Montgomery County Maryland Building Design Standards

2022

2022.1

Planning, Design & Construction of Public Facilities

Montgomery County Department of General Services
Division of Building Design and Construction
DIGS – Delivering Great Service!

Figure 1: Contemporary public building featuring a prominent glass curtain wall façade, vertical fins, and a cantilevered upper volume over an entrance plaza.

Figure 2: Interior of a concert hall with tiered balcony seating, wood-paneled acoustic walls, and an orchestra performing on a brightly lit central stage.

Figure 3: Multi-story public facility with a brick and glass exterior, recessed entrance, and landscaped streetscape including sidewalks and streetlamps.

Building Design Standards

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Revision Notes

All revisions and additions compared to the last issue are identified in the document. Revisions are not indicated by color alone; refer to accompanying revision markers or notes where provided.

Introduction

Montgomery County Maryland plans, designs, constructs, and operates numerous public facilities such as libraries, community and recreation centers, indoor and outdoor pools, offices, clinics, emergency management centers, correctional facilities, judicial facilities, police stations, fire stations, laboratories, art and performing arts centers, conference centers, theaters, cinemas, civic buildings, transit centers, parking garages, bus and maintenance depots, liquor warehouses and stores, animal shelters, and a host of other facilities that serve the citizens of Montgomery County, Maryland. Montgomery County has a great interest in the highest quality buildings for the comfort of their occupants and visitors. As a public developer, the County is committed to best practices that sustain the environment through energy efficiency, pollution prevention, community revitalization, and the establishment of standards and policies that enhance quality of life.

The first design manual was created in 1996 by the Division of Facilities and Services, Department of Public Works and Transportation, Montgomery County, Maryland, titled *Design Guidelines and Standards*. It was updated in 1998 and partially revised in 2002. At the same time, as part of the Energy Star program and broader energy-saving initiatives, and in response to various energy regulations, a companion document titled *Montgomery County Energy Design Guideline* was developed. These two documents became the principal guidance for the design and construction of County facilities.

In 2004, the County Council and County Executive initiated and adopted an environmental policy titled *County Environmental Policy*. This policy states: "The County wishes to be recognized as a leader in the area of environmental policy by other public and private organizations that operate both in the county and the region. Adoption of a comprehensive environmental policy will better position the county to lead by example." It further states: "The County desires to increase the awareness of all county agencies, departments, and employees that their actions have environmental consequences and that we all have a responsibility to promote public health, environmental resources management, and environmental protection." As a result, the County initiated an update to its Design Guidelines and Energy Guidelines. In seeking to incorporate green requirements into the design and construction of County facilities, it became clear that all sections of the manuals needed revision to address sustainability concerns.

In 2007, the first version of the updated design manual was published under the title *Montgomery County Maryland, Manual for Planning, Design and Construction of Sustainable Buildings*. The new manual transitioned from a guideline to a set of requirements with a strong emphasis on green design. Green design principles were embedded throughout nearly all chapters of the manual.

In the 2008 version of the manual, systematic project management fundamentals were incorporated, including quality control management, cost management, schedule management, and communication management.

In the 2009 version, numerous updates and comments received from project managers and consultants were incorporated. A new section titled *General Building Standards* was also added. The goal was to consolidate required standards within this section and reduce the number of specification sections.

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Document Updates

The 2010 version included many requested changes, additions, and updates to our design process and requirements. We expanded the "General Building Standards" section and eliminated several specification sections. For the first time, we incorporated the "Energy Design Guidelines" into the Design Manual (DM). The Energy Guideline was no longer an independent document.

In 2018, the County adopted the International Green Construction Code (IgCC) as a substitute for LEED. In addition, a large number of our design requirements are incorporated into the building codes. As a result, we have avoided repeating these code requirements in the new *Building Design Standards*. The 2019 version is a streamlined document that includes only essential design requirements. Our goal is to avoid repeating requirements that are already addressed in the building codes.

Purpose of the Standards

I am pleased to introduce a series of documents that provide the processes, requirements, and standards needed to achieve these goals. These documents will be updated as necessary to reflect changes in the market, delivery methods, technical advancements, innovations, and shifts in project management philosophy and methodologies. The following documents complement one another:

- **Project Management Handbook for Project Managers:** Provides direction to County project managers for managing projects in all phases. The handbook defines and maintains standard processes for project management within the organization.
- **Project Management Handbook for Consultants:** Describes processes, deliverables, and requirements for managing County design contracts by consultants, sometimes referred to as Architects/Engineers (A/E).
- **Building Design Standards:** Contains the County's specific standards for design and construction, including product specifications, performance criteria, and referenced materials.
- **BIM Management Handbook:** Describes processes, deliverables, and requirements for managing Building Information Modeling (BIM) design and documentation. This document will be published upon completion.

Relationship to Contracts and Professional Responsibility

These standards do not replace professional design analyses. Consultants are expected to conduct independent evaluations of the requirements and to discuss with the Project Manager any difficulty in meeting them. These standards are not intended to be used directly as contract specifications. For simplicity, they are devoid of the legal qualifications and language required in contract documents.

If there are any conflicts, the Contract Agreement signed by the County and the Consultant and/or Contractor shall take precedence.

These standards are intended to represent a cost-effective application of proven systems that provide sustainable facilities, satisfy the County's "Program of Requirements" (POR), and are efficient to operate and maintain. Suggestions for improving these standards are encouraged and should be addressed to project managers or directly to the Chief, Division of Building Design and Construction Special Projects.

