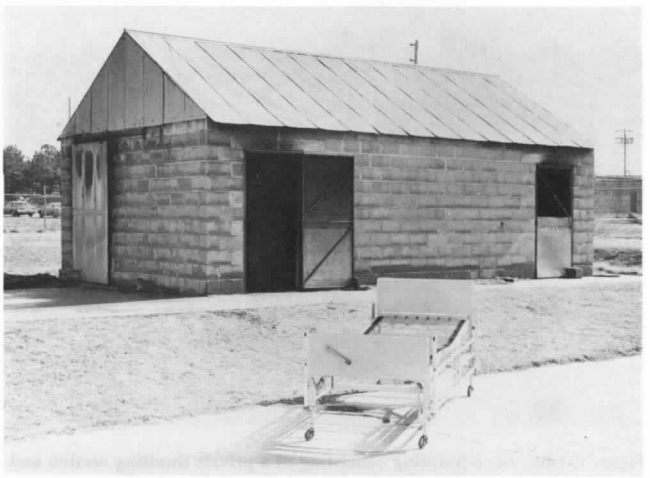


**Figure 9-1 Smoke building. University of Kansas, Lawrence, Kansas.**

**Figure 9-1.1 Smoke building with exhaust fan at roof level. Burlington County Fire Academy, Burlington County, New Jersey.**

**9-1.3** A maze can be built as an enhancement for mask training. It should be large enough to allow the trainees to crawl with their masks donned. This could be a simple 4-sq ft (120-cm$^2$) wooden tunnel.

**Figure 9-1.3 Maze-interior of smoke building. Burlington County Fire Academy, Burlington County, New Jersey.**

**9-2 Flexibility.** The facility should have the ability to change the interior configuration so that various situations can be created. The use of modules or segments that can be quickly changed provides for maximum benefit at a minimum cost.

**9-3 Safety.**

**9-3.1** The smoke building should have entry points and escape hatches at frequent intervals in case of an emergency.

**9-3.2** Any area of the maze that cannot be seen and reached by the instructor should have the walls or top hinged so that any section could be opened. This would make trainees accessible to the instructor continually.

**9-3.3** Some smoke rooms have sensors built into the floor that indicate where the trainees are at all times.

**9-3.4** Provisions should be made for quick ventilation of the building if needed. Consideration should be given to quickly stopping or redirecting the smoke being introduced into that section of the smoke building; this may be accomplished by the use of blowers or exhaust fans.

**9-3.5** Communications capability between the instructor and trainees should be designed into the system. This will provide additional safeguards as well as the ability to transmit instructions to the trainees.

**9-4 Smoke.** Smoke used in the training facility should be nontoxic and of a known composition. Specially designed mechanical equipment may be installed in the facility to produce nontoxic smoke for training purposes.

## Chapter 10 Combination Buildings

**10-1 General.**

**10-1.1** In many training facilities, because of a lack of either available space or funds, or both, individual structures for ladder evolutions, fires, or smoke training may

**Figure 10-1(a) Combination building. Omaha Fire Academy, Omaha, Nebraska.**

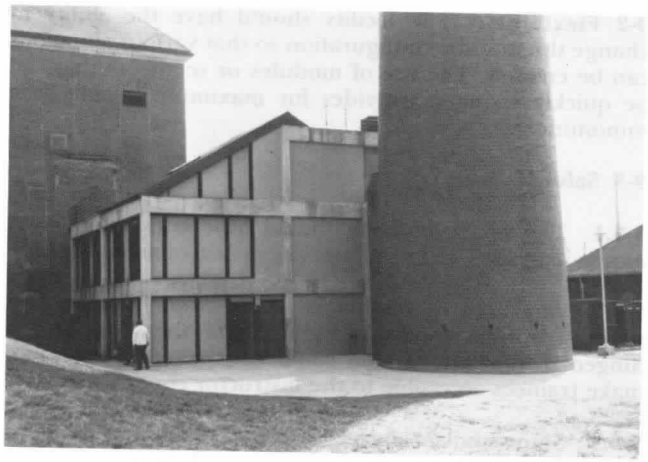


Figure 10-1(b) Combination building — maximum use of minimum space with existing smoke stack for EPA considerations. Building provides for ventilation; smoke chamber; rappelling; laddering; live fire training; sprinkler laboratory; gas and electric cutoff; and forcible entry.

not be built. In these instances, a combination building may be constructed embracing all of the desirable functions in one structure. Consideration should be given to any detrimental effects any one function will have on the facility, equipment, or other functions.

