USACE Guidance for the Preparation of Design Packages Fire Protection Engineering "Design-Build" versus "Design-Bid-Build" 25SEP2006

I. Abstract

This information is provided as guidance only. In other words, it is not a standard. Currently, neither the US Army Corps of Engineers nor the US Air Force has published guidance to address the subtle differences that must be considered in the preparation of contract documents for Design-Build versus Design-Bid-Build procurements for fire protection systems for aircraft hangars. To go a step further, this guidance should be used, not just for projects involving aircraft hangar fire protection, but for all projects where fire protection and life safety are included.

We have seen many Department of Defense (DoD) projects where there is much confusion associated with how to effectively prepare each type of design. In many cases, we see Design-Bid-Build methodologies, such as Unified Facilities Guide Specifications (UFGS) and other generic requirements, being placed into the contracts for Design-Build projects, which is inappropriate and leads to inadequate preparation and poor execution of these contracts. While the starting and finishing points in both Design-Build and Design-Bid-Build are the same, the process to get from the beginning to the end is distinctly different.

This guidance is intended to assist all stakeholders in being consistent in what is required, whether a project is being prepared “in house” (i.e., by DoD personnel) or “out-of-house” (i.e., by an A-E firm or its consultants). The hope in developing this guide is to put all stakeholders “on the same page” so that the requirements and expectations are clearly identified and are consistent from project-to-project and from district-to-district.

II. Design-Build

A. Solicitation Preparation

1. Basis of Design (BoD)

[Note: The use of the term “design analysis” is not appropriate for a Request for Proposal (RFP). There are specific requirements associated with any design analysis prepared for, or prepared by, the US Government. For procurement purposes, these requirements are better referred to as the “Basis of Design.”]

a. Identify the basic design criteria and realize that other Unified Facilities Criteria (UFCs) may also apply. Do the appropriate research as needed. For example, see the subtle differences of criteria between fixed- and rotary-wing aircraft hangar projects.

US Army Rotary-Wing Aircraft Hangar Projects (including, but not limited to, the following)

- UFC 1-300-07A
- UFC 3-600-01
- ETL 1110-3-484
- ETL 1110-3-485

US Air Force Fixed-Wing Aircraft Hangar Projects (including, but not limited to, the following)

- UFC 3-600-01
- ETL 1110-3-484
- ETL 02-15 (UFC 3-610-01)
- ETL 99-4

b. Prepare and include in the BoD a preliminary hydraulic analysis, which includes an estimate for required flow and pressure with all assumptions clearly defined and referenced. For aircraft hangar fire protection, these calculations must demonstrate simultaneous operation of both the hangar sprinkler and foam systems and that the available water supply is capable of meeting the required water demand of the project. Failure to do this may (and often does) result in a project being inadequately scoped and funded to provide a functional system.

2. Drawings

No drawings for fire protection are necessary to accompany the BoD; however, drawings showing approximate locations and sizes of related components may be needed to successfully convey the extent of the project.

3. Technical Requirements
    a. Performance-based specification sections must be prepared for fire protection. According to the Design-Build Institute of America, this is “a specification expressed in terms of an expected outcome or acceptable performance standard. This type of specification is used to articulate the customer’s requirements.” Furthermore, “when facility requirements are stated in performance terms and related to recognized industry standards, the approach not only provides flexibility to the offerors in meeting the desired objectives, but it fixes responsibility upon the design-builder in clearly understood performance terms.”
    b. Define the acceptable qualifications for the project fire protection engineer. For aircraft hangar projects, the qualified fire protection engineer shall be an individual who is a registered professional engineer that has successfully passed the fire protection engineering examination administered by the National Council of Examiners for Engineering and Surveying (NCEES). Include past performance criteria as a part of the qualifications process.
    c. Define the qualifications for the installing contractor, e.g., the National Institute for Certification in Engineering Technologies (NICET) level or minimum number of years’ experience and training. Include past performance also.
    d. Mandate that project specifications be tailored to the specific project. In other words, remove materials or equipment that do not apply to the particular project.
    e. Identify fire protection requirements in a minimum of three specification sections: TECHNICAL REQUIREMENTS, SUBMITTAL PROCEDURES and CONTRACTOR QUALITY CONTROL.
    f. For the SUBMITTAL PROCEDURES section, see also the specific requirements for fire protection systems in the National Fire Codes.

B. Awarded Design-Build Package

Note: The designer of an awarded design-build package is expected to provide the following during the execution of the project.