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Chapter 1: Building Design Requirements

Division 1

Section 01 00 00 - General

1. This document provides a general and broad scope of requirements for various building components. No details or performance specifications are included in this section. Program of Requirements (POR) should not repeat these requirements for every space. In specifying these requirements in the POR, use of the phrase "Building Standard" will be adequate. Variations from the General Building Standards must be included in the POR.
2. When approval by the County is requested, County means Chief, Division of Building Design and Construction (DBDC), DGS.
3. Other requirements and documents: Consultants must use the following documents and requirements in preparation of design and construction documents:
    a. This document, Montgomery County Design Standards
    b. Commissioning Requirements Handbook
    c. Division 1: to be used in the specifications
    d. Project Management Handbook for Consultants: explains design process requirements
    e. Montgomery County Sign Standards
    f. Program of Requirements Template: to be used for preparation of POR
    g. Building Condition Assessment Template: to be used in preparation of building condition assessment

Design

4. According to the "Project Management Handbook for the Consultants," the purpose of design is to prepare a set of documents that meet the following requirements (priority will be established by the owner if needed):

- **Basic Requirements:**
    - Scope: Comply with the Program of Requirements (POR)
    - Budget: Comply with established budget (CCAP)
    - Comply with latest approved building codes, regulations, and County policies
    - Safe and secure design
    - Sustainable, green, and high energy efficient
    - Constructed with high quality, durable, and maintainable materials
    - Comply with the County Design Standards
- **Overlay Requirements:**
    - Aesthetically pleasing
    - Contextual and community friendly
    - Innovative
    - Flexible and adaptable to future changes in use and technology

Code and Other Compliances

5. Building and site must be designed in compliance with all applicable codes and regulations including Federal, State, County, and Local jurisdictions, regulating agencies, utility companies, etc.
6. If not part of the scope of work, a Program of Requirements (POR) will have been prepared by the County, perhaps with the involvement of a consultant. The POR is intended to identify the types of spaces required, the activities and number of people to be accommodated, space sizes and proximity relationships, services requirements, etc. The program must be well prepared to provide a good starting point for the design process. All programming for County facilities shall be based on the criteria contained in this manual.

Section 01 00 01 - Accessibility Provisions

1. It is County policy to provide a barrier-free environment that will benefit all people: the disabled, infants, seniors, and the temporarily injured, etc. Such an environment should not be perceived as unusual or burdensome, but rather simply another aspect of our cultural fabric needing positive integration. The design teams shall design County projects so that all, including the disabled, can experience community activity.
2. Full compliance with ADA is required.
3. All conference rooms must be designed for wheelchair access and use. The table must be accessible by wheelchair and the room must be maneuverable in accordance with codes.
4. All County facilities larger than 10,000 SF must have a single-user, assisted-use or unisex toilet room for family use.
5. ADA codes are minimum compliance requirements. Consultants/designers must design buildings and spaces that exceed these requirements. Tolerances should be such that if marginal mistakes in the installations happen, code is not violated. If slope is required to be not exceeding 2%, then design should specify 1%. If height is required to be between 27 to 31 inches, design should be 29 inches to leave room for site adjustment.
6. All facilities must have a room that meets federal requirements for a Lactation Room.

With the passage of The Patient Protection and Affordable Care Act (Affordable Care Act) in 2010, the provision of lactation rooms in workplaces and reasonable break time for employees to express breast milk became a federal requirement. Section 4201 of the Affordable Care Act requires provision of "a place, other than a bathroom, that is shielded from view and free from intrusion from coworkers and the public, which may be used by an employee to express milk." These requirements became effective in March 2010 and apply to all employers with more than 50 employees. Smaller employers can apply for an exception if they can prove undue hardship.

Lactation rooms should not be in or accessed through bathrooms, locker rooms, or similar facilities, but should be distinct rooms designed for their intended purpose. Lactation rooms may be located near lobbies or main corridors, in proximity to breakrooms, bathrooms, and other core building functions. In larger facilities it may be beneficial to consider distributed rooms for convenience and to reduce travel time.

Each room shall be equipped with a lockable door (accessible by emergency personnel), table(s) or counter, comfortable ergonomic chair(s) with adjustable armrest, trash can, paper towels, cleansers, adequate lighting, and two duplex electrical outlets.

outlets and a medical grade breast pump. A sink with hot and cold water is required near but is highly preferred to be within the actual lactation room.

7. Section 01 00 02 - Safety and Security

1. Safety and security provisions are becoming more complex as concerns for personal safety increase, equipment becomes more sophisticated and costly, and security systems of all types become more readily available at reasonable cost. Often, security requirements conflict directly with convenient access for maintenance, custodial care, and response to emergencies.
2. Early security planning may directly influence the design and location of many strategic mechanical and electrical components to the benefit of all concerned. Standardized access and CCTV systems as required by Electrical Requirements shall be provided.
3. In planning and designing building areas that are 80 inches or greater above surrounding floor/ground level, the designer shall make provisions for fall protection/fall restraint as required by OSHA 1910.132.
4. Building areas that are defined by OSHA 29 CFR 1910-146 as "Permit Required Confined Spaces" shall be minimized in the design of new or renovated County facilities.
5. The consultant shall consider crime prevention (anticipation, recognition and appraisal of crime risk and the initiation of some action to remove or reduce it) in the development of the overall design of facilities. The included CPTED (Crime Prevention Through Environmental Design) shall be used in the design of County facilities.

Crime Prevention Through Environmental Design

Only in the last 20 years have designers and architects begun to see the need to plan and build with more than just the traditional threats of nature — fire, earthquakes, and hurricanes — in mind. They must now consider the threat of crime.

There are four overlapping CPTED strategies:

Natural Surveillance A design concept directed primarily at keeping intruders easily observable. Promoted by features that maximize visibility of people, parking areas and building entrances: doors and windows that look out onto streets and parking areas; pedestrian-friendly sidewalks and streets; front porches; adequate nighttime lighting.

1. Restrooms should be observable from nearby offices.
2. All exterior doors should be well lit.
3. Hallways should be well lit.
4. Dumpsters should not create blind spots or hiding areas.
5. Windows and exterior doors should be visible from the street or by neighbors.
6. All four facades should have windows.
7. Parking areas should be visible from windows; side parking areas should be visible from the street.
8. Parking and entrances should be observable by as many people as possible.
9. Parking areas and walkways should be well lit.
10. Dumpsters should be clearly visible.