**10-1.2** Certain combinations of functions are, by their very nature, more compatible than others. Consideration might be given to combining all functions except actual fires; the fire function usually results in faster than normal deterioration of the facility. If adequate protection from water and smoke damage is provided, then classroom facilities may be combined with the drill tower and smoke function. Many other combinations are possible, depending on what functions are required or desired, including functions performed by other divisions of the department. Most facility planners find that the limiting factors are available space and funding.

Figure 10-1.2(a) Fire apparatus building classroom. This building is approximately 100 ft (29.9 m) long with five 15-ft (450-cm) over-head doors, classroom, maintenance area, and apparatus storage area. Mississippi Fire Academy.

Figure 10-1.2(b) Combination building classrooms, mask service unit, garage, and kitchen. Burlington County Fire Academy, Burlington County, New Jersey.

## Chapter 11 Outside Activities

**11-1 General.** Ample outside space should be provided for a variety of activities including auto extraction, ventilation, forcible entry, and salvage. Specific layouts will be needed as permanent installations for training in the following areas:

**11-2 Flammable Liquids and Flammable Gases.**

**11-2.1** This area should be located as remote from the main building as possible. Fencing should be provided as a safety factor.

**11-2.2** Pits can be constructed in various sizes and shapes. Obstructions can be built into these pits to make extinguishment more difficult. Pit aprons should be made of concrete, crushed stone, or iron ore slag.

Figure 11-1 Transportation problem — train in tunnel. New York Fire Department Academy, New York, New York.

**Figure 11-2 Flammable liquid burn area. Area includes cross pit, oval pit, square pit, electrical transformers, baffled pit, running spill area, drum pit, vertical tank, horizontal tank, and railroad tank car. Mississippi Fire Academy.**

**Figure 11-2.2 District of Columbia Fire Department flammable liquid pond. Note heavy stone surrounding pond.**

**11-2.3** Other props might include aboveground tanks, overhead flanges, "Christmas trees," and liquefied petroleum gas facilities. For this area, careful consideration should be given to water supply, fuel supply, fuel pumping capability, drainage, and environmental regulations. Close coordination with environmental protection agencies is essential to ensure that the area is designed to applicable standards.

**11-2.4** If flammable liquid or gas is fed to an area, the flow should be controlled by quick shutoff valves. In case of an emergency, an instantaneous shutdown will be necessary.

**11-3 Electrical.** Electrical safety could be taught by constructing various electrical wiring systems between poles. Some electrical problems that might be addressed are downed wires, vaults, transformers, meters, and main disconnects. The local utility could be requested to participate in the planning phase of this section of the training facility.

**Figure 11-2.3(a) Chemical complex fire training aid. Fire Protection Training, Texas A & M University.**

**Figure 11-2.3(b) Rail car loading terminal. Fire Protection Training, Texas A & M University.**

**11-4 Drafting Pit.**

**11-4.1** A drafting pit is desirable to facilitate the training of pump operators and to test pumper apparatus. In general, a capacity of at least 5000 gal (19000 L) of water is

Figure 11-2.3(c) Portable fire extinguishers training area. Training area is 75 ft by 85 ft. Seven training scenario areas are located on this pad. Mississippi Fire Academy.

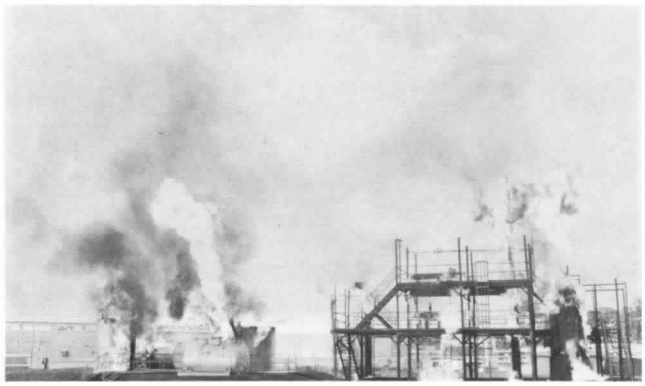


Figure 11-2.3(d) The three-level chemical complex and tank farm is used to simulate fire and leak situations that could occur within a petrochemical process unit. Multiple fire objectives can be created and controlled from the training field control tower. The "pressure vessels" are equipped with remotely operated relief valves to simulate inadequate cooling and containment techniques. Fire training facility, Texas Eastman Co.

necessary, assuming water will be recycled to the pit. Where the pit also serves as the sole supply of water for training, much larger quantities will be needed. The size should be large enough to reduce/minimize heating of water.