1. Design Analysis (DA)
    a. Identify all design criteria: applicable codes, standards and recommended practices.
    b. Prepare the DA in accordance with Section 1-5 of UFC 3-600-01.
    c. Prepare the hydraulic analysis, including hydraulic calculations and the other necessary components for a complete design.

d. The hydraulic calculations shall be accompanied by a drawing(s) identifying the hydraulic pipes and nodes.
e. Obtain current hydrant flow test data. Existing data may be deemed acceptable if they were obtained within four months of the notice-to-proceed.
f. Provide a building code analysis (also identified as a fire protection/life safety analysis) accompanied by a drawing or set of drawings to support this analysis.

2. Specifications
   a. Do not use UFGS. Instead, use project-specific, non-generic specification sections. Include manufacturer-specific information, such as model numbers and any product limitations, in each specification section prepared. In other words, during the process of preparing the specification sections, include Part I (General) and Part III (Execution); however, Part II (Products) may be combined with the materials and equipment catalog documentation for the project. It is suggested that the designer utilize technical specifications from the manufacturer as a template.
   b. Since competition requirements have already been met at this stage in the process, the contractor is free to identify specific products.
   c. Do not identify again the qualifications of the project fire protection engineer once the project has been awarded in D-B.
   d. Tailor the specification sections prepared for the specific project.

3. Drawings
   a. Provide shop drawing quality drawings. For example, see the Plans and Calculations chapter of NFPA 13 concerning automatic sprinkler system design for what is required to be provided on “working” drawings.
   b. Provide an input/output matrix for both fire alarm and fire suppression.
   c. Where two or more fire protection systems are being provided, like those commonly specified for aircraft hangars, include a piping and instrumentation diagram (also identified as a fire flow diagram) to graphically represent the interconnectivity of the fire protection systems. It is suggested that the fire flow diagram identify all major system components, such as alarm check valves and fire pumps and backflow preventers. Represent, with arrows, the direction of flow (to the extent necessary) for clarity.

4. Equipment and Materials Catalog
   a. Provide a table of contents.
   b. Classify the contents of the catalog to facilitate dividing materials and equipment into appropriate categories.

III. Design-Bid-Build

A. RFP Preparation

1. Basis of Design (BoD)

[Note: The use of the term “design analysis” is not appropriate for an RFP. There are specific requirements associated with any design analysis prepared for, or prepared by, the US Government. For procurement purposes, these requirements are better referred to as the “Basis of Design.”]

a. Identify the basic design criteria and realize that other Unified Facilities Criteria (UFCs) may also apply. Do the appropriate research as needed. For example, see the subtle differences of criteria between fixed- and rotary-wing aircraft hangar projects.

US Army Rotary-Wing Aircraft Hangar Projects (including, but not limited to, the following)

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- ETL 02-15 (UFC 3-610-01)
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b. Prepare and include in the BoD a preliminary hydraulic analysis, which includes an estimate for required flow and pressure with all assumptions clearly defined and referenced. For aircraft hangar fire protection, these calculations must demonstrate simultaneous operation of both the hangar sprinkler and foam systems and that the available water supply is capable of meeting the required water demand of the project. Failure to do this may (and often does) result in a project being inadequately scoped and funded to provide a functional system.

2. Technical Requirements

a. Clearly define (in the RFP) the acceptable qualifications for the project fire protection engineer. For aircraft hangar projects, the qualified fire protection engineer shall be an individual who is a registered professional engineer that has successfully passed the fire protection engineering examination administered by NCEES. Include past performance criteria as a part of the qualifications process.

b. Define the qualifications for the installing contractor, e.g., the National Institute for Certification in Engineering Technologies (NICET) level or minimum number of years' experience and training. Include past performance also.
c. Mandate that the project specifications be tailored to the specific project. In other words, remove materials or equipment that do not apply to this particular project.

3. Drawings

No drawings for fire protection are necessary to accompany the BoD; however, drawings showing approximate locations and sizes of related components may be needed to successfully convey the extent of the project.

B. Part I – Pre-Bid Design Efforts

1. Design Analysis (DA)
   a. Identify all design criteria: applicable codes, standards and recommended practices.
   b. Prepare the DA in accordance with Section 1-5 of UFC 3-600-01.
   c. Obtain current hydrant flow test data. Existing data may be deemed acceptable if they were obtained within four months of the notice-to-proceed.
   d. Prepare an updated preliminary hydraulic analysis since new and more pertinent information concerning site conditions and the details of the design may be more defined after the contract award.
   e. Identify sprinkler hazard classifications properly – either graphically delineated in the drawings (with cross-hatching) or identified in detail in the design analysis.