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Shrubbery should be kept under two feet in height for visibility.

The lower branches of existing trees should be kept at least six feet off the ground.

Windows should not be obstructed with signs.

Windows and doors should have views into hallways.

Territorial Reinforcement

Physical design can create or extend a sphere of influence. Users then develop a sense of territorial control while potential offenders, perceiving this control, are discouraged. This approach is promoted by features that define property lines and distinguish private spaces from public spaces using landscape plantings, pavement designs, gateway treatments, and fences.

1. Perimeters should be defined by landscaping or fencing.

2. Fences should be designed to maintain visibility from the street.

3. Exterior private areas should be easily distinguishable from public areas.

4. Security and/or reception areas should be positioned to screen all entrances.

Natural Access Control

A design concept directed primarily at decreasing crime opportunity by denying access to crime targets and creating in offenders a perception of risk. This is achieved by designing streets, sidewalks, building entrances, and neighborhood gateways to clearly indicate public routes and by discouraging access to private areas with structural elements.

5. Public entrances should be clearly defined by walkways and signage.

6. Building entrances should be accentuated through architectural elements, lighting, landscaping, and/or paving stones.

Target Hardening

Accomplished by features that prohibit entry or access, such as window locks, dead bolts for doors, and interior door hinges.

7. Exterior doorknobs should be a minimum of 40 inches from adjacent windows.

8. Case-hardened dead bolt locks should be installed on all exterior doors with a minimum of a one-inch throw.

9. Door hinges should be installed on the interior side of the door, or tamper-proof hinges should be used.

Section 01 00 03 - Structural Considerations

General

1. It has been common practice to design to International Building Code (IBC) minimum structural requirements for floor loading, seismic zone, and related criteria. Operational experience indicates that designing to code minimums is not in the owner's long-term best interests. One example is floor load capacity. Another major consideration is vibration. A great deal of instrumentation is extremely sensitive to vibration, which may require more rigid structures or the inclusion of vibration isolation

pads. Designers shall address, during the Schematic Design Phase, floor loading and vibration isolation provisions and the advantages provided by the proposed structural system.

Column Distances

2. To provide a flexible work environment, narrow structural bays will not be accepted. A span of 30 feet by 30 feet or larger shall be designed.

Floor-to-Floor Height

3. Floor-to-floor height is an area of major concern. Although there may be variation based on the intended use of the space, anything less than fourteen feet will not be considered adequate. Further, the depth of the structure for each floor should be carefully controlled to be as uniform as possible throughout and not interrupted by major beams. Floor-to-ceiling distance must be a minimum of 8 feet (9 feet is recommended to provide a 2-foot clerestory to transfer daylight into interior spaces). This requirement supports green building objectives.

4. The space between the ceiling and underside of the structure above shall be a minimum of 3 feet to provide adequate space for all mechanical, sprinkler, and lighting devices.
5. Although not mandatory, concrete waffle slab construction offers several advantages over most other forms of construction, e.g., no deep beams; a uniform/modular surface to work under; opportunity for patterns for hangers, sleeves, etc.; rigidity; etc., and should be given adequate consideration.

Floor Load

6. Floor live loads must be 100 lb/sf or more to comply with codes. On each floor, a designated area must have a 200 lb/sf live load for filing area.

Seismic Resistance Considerations

7. It is reasonable to expect that the science and art of seismic design will continue to change rapidly as new information and faults are discovered, and consultants are encouraged to anticipate and account for possible future practices and requirements as much as practicable. The structural design for all new County facilities shall meet the current codes.

Section 01 00 04 – Internal Accessibility

1. One of the most important requirements in facilities is accessibility to service distribution systems. Pipe and duct shafts should be provided with floor landings or platforms with lighting, electric outlet, and doors rather than access panels. Suspended ceilings should be provided in offices, conference rooms, etc. Where suspended ceilings are appropriate, they must be lift-out exposed T-bar type systems. Hidden spline type ceilings are unacceptable. Suspended ceiling material must be able to withstand a lot of handling and be easily cleaned. Where hard finish ceilings are required, extensive access panel provisions must be included, carefully sized and located to provide effective access to the equipment and valves above.

Division 03

Section 03 00 00 – Concrete

General

1. All DCD projects that include concrete shall conform to the requirements of the latest edition of American Concrete Institute ACI 301, *Specifications for Structural Concrete for Buildings*. These specifications shall be used essentially in their entirety by referral in the project Specifications.
2. The Designer shall review the mandatory and supplemental requirements listed in ACI 301. Items not listed in these Specifications will be assumed to be inapplicable to the project or shall be subject to the option of the General Contractor.
3. As a requirement of the Specifications, two (2) copies of the latest version of ACI 301 shall be furnished by the General Contractor for use in the field by the General Contractor and the Construction Representative.
4. Floors, walls, and decks of swimming pools and the roof above shall have galvanized steel reinforcement.
5. No insulating concrete fill shall be used on roof decks.
6. All exposed embedded items in exterior concrete or parking garage floors or ramps shall be galvanized if fabricated from ferrous metal.
7. The Specifications shall include a provision requiring that the General Contractor shall submit proposed methods for curing of concrete to the Designer for approval prior to placement of any concrete.

8. The Specifications shall direct the General Contractor to maintain an accurate daily record of the locations in which concrete is placed and shall furnish a certified copy of this record to the Designer.

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9. The Contract Specifications shall also include the Specification Standard paragraph entitled "Additional Concrete due to Unanticipated Soil Conditions".
10. All underground chambers for exterior electrical work shall be constructed of cast-in-place concrete or one-piece precast concrete chambers.
11. For a period of at least 18 months after placement of concrete, no salt or any material containing salt shall be used on exterior concrete surfaces.