**11-4.2** Permanently installed wood chafing blocks are desirable to lessen wear on the hose; tie-down rings are also beneficial. It is desirable to have a hinged cover on the pit. Ample access openings are needed, and collection hoods can be arranged to direct pumper discharge back into the pit. Baffles are needed in the pit to minimize turbulence.

**11-4.3** Instrumentation should be placed in a protected location. It may be advantageous to locate the instruments in an area removed from apparatus noise. In this case an intercom system may be needed between the instrumentation area and the pump operator. When portable instrumentation is used, special provisions should be made for the units.

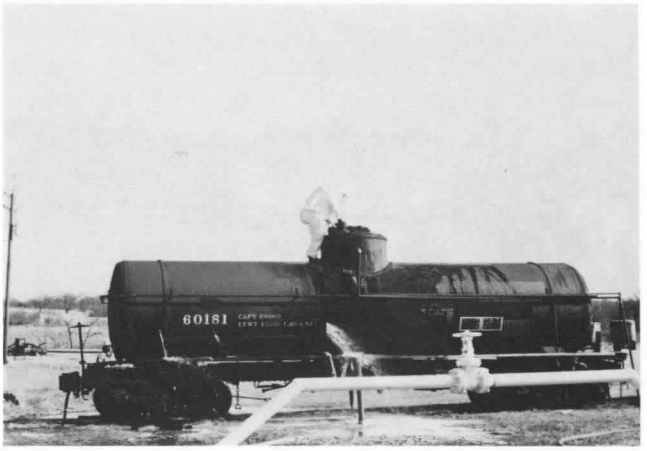



Figure 11-2.3(e) Hazardous material spill training aid. Fire Protection Training, Texas A & M University.

Figure 11-2.3(f) Flammable liquid cooled electric transformer mock-up. Note diking to contain runoff.

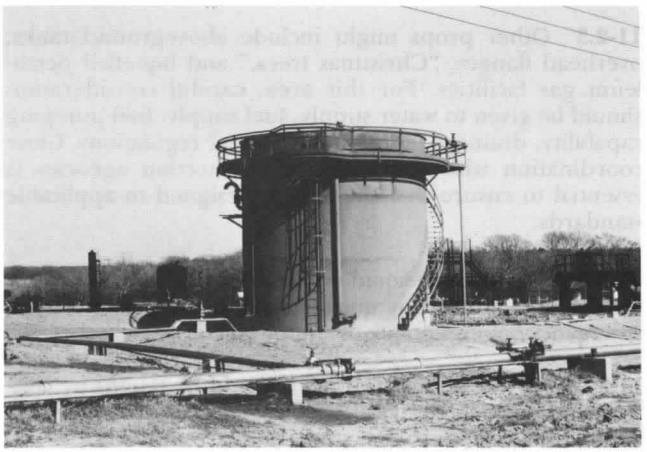


Figure 11-2.3(g) Vertical "floating roof" fuel storage tank fire training aid. Fire Protection Training, Texas A & M University.

**Figure 11-3 Electrical safety when using ladders. Dover County Fire Academy, Dover County, New Jersey.**

**Figure 11-4.2 Collection hood. Omaha Fire Academy, Omaha, Nebraska.**

## 11-5 Apparatus Driver Training Course.

**11-5.1** The design features of any driver training course should challenge the abilities of the student driver based on the customary or anticipated problems encountered in that particular jurisdiction and by matching those challenges to practical situations. In addition, course components should reflect national professional qualification standards for driver training certification.

**11-5.2** Limited resources, high property values, and availability of sufficient property adjacent to the proposed facility will impact on the design features of the driver training course. Resource pooling with other departments or agencies might be explored as a means to overcome these obstacles.

**11-5.3** The specific design components should be agreed upon in advance and suitable time sharing agreements reached prior to any commitment of funds. Agreements between different parties should be resolved at the very minimum through an appropriate "letter of understanding" or preferably a formal contract.

**11-5.4** Incorporating driver training space within the drill field area of the training facility is by far the most practical solution to budgetary or property concerns, but this arrangement will require priority setting with a diminution of driver training activities.

**11-5.5** The optimum arrangements would be a combination of two separated yet interconnected areas, such as the open drill field and a separate driver training area with roadways, hills or inclines, and lane markers.

These areas should be interconnected so that ready transmit from one to the other is accomplished without interference; yet they should be distinctly separated in some manner to make entry from one area to the other a conscious effort, thus protecting the activities underway in each at any given time. A burn building, for instance, would make a good and practical separation barrier.