2. Specifications
   a. Identify the qualifications of the project fire protection engineer in the specification section for TECHNICAL REQUIREMENTS.
   b. Use the UFGS since generic specification sections must be developed; however, remember to tailor the specification sections to the specific project
   c. Identify fire protection requirements in a minimum of three specification sections: TECHNICAL REQUIREMENTS, SUBMITTAL PROCEDURES and CONTRACTOR QUALITY CONTROL.
   d. For the SUBMITTAL PROCEDURES section, see also the specific requirements for fire protection systems in the National Fire Codes.
   e. Clearly define (in the specifications) the designer's tolerances with respect to the requirements for calculations to support the design of fire protection systems. For example, if the designer has already prepared hydraulic calculations as a part of his/her design, it is

important that his/her tolerances must be clearly defined to the sprinkler system installer with respect to number of fittings allowed and pipe length deviations permitted in the actual installation so that the installer knows when hydraulic calculations must be performed again.

f. Develop prescriptive specification sections for fire protection. When the final product is described in terms of component materials, dimensions, tolerances, weights, or some other required construction methodology, like equipment type, size, or speed, the specifications are commonly known as prescriptive specifications.

3. Drawings
   a. Coordinate the development of design drawings with the design analysis and the project specifications.
   b. Graphically delineate sprinkler hazard classifications.
   c. Provide an input/output matrix for both fire alarm and fire suppression.
   d. Where two or more fire protection systems are being provided, like those commonly specified for aircraft hangars, include a piping and instrumentation diagram (also identified as a fire flow diagram) to graphically represent the interconnectivity of the fire protection systems. It is suggested that the fire flow diagram identify all major system components, such as alarm check valves and fire pumps and backflow preventers. Represent, with arrows, the direction of flow (to the extent necessary) for clarity.

C. Part II – Post-Bid Construction Efforts

1. Design Analysis & Specifications – At this stage of the project the design analysis and the specifications are already complete, and the methodologies described in the DA as well as those detailed in the specifications have been accepted. No changes are permitted to be made to either the DA or the project specifications prepared in the Design phase.

2. Drawings – Provide shop drawing quality drawings. For example, see the Plans and Calculations chapter of NFPA 13 concerning automatic sprinkler system design for what is required to be provided on “working” drawings.

3. Equipment & Materials Catalog
   a. Provide a table of contents with the catalog.
   b. Classify the contents of the catalog to facilitate dividing materials and equipment into appropriate categories.

IV. Design Analysis

The design analysis is a critical component of the design since it controls design features and details. Regardless of whether the project is being administered as D-B or D-B-B, it is recommended that the design analysis be prepared as outlined in this section.

Divide the fire protection design analysis into a minimum of five chapters to address the fire protection and life safety requirements of the subject project as required by UFC 3-600-01: Building Code Analysis, Life Safety/Means of Egress, Structural Fire Protection, Active Fire Protection, and Passive Fire Protection. When it is appropriate, identify and discuss the applicable minimum fire protection provisions in terms of what is required versus what is being provided. It is also recommended that the design analysis be accompanied by a drawing or a set of drawings (depending on the size and complexity of the project) to graphically represent this information – see Drawing No. LS-1 for an example [attached]. The following is a suggested breakdown within each of the chapters to address in this analysis.

Building Code Analysis

- Occupancy Classification
- Type of Construction
- Basic Allowable Area
- Area Modifications
- Total Allowable Area
- Actual Planned Area
- Allowable Story Height
- Allowable Measured Height
- Height Modifications
- Actual Story Height
- Actual Measured Height
- Anti-Terrorism/Force Protection and Security Coordination into the design

Life Safety/Means of Egress

- Number of Exits
- Maximum Travel Distance
- Maximum Common Path of Travel
- Maximum Dead-End Corridor
- Interior Finish

Structural Fire Protection

- Exterior & Interior Load-Bearing Walls
- Exterior Nonload-bearing Walls
- Structural Frame
- Permanent Partitions

Structural Fire Protection (continued)