Division 05

Section 05 00 00 - Metals

1. All miscellaneous and ornamental iron exposed to the weather or high humidity areas and fabricated of corrosive iron or steel shall be hot-dip galvanized after fabrication in accordance with ASTM A386 or A123. All hot-dip galvanized steel shall be inspected for compliance with ASTM requirements and shall be stamped to indicate the ASTM number and the ounces of zinc per square of surface.
2. Galvanized items to receive additional finishes shall be additionally treated by applying a passivating process equal to Bonderizing, Granodizing, or Duncanizing.
3. All iron and steel not to be galvanized shall require a shop coat of metal primer prior to shipping.

Division 06

Section 06 00 00 - Wood and Plastics

1. All lumber used for blocking, nailing cleats, and other wood set in exterior walls or roofs, or in contact with damp concrete, shall be impregnated under pressure with a wood preservative. All treated wood shall be dried before installation, and all field cuts shall be brush treated with the preservative materials.

Division 07

Section 07 00 00 – Envelope

All exceptions requiring written approval by the County mean written approval by the Chief, Division of Building Design & Construction, Department of General Services, Montgomery County, Maryland.

Exterior Walls

1. Exterior walls shall be brick, cast stone, concrete masonry units (high-quality and decorative types), or other long-lasting high-quality materials. Materials and finishes must be suitable for the function of the building.
2. Exterior walls must be detailed and calculated such that the dew point is on the outside surface of the vapor barrier. An air barrier and vapor barrier must be provided.
    a. The Designer shall provide the County documentation, detail graphics, and calculations showing dew point location.
3. Where an air space or cavity between the inside surface and outside surface is used, the air space must be 2 inches, and appropriate flashing and weep systems must be provided. (Green)
4. Air Barrier Systems

a. The Designer shall provide the building enclosure with a continuous air barrier system to control air leakage into or out of the conditioned space.

b. The Designer must review and provide full and proper closure for all roof curbs and other mechanical penetrations not contained in the vertical and horizontal surfaces that will receive an air barrier system.

c. Designer in the written specification must require the contractor to ensure the compatibility of all air barrier components with the various substrates; including but not limited to additional air barrier systems used within the same project, the roofing system(s) and the waterproofing/damp roofing material(s).

d. The two preferred systems are either a spray applied system with membrane flashing and transitions or a fully adhered sheet membrane system.

e. Any alternate Air Barrier System type different from the preferred must be specifically named/requested at Schematic Design and must receive a written approval from the County prior to incorporation into the design documents.

Glazing

1. Glazing units and windows must be High-Performance, U factor smaller than 0.39 Btu/hr-ft²-deg F, Shading Coefficient (SC) smaller than 0.55, double pane, low E (0.34 or better), with tinted and reflective glass with frames that are equipped with thermal breaks all around. Architectural shading devices for control of sunlight are highly recommended. (Green)
2. Windows must be extended as minimum from 2 -6 above finished floor to 7 -6 (5 high). Maximum view to outside must be provided. (Green)
    a. Window height and size may require adjustment to meet ballistic requirements for Police/Public Safety facilities.
3. All windows must be weather-tight. Opening windows must be equipped with locks. Off street, ground level windows and those accessible from fire escapes, adjacent roofs, and other structures that can be opened must be fitted with a sturdy locking device.
4. Provide light control reflective blinds for all windows. (Green)

Roofing

1. All roofing designs must comply with the minimum requirements of the latest National Roofing Contractors Association (NRCA) guidelines for Low Sloped and Steep Sloped Roofing and when appropriate Waterproofing and in compliance with FM Global requirements for roofing installation.
2. All roofing copings, gravel stops, flashing, scuppers, gutter, downspouts, and other roofing related sheet metal work shall be done in conformance with latest edition of Sheet Metal and Air Conditioning Contractors National Association (SMACNA) and in compliance with FM Global requirements for sheet metal flashing installation.
    a. All metal flashing (such as copings, eaves, rakes, etc.) must be face attached using cleats. Use of through fasteners is unacceptable for face attachment.
    b. Cleat material must be the next gage heavier or next size thicker than the base material thickness of the face material that is being attached to the cleat.
    c. All counterflashing must be two (2) pieces, with receiver and insert using wind clips for retention for mechanical curbs, thru-walls, or any other detail requiring counterflashing.
    d. All Public Safety facilities must be provided with “seasonal lights” attachment points at copings, rakes, and eaves at a spacing not greater than eighteen inches (18”).
3. Should a conflict exist between the NRCA, SMACNA, or FM Global standards, the most demanding/stringent/durable detail shall be selected and used.
4. All low sloped roofs must have fall protection design at the edge such as parapets or railing with minimum 42.5 inches height.

5. Roof Access:

    a. Exterior ladder access between roof elevation changes greater than three feet (3') but less than ten feet (10') must be provided.

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2. Elevation changes greater than ten feet (10') between levels must be provided with an interior walk outdoor from a penthouse/doghouse door or must have a large maintenance hatch which is accessed from an interior stairway access. Stairs must be standard tread rise and run.
3. An exterior stairway access (in lieu of an interior access) for elevation changes greater than ten feet (10') may be considered but must be specifically named/requested at Schematic Design and must receive written approval from the Division Chief prior to incorporation into the design documents. Stairs must be standard tread rise and run.
4. A "ships ladder" may be considered for access for elevation changes of ten feet (10') or more but must be specifically named/requested at Schematic Design and must receive written approval from the County prior to incorporation into the design documents and must have a large maintenance hatch.
5. No equipment should be located any closer to the edge of a roof than 10 feet-six inches (10'-6").
6. Proper safety rails or high parapet walls must be provided at low sloped roof perimeters if any mechanical equipment is located within 10'-6" of the edge.
7. Mechanical (any) equipment requiring regular and routine maintenance that must be accessible 24/7/365 should not be placed on any steep slope roof.
    1. Designer must provide two (2) alternate design options eliminating the placement of the equipment on the steep sloped roof with relative costs as alternates to be considered by the County.
    2. Written approval from the County is required prior to incorporation into the design documents of the selected design alternative.