**11-5.6** Student, staff, and visitor parking areas should be segregated from any driver training areas and should be posted or within some physical barrier or fence. Apparatus involved in driver training exercises should not enter parking areas, and areas of training should be posted to avoid accidental access by unauthorized vehicles.

**11-5.7** The components of any good driver training course should incorporate the following basic driving maneuvers as a minimum:

(a) Serpentine

(b) Alley docking

(c) Opposite alley pull-in

(d) Diminishing clearance

(e) Straight line driving

(f) Backing.

In addition, a hill-incline ramp, with sufficient angle to test the student driver's ability to "hold" apparatus or to demonstrate stopping on an incline, would be of immense value. For those facilities with ample resources and space, a skid pad would be excellent for skid control and braking exercises.

**11-5.8** Whether safety cones are used to mark the course (this would facilitate variances in apparatus size and flexibility in timesharing with other agencies) or permanent obstacles are erected, the course design will depend greatly on the following:

(a) Knowledge of the standard width of streets and intersections in the geographical location

(b) Specifications for highway and road construction in the area served with special emphasis on weather and climate conditions

(c) Length, type, and specifications (turning ratio and wheel base) for apparatus new, old, and anticipated

(d) Snow removal and grass cutting maintenance

(e) Storm drainage of driving track and skid pad

(f) Weight and size of vehicles.

## Chapter 12 Mobile Training

### 12-1 General.

**12-1.1** When the personnel to be trained are spread over a large geographical area, a mobile training unit may be a good alternative to transporting the personnel to a fixed or permanent training center.

**12-1.2** Mobile training units can be customized to address the specific needs of a training course or of the personnel to be trained.

**12-1.3** Mobile training units can decentralize the training programs of a training center, thereby reducing the demands at the training center.

**12-1.4** Mobile training units can bring training to personnel that would not ordinarily or could not travel to a training center.

**12-1.5** Mobile training units afford the ability to provide in-service training to personnel, thus keeping them near their duty station and available for emergency service.

**12-1.6** Mobile training units provide an opportunity to highlight a training program because of their high visibility, mobility, and, usually, large surface areas that can graphically transmit a message to the bystander.

Graphic designs and lettering can show the general public that there is an active training program and that their fire fighters are actively training. The message that is delivered could be a firesafety message, thus using the vehicle as a rolling billboard.

### 12-2 Types of Units.

**12-2.1** The types of units can be divided into two broad categories:

(a) Vehicles that themselves serve as the training device and

(b) Vehicles that transport one or more training props or scenarios.


**Figure 12-1 SCBA training unit, Hanford Fire Department. Photo courtesy of Clegg Industries, Inc., Victoria, Texas.**

**12-2.2** Vehicles that serve as the training device include:

(a) Tankers that leak to simulate hazardous materials spills

(b) Specialized pumping and aerial training vehicles

(c) Portable training towers

(d) Vehicles containing a maze for self-contained breathing apparatus training

(e) Portable classrooms

(f) Public fire education trailers for the promotion of residential sprinklers, smoke detectors, stop, drop, and roll, and escape planning.

**12-2.3** Vehicles that transport one or more training props or scenarios can range from a pick-up truck, van, or station wagon to a trailer or large truck. These vehicles are especially useful for transporting smaller, more portable training devices and simulators. Devices may include:

(a) Computer simulators

(b) Pump panel simulators

(c) Driver training equipment

(d) Rescue tools and equipment

(e) Hazardous materials handling equipment

(f) Live fire training (LPG, extinguishers, etc.).

### 12-3 Vehicle Design.

**12-3.1** Vehicles should meet all federal and state motor vehicle requirements.

**12-3.2** The safety of the operators and users of the vehicle should be a top priority during the design of the vehicle.

**12-3.2.1** Switches and knobs should be properly labeled as to their function and should be designed or located so that they do not protrude, thus presenting a bumping hazard.

**12-3.2.2** Walkways, stairs, and ladders may require nonslip surface treatment. Areas where students will be crawling should be smooth, without splinters, and have edges and corners that are rounded.

**12-3.2.3** Interior lighting should be appropriate for the type of training being conducted. It may be necessary to provide a different lighting system to be used during emergencies or maintenance.

**12-3.2.4** Handrails and grab bars should be strategically placed to assure that students can maintain their stability. Rounded and smoothed edges will prevent the students from being snagged or scraped by these devices.

**12-3.2.5** Reflectors are inexpensive and help mark the outside of the vehicle to avoid nighttime collisions. Reflectors and safety tape are particularly helpful to delineate staircases, handrails, and doorways.