- Shaft Enclosures
- Floors
- Roofs
- Exterior Openings
- Stairway Construction

Passive Fire Protection

- Occupancy Separations
- Fire Barrier Walls
- Fire Walls
- Smoke Barriers

Active Fire Protection

- Water Supply
  - Status and Condition of Water Distribution (e.g., Flow and Pressure)
  - Fire Hydrant Distribution
- Fire Department
  - Access to Project
  - Response Time
- Fire Suppression
  - Automatic Sprinkler
  - Automatic Standpipe
- Fire Pumping
- Fire Alarm and Detection
  - Type of Alarm System
  - Location of Alarm Equipment
  - Methods of Detection
  - Status and Condition of Base Fire Alarm Reporting System
  - Compatibility of Alarm System with Base Reporting System
  - Mass Notification and/or Emergency Voice Communication
- Fire Extinguishment
  - Portable Fire Extinguishers
  - Nonwater-based Fire Extinguishing Systems
- Smoke Control Methods
  - HVAC Shutdown
  - Duct Smoke Detection
- Smoke Control Systems
  - Method Used: Prescriptive versus Performance

Note [excerpt from UFC 3-600-01]: “When directed by the cognizant fire protection engineer (FPE), projects with little or no fire protection considerations may not require a fire protection design analysis.”

LIFE SAFETY AND MEANS OF EGRESS		
	ACTUAL	REQUIRED
MAX. TRAVEL DISTANCE	40 M	91 M
LOCATION	RM. 136 (CNTL STERIL) IN EXISTING CLINIC	
MAX. DEAD END	3 M	15 M
LOCATION	RM. 155 (CORRIDOR) IN EXISTING CLINIC	
COMMON PATH OF TRAVEL	9 M	30 M
LOCATION	RM. 102 (PHARMACY) IN EXISTING CLINIC	
NUMBER OF EXITS	10	2

LEGEND

AW ACTUAL WIDTH (M)
RW REQUIRED WIDTH (M)
AO ACTUAL OCCUPANT LOAD BEING SERVED
CO CALCULATED OCCUPANT LOAD SERVED

▲ REQUIRED EXIT

DOOR TAG - AW/RW / AO/CO

BUILDING CODE ANALYSIS

PROJECT: ADDITION TO EXISTING MED/DENT FACILITY
OCCUPANCY CLASSIFICATION OF EXISTING FACILITY: BUSINESS (CHAPTER 39/NFPA 101); BUSINESS (CHAPTER 3/IBC)
OCCUPANCY CLASSIFICATION OF ADDITION: BUSINESS (CHAPTER 38/NFPA 101); BUSINESS (CHAPTER 3/IBC)
OCCUPANT LOAD: EXISTING CLINIC - 191
ADDITION - (GROUND-42; FIRST-88; TOTAL 125)
TOTAL - 316

CONSTRUCTION TYPE: IIB
BASIC ALLOWABLE AREA [(AT) FROM TABLE 503] 2,136 SM
(NOTE: MIN. 9.1 M OF OPEN YARD ON 3 SIDES)
FRONTAGE INCREASE (IF): 40%* 854 SM
SPRINKLER INCREASE (IS): 300% 6,408 SM
TOTAL ALLOWED AREA (AA) 9,398 SM