5. Roof Slope

1. **Low sloped** roofing must not be less than 1/2 inch per 12 inches (1/2:12).
    1. Use of tapered insulation is strictly reserved for installation of drainage crickets or saddles to promote water flow to drains, scuppers, or roof edge, with the primary slope built into the structural deck.
2. **Steep sloped** roofing must not be less than 4 inches per 12 inches (4:12).
    1. Roof systems less than 4:12 must be provided with 100% coverage with fully bonded/adhered moisture barrier on the insulation/deck.
3. Deviation from aforementioned slopes must be requested and specifically named during Schematic Design and must receive written approval from the County prior to incorporation into the design documents.

6. Flashing Height

1. Minimum base flashing height at locations of window sills, thru-wall flashing, and other fixed elevations on the vertical surfaces must be not less than twelve inches (12") measured from the high point of the finished height of the roof (top of drainage crickets or saddles).
2. Minimum base flashing height for general mechanical curbs and penetrations must be not less than twelve inches (12") measured from the high point of the finished height of the roof (top of drainage crickets or saddles).
3. Package unit HVAC equipment minimum base flashing height must be not less than eighteen inches (18") measured from the high point of the finished height of the roof (top of drainage crickets or saddles).

7. Roof System Warranty

1. All low slope roofing systems must provide a manufacturer's warranty for a period of not less than 20 years and must contain no dollar limitation for the warranty.

- **b.** All steep slope roofing systems must have a manufacturer's watertight warranty for not less than:
  - **i.** Metal Roof – twenty (20) years
  - **ii.** Shingle Roof – twenty-five (25) years
  - **iii.** Membrane Roof – twenty (20) year no dollar limit warranty
  - **iv.** Other – not less than twenty (20) years
- **c.** The prime/general contractor and all appropriate subcontractors and sub-subcontractors must provide a minimum two (2) year Contractor's total roof system (covering **ALL** components installed) warranty in addition to the manufacturer's roof warranty.
  - **i.** Performance of work required under this listed warranty/guarantee will be listed as part of the conditional acceptance of the building at substantial completion.
- **d.** Manufacturer's warranty must not limit warranty for any damage created by wind speed less than 55 mph.

8. Preferred County Material for Low Sloped Roof Systems

- **a.** 80 mil PVC or TPO fully adhered single ply roof membrane.
- **b.** 4 ply asphalt built-up roof system using Type VI fiberglass felts with white granular SBS cap sheet, all mopped with Type IV asphalt.
- **c.** Protected Membrane Roof Assemblies (PMRA) on concrete or metal/concrete composite decks should use a two coat Hot Modified Bitumen/Hot Rubberized Asphalt with polyester reinforcing (approximately 210 mil or greater) system. This is also intended for plaza construction, as well as vegetative roofing systems.
- **d.** Roof systems shall be FM Global approved systems.
- **e.** General roof system material selection includes a system of components including the structural deck, air barrier, vapor retarder, insulation, roof membrane, roof membrane flashing, sheet metal flashing, under deck interior fire proofing (if needed), and interaction of the roof system components with various building components such as walls, parapets, HVAC equipment, electrical services, design slope, and storm water management (e.g., drains and gutters). In addition, roof system material selection must consider the needs for the **inevitable roof system replacement**, access, foot traffic, equipment maintenance, and building component replacement (e.g., HVAC equipment).
- **f.** Any alternate roofing membrane type different from the preferred must be specifically named/requested at Schematic Design and must receive written approval from the Division Chief prior to incorporation into the design documents.

9. Preferred County Material for Steep Sloped Roof Systems

- **a.** Designer must request and specifically name the steep sloped roofing system during Schematic Design and must receive written approval from the County prior to incorporation into the design documents.

4. Vegetative Roofing Systems

- **a.** The preferred County roof deck to be used for the installation of a vegetative roofing system is either poured concrete or a composite metal/concrete deck.
- **b.** The minimum slope that must be built into the deck must be not less than 1/2 inch per 12 inches

(1/2:12).

- **c.** Vegetative roofing systems shall be specified with a minimum three (3) years of quarterly maintenance included in the project base bid requirements, with written maintenance reports including photographs, and training to the owner no sooner than one (1) month prior to the maintenance contract end date, but no later than two (2) weeks prior to the maintenance contract end date.

- d. Vegetative roofing systems shall include a minimum of eight inches (8") of growing medium/soil.
- e. Any alternate depth from the eight inches (8") depth must be specifically named/requested at Schematic Design and must receive written approval from the County prior to incorporation into the design documents.
  - i. If a soil depth of less than eight inches (8") is approved for use, the flashing heights for all fixed elevations such as walls, equipment curbs, and windowsills must be designed as if eight inches (8") of medium/soil is being used.
- f. Vegetative roofing systems shall be complete systems that include protection board, root barriers, drainage membrane, growing medium, and all edging and trim accessories.
- g. Plant selection shall be made based on actual conditions of specific roof areas considering factors such as the amount of sun, wind, and proximity to rooftop equipment and parapets.
- h. Ensure that the structural engineer is given the maximum saturated weight of the vegetative roofing system to use in their structural design and shall assume for design load purposes nothing less than eight inches (8") of medium/soil is being used, even with an approved lesser alternate depth system.
- i. All vegetative roof systems must have a proper safety rail system or parapet, either of which must not be less than 42.5 inches (42 1/2 inches) in height from the high point of the finished height of the roof (top of drainage crickets or saddles).