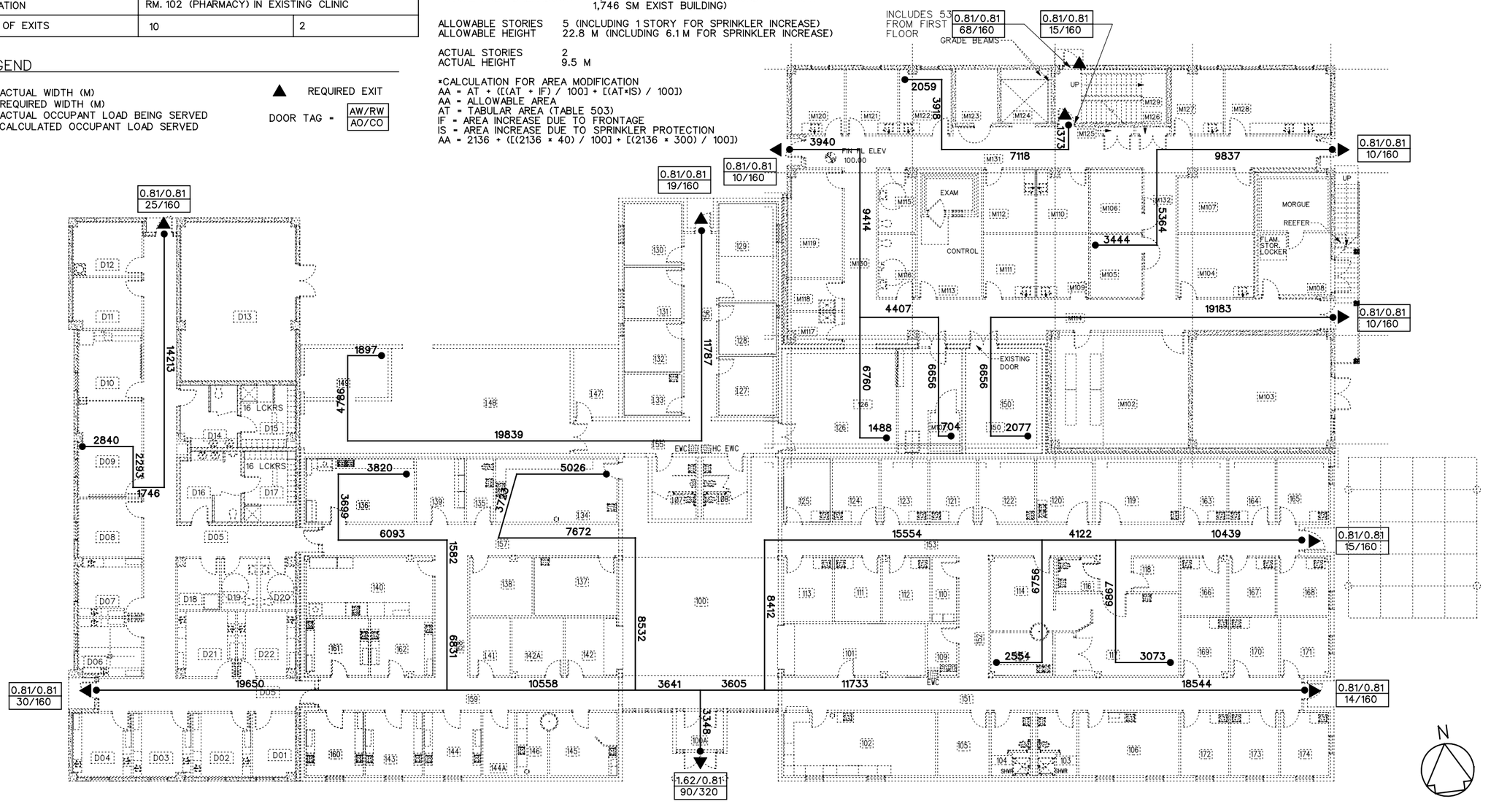
ACTUAL AREA 2,797 SM (TOTAL BLDG - EXIST & NEW)
ACTUAL AREA BREAKDOWN (1,051 SM ADDITION; 580 GROUND/471 FIRST)
1,746 SM EXIST BUILDING)

ALLOWABLE STORIES 5 (INCLUDING 1 STORY FOR SPRINKLER INCREASE)
ALLOWABLE HEIGHT 22.8 M (INCLUDING 6.1 M FOR SPRINKLER INCREASE)

ACTUAL STORIES 2
ACTUAL HEIGHT 9.5 M

*CALCULATION FOR AREA MODIFICATION
AA = AT + ([(AT + IF) / 100] + [(AT*IS) / 100])
AA = ALLOWABLE AREA
AT = TABULAR AREA (TABLE 503)
IF = AREA INCREASE DUE TO FRONTAGE
IS = AREA INCREASE DUE TO SPRINKLER PROTECTION
AA = 2136 + ([(2136 * 40) / 100] + [(2136 * 300) / 100])

STRUCTURAL PROTECTION	
EXTERIOR LOAD-BEARING WALLS	0
INTERIOR LOAD-BEARING WALLS	0
EXTERIOR NONBEARING WALLS	0
STRUCTURAL FRAME	0
PERMANENT PARTITIONS	0
SHAFT ENCLOSURES	0
FLOORS	0
ROOFS	0
EXTERIOR OPENINGS	N/A DUE TO LOCATION
SHAFT ENCLOSURE	1



LIFE SAFETY CODE GROUND FLOOR PLAN
SCALE 1: 125

5 2.5 0 5 7.5
1:125

UNLESS OTHERWISE NOTED, LINEAR DIMENSIONS SHOWN ARE IN MILLIMETERS.

SYMBOL	DESCRIPTION	DATE	APP

US Army Corps of Engineers
Transatlantic Programs Center

MEDICAL CLINIC ADDITION/ALTERATION
LIFE SAFETY CODE FLOOR PLAN

SHEET REFERENCE NUMBER:
LS-1