10. Insulation

- a. Clearly indicate the minimum aged R-value for all roofing insulation.
- b. Insulation thicknesses greater than four inches (4") must be installed in at least two layers with all joints between the layers broken (offset so as not to align).
- c. Base layers of insulation on metal decks must be mechanically fastened with subsequent layers adhered using either hot asphalt or low-rise adhesive.
  - i. Joints between layers must be broken (offset so as not to align).
- d. Wind resistance attachment must not be less than I-90 in accordance with FM Global requirements for the installation of roofing systems.
- e. Consideration should be given to increasing wind resistance attachment to FM Global I-120 for all buildings classified as Type IV facilities according to ASCE 7 in accordance with FM Global requirements for the installation of roofing systems.
- f. Use of a minimum 1.8 pounds per cubic foot density insulation is preferred regardless of type.
- g. In all cases, an Exterior Basement Insulation System (EBIS) is required for all habitable spaces below exterior finish grade.
  - i. Extruded Polystyrene must be used.

11. Walk Pads

- a. Provide walk pads around all rooftop mounted mechanical equipment and over to the point of roof access.
- b. Provide walk pads at locations where foot traffic causes impacts to the roofing area such as at ladders and points requiring stepping over expansion or control joints.
- c. Care must be taken to prevent the blocking of water flow to drains, scuppers, or roof edge.

12. Snow Guards for Steep Slope and Protection

- a. All steep slope roof systems must be carefully reviewed to determine if snow guards/protection are required to prevent injury to people, damage to vehicles, or damage to building/facility structures and landscaping.

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b. Provide mechanically locking snow guards which attach on the standing seam for standing seam metal roofs.

c. Through penetration of the metal must be avoided.

d. Generally, the minimum design of snow guards/protection should provide not less than a complete row of protection at the eave and then again at the third point moving from the eave to the ridge.

e. The intent of snow guards/protection is to design to keep snow static and to prevent dynamic movement of the snow.

13. Dam proofing and Waterproofing

a. Provide vertical waterproofing at all locations where habitable space is located below exterior finished grade.

b. Waterproofing system shall include protection/drainage board and tie into a foundation drain system.

c. Foundation drains should, whenever possible, gravity drain to the stormwater system.

ii. If mechanical pumping for foundation drains must be used, the sump collection pit should first be considered for location outside the building.

iii. Mechanical pump(s) must have separate electric power circuits for the individual pump and the high-water alarm system.

14. General

a. Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

b. A sealant with a reasonable projected life of fifteen (15) years must be used.

ii. Urethane or silicone can be considered. In any case, the designer must place a heavy emphasis on the surface preparation for performance of the work.

iii. Use of appropriate closed cell backer rod is required.

b. Fire Proofing:

c. Designer must consider whether the interior fireproofing material (if required as an approved fire-rated assembly) for the roof will be damaged during the inevitable roof replacement. If the reroofing activity will cause loss of adhesion or displacement of the fireproofing, then the material must **not** be specified or used, and the designer must provide an alternate system or material.

d. Roof drains must not be less than four inches (4”) in size regardless of the drainage area being served.

e. This is a quality, not quantity, requirement related to maintenance and care of the drains from roof debris.

ii. All drain strainer baskets must be coated cast iron or of similar durability.

iii. Plastic dome material is not acceptable.

iv. Ventilation for steep sloped roofs should be at 1.33 times that required by code minimum.

v. Combinations of gable vents, ridge vents, and soffit vents are the preferred method for achieving ventilation without the use of electric fans.

e. Conduit, piping, ducts, or other MEP apparatuses must not be attached to the structural roof deck. All attachment should be from appropriate beams, girders, joists, or other structural members, or from bridging angles and supports.

f. With prior approval in writing during the Schematic Design from the Division Chief prior to incorporation into the design documents, and if the load is considered by the Engineer of Record and provided for in the design of the composite structure, limited exceptions may be permitted.

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metal/concrete structural deck or cast in place concrete structural deck, then the aforementioned requirement not to allow attachment to the structural deck may be waived.

- Use of Exterior Insulation Finish System (EIFS) is strongly discouraged.
    1. If EIFS is to be used, it must have a backing with a 100% membrane waterproofing system and drainage plane provided and must have all unique and typical details provided in the design documents, especially all the flashing and sealant detailing.
    2. Delegation of the EIFS system design to the General Contractor (and its Subcontractors) is not allowed.
    3. If EIFS is proposed to be used in the project design, then the designer must specifically name/request use of the system at Schematic Design and must receive written approval from the Division Chief prior to incorporation into the design documents.
    4. Extruded polystyrene for EIFS with a weight not less than 1.8 lbs./cf and a minimum compressive strength per ASTM D1621 of 40 psi must be used.

Division 08

Section 08 00 00 - Doors and Windows

1. Exterior doors must be heavy duty full flush, hollow steel construction, solid core wood, or insulated tempered glass. Wood doors must be at least 1.75 inches thick. Exterior doors must be weather-tight, equipped with automatic door closers, and open outward. Hinges, pivots, and pins shall be installed in a manner that prevents removal when the door is closed and locked.
2. Interior doors must have a minimum opening of 36W by 80H inches. Hollow wood doors are not acceptable. They must be flush, solid core natural wood, veneer faced, or equivalent finish as approved by the County. They must be operable by a single effort.
3. Doors must have heavy duty hardware with hardware stops. Door closers must be concealed. Corridors and outside doors must be equipped with 5-pin tumbler cylinder locks and door checks.
4. All locks must be master keyed.
5. The County must be furnished at least two (2) master keys and two (2) keys for each lock.
6. The keying system should require a minimum number of keys/cards/pads. A locking system with card reader, compatible with the County Access Control System over the County LAN, is required at the main entrance door, the director's office, and the custodial storage room. Separate keys/cards/pads for exterior doors and interior doors are required. The center offices should be keyed differently from other activity spaces inside the building. One key should access all recreation activity spaces, except the offices, within the building. Access to the exercise room shall also be controlled by the key/card/pad system.

Division 09

Section 09 00 00 - Interior Finishes

1. The County's goal in the selection of interior finishes is to select materials that are appropriate to the type of space served; are free of hazardous materials; give maximum value for their initial costs; are cost-effective to clean, maintain, and repair; provide quality indoor air; and support the sustainability policies of the County.
2. The specifics for the selection of interior finishes are detailed in this manual. The consultant shall review and become familiar with these requirements, which shall not be violated without specific notice and approval.

Building Design Standards

1. All flooring materials must be provided with 5 to 10% attic stocks as required by the County during the design.
2. County must be provided with at least three different color schemes for the entire interior finishes not later than the middle of design development phase. The selected scheme must be presented in a booklet/binder format and presentation board as well as enveloped packages to include all samples of finishes, marked to show the complete major specification and locations used.
3. All exterior windows must be equipped with window blinds or shades. The blinds may be aluminum or plastic vertical or horizontal blinds with aluminum slats of one-inch width. Blind must have non-corroding mechanism.

Paint

1. Product must not contain formaldehyde, aqueous ammonia, crystalline silica, or ethylene glycol. Total VOC must be below 2.9 pounds per gallon.
2. Specifications shall include storage and protection of equipment, materials, and surfaces, preparation of surfaces, quality assurance, and method of application of paints and finishes.
3. Include a painting schedule in the Specifications for describing coating systems for all surfaces.
4. Provide for field painting of all non-galvanized or corrosive type metals with two coats of a rust inhibitive paint. Concealed surfaces shall be painted prior to installation.
5. Specify back painting or treatment for all interior and exterior wood surfaces that will be concealed after installation.

Wallboard

1. All gypsum wall board to be minimum 5/8 inch thickness, fire-rated where required and water-resistant at areas subject to moisture.
2. All finish surfaces to receive one coat primer/sealer and two coats of latex semi-gloss enamel paint.

Lathing and Plastering

1. Waterproof Portland Cement plaster shall be used for walls and ceilings wherever plastered areas occur in kitchens, bath, showers, utility, toilet and service sink rooms and other spaces subject to higher humidity. Metal lath and accessories shall be galvanized when used in such areas.
2. Acoustical plaster will not be permitted, except with the written approval of the County.

Woodwork

1. Constructed from formaldehyde-free, low VOC (Volatile Organic Compound) materials or permanently sealed to prevent out-gassing. Non-toxic glues and low VOC products should be used in fabrication.
2. Where feasible, previously used materials in good and usable condition should be used first, followed by products with a high percentage of recycled content. Veneer should be from species harvested and procured in the US or Canada from providers certified as practicing sustainable forest management as recognized by independent forest management certification agency.
3. All finished woodwork, where painted, to have one coat wood primer, one coat alkyd enamel primer and two coats semi-gloss alkyd enamel.
4. All finished woodwork, where stained, to have one coat stain and two coats satin finish lacquer.

Laminate

1. All adhesives are to be those with the lowest possible VOC content below 150 g/L and contain no formaldehyde.

Suspended Ceiling System

1. Acoustical tile to be NRC 50 or greater, STC 35 or greater, and light reflective 0.75 or greater.
2. Designer shall provide reflected ceiling plans on Construction Drawings indicating layout and pattern of acoustical units and cut tiles. Details shall also be provided at changes of levels, at ceiling penetrations, access doors, special edge treatment, and all necessary accessories of other trades.

Building Design Standards

24. Extra tile units shall be provided at the rate of two percent of each type of tile units installed.

25. Moisture-resistant tiles shall be specified for high-moisture areas.

Carpeting

26. Installation to be direct glue down. All adhesives are to be those with the lowest possible VOC content below 150 g/L, contain no formaldehyde, and meet the requirements of the carpet manufacturer.

27. Recycled content for both backing and synthetic fibers is to be the highest possible to achieve credit toward LEED certification.

28. Carpet, backing, and adhesive shall have an Indoor Air Quality Certification issued by the Carpet and Rug Institute (CRI).

29. The carpet manufacturer shall provide a ten-year fiber wear warranty on all broadloom and tiles. The carpet manufacturer shall also provide a pattern match warranty for carpet tiles.

30. Store materials for three days prior to installation in the area of installation to achieve temperature stability.

Marble

31. Specify non-staining caulking. All ties shall be brass.

32. Specify the sealing of backs of exterior wall stone.

Tile

33. Specify a full mortar bed system for floors and walls in wet areas.

Standard Room Finishes by Space Type

Table 1: Standard Room Finishes by Space Type

No.	Space	Wall	Floor	Ceiling
1	Building Main Lobby	Multi-Color Polymer Paint	Ceramic Tile	2x2 Suspended Ceiling or Gypsum Board
2	Elevator Lobby	Multi-Color Polymer Paint	Ceramic Tile	2x2 White Suspended Grid with White Acoustical Tiles or Gypsum Board
3	Elevators	Stainless Steel Raised Stiles and Laminated Plastic or Other Durable Decorative Material for Recessed Surfaces	Ceramic Tile, Granite, or 32 oz. 100% Nylon Carpet	Perforated Steel or Other Durable Decorative Materials
4	Service Elevators	Stainless Steel	Rubber	Perforated Steel

No.	Space	Wall	Floor	Ceiling
5	Corridors Leading to the Main Lobby	Multi-Color Polymer Paint	32 oz. 100% Nylon Carpet	2x4 White Suspended Grid with White Acoustical Tiles
6	Restroom	Ceramic Tile	Ceramic Tile	Gypsum Board Painted, Minimum of 2 Coats of Gloss Paint
7	Not Applicable – Reserved for Future Use	Not Applicable	Not Applicable	Not Applicable
8	Electrical Room	2 Coats of White Gloss Paint	Sealed Concrete	Gypsum Board Painted, Minimum of 2 Coats of Gloss Paint
9	Telephone Room	2 Coats of White Gloss Paint	Sealed Concrete	Gypsum Board Painted, Minimum of 2 Coats of Gloss Paint
10	Janitor's Closet	Ceramic Tile	Ceramic Tile	Gypsum Board Painted, Minimum of 2 Coats of Gloss Paint

Building Design Standards

The following table outlines required wall, floor, and ceiling finishes for designated building spaces (Items 11–21).

Table 1: Interior Finish Requirements by Room Type

No.	Space	Wall	Floor	Ceiling
11	Building storage room	2 coats of white gloss paint	Sealed concrete	2x4 white suspended grid with white acoustical tiles
12	Supply room	2 coats of white gloss paint	Sealed concrete	2x4 white suspended grid with white acoustical tiles
13	CPU room	2 coats of white gloss paint	Sealed concrete	2x4 white suspended grid with white acoustical tiles
14	Kitchen	2 coats of white gloss paint	Vinyl Composite Tile, 1/8 inch thick	2x4 white suspended grid with waterproof white acoustical tiles
15	Lounge with tables	2 coats of white gloss paint	Vinyl Composite Tile, 1/8 inch thick	2x4 white suspended grid with waterproof white acoustical tiles
16	Standard office	2 coats of off-white flat paint	32 oz. 100% nylon carpet	2x4 white suspended grid with white acoustical tiles
17	Executive office	2 coats of off-white flat paint	32 oz. 100% nylon carpet	2x4 white suspended grid with white acoustical tiles
18	Conference room	2 coats of off-white flat paint	32 oz. 100% nylon carpet	2x4 white suspended grid with white acoustical tiles
19	Executive conference room	26 oz. vinyl wall covering	32 oz. 100% nylon carpet	2x4 white suspended grid with white acoustical tiles
20	Computer room	2 coats of off-white flat paint	Vinyl Composite Tile, 1/8 inch thick	2x4 white suspended grid with white acoustical tiles
21	Stairs	2 coats of off-white flat paint	Sealed concrete with anti-skid tread ledges	Concrete

Division 10

Section 10 00 00 – Specialties

Toilet Partitions

1. Toilet partitions shall be solid polymer resin, floor supported, overhead braced.

Flagpole

2. Each facility shall have at least a single flagpole capable of flying three flags, with a spotlight provided to illuminate the flags.

Signs

3. All signs must be approved by the County.

4. Interior signs must be designed as a uniform package. The sign style must be approved by the County.

5. Signs must be mounted on the latch side of doors at 54 inches above finished floor and/or comply with applicable codes.

6. One building exterior sign must be provided at each major entrance and in accordance with the County sign standards.

Drinking Fountain

7. One accessible chilled drinking fountain must be provided within 150 feet of travel distance on each floor of office space. The water fountain shall have an ADA-compliant bottle filler dispenser.

Section 10 10 00 – Restrooms and Accessories

Building Design Standards

1. Provide a mirror above each lavatory. If multiple lavatory counters are provided, provide a large full-width and full-height mirror above the counter.
2. Provide a coat hook on the inside face of the door to each water closet stall and at several wall locations by lavatories.
3. Provide at least one paper towel dispenser, soap dispenser, and waste receptacle for every two lavatories.
4. Provide a disposable toilet seat cover dispenser in every toilet room.
5. Provide a coin-operated sanitary napkin dispenser in women's toilet rooms with a waste receptacle for each water closet stall.
6. Provide ceramic tile from the floor to a minimum height of 4'-6" above finished floor.
7. Provide a toilet paper dispenser having an unrestricted paper flow in every stall.
8. Flush controls must be automatic, or preferably a dual up-and-down two-volume control green flush system, or comparable water-saving flush systems approved by the County. (Green)
9. Urinals must be water-saving type with no lips for sanitary and health reasons. Waterless urinals are preferred. (Green)
10. Design of rest rooms must be fully in compliance with ANSI and ADAAG.
11. All County buildings must be designed to provide family (otherwise known as single-user, assisted-use, or unisex) toilet and bathing rooms. This is intended for large assembly and mercantile facilities for people who use opposite-sex personal care assistants.

Division 14

Section 14 00 00 - Vertical Transportation

General

1. Elevators and stairways are required in every facility more than one story high to handle movement of people, materials, and equipment among floors. Early consideration must be given to the scale and potential conflict of equipment, material, and waste movement versus passenger movement.
2. All steps on a single flight of stairs shall have uniform riser heights and uniform tread widths. Open risers are not permitted. Stair treads shall not have abrupt nosing and must be no less than 11 inches wide, measuring from riser to riser. The radius of curvature at the leading edge of the tread must not be greater than 1/2 inch. The maximum nosing projection must not be greater than 1 1/2 inches. Stairs must have non-skid treads.
3. Several elements are available to the designer to fashion efficient vertical transportation systems. Well-designed and properly located stairways and dual-purpose freight-passenger elevators can be important elements in the vertical movement of people. Dedicated freight elevators are normally required near loading docks, supply rooms, and other marshaling points for material traffic. Dumbwaiters and dual-purpose freight-passenger machines are useful complements to freight elevators and can substitute for freight elevators in special situations. However, the error of not providing adequate elevator systems is usually considered to be a huge operational penalty by the end users and is one of the costliest deficiencies to correct in later years.

Elevators

4. Maximum projected wait to load, up-bound peak = 30 seconds.
5. Maximum projected wait to load, down-bound peak = 30 seconds.
6. Maximum projected wait to load, daytime base = 30 seconds.
7. For buildings of two stories and above, provide elevator(s).
8. Consultants shall identify the basic performance parameters of number, size, and speed of cars as part of the Basic Technical Program. Size and speed requirements will generally dictate the type, whether hydraulic, geared traction, or gearless traction. In some instances, combinations such as

double-roped gearless should be considered. In general, hydraulic machines should be specified only for elevators with relatively infrequent use. Any elevator serving 4 or more floors shall be sized for use by emergency stretcher as required by codes.

9. A separate service elevator adjacent to the loading dock must be provided.

10. Interior of service elevator must be stainless steel with hooks for the protection blankets.

11. Interior of the passenger elevators must be elegant and durable.

Division 22

Section 22 00 00 - Plumbing System

1. Cross contamination control in facilities is a critical concern. Consequently, two water distribution systems shall be provided within each facility, i.e., potable and non-potable/industrial water. The non-potable/industrial system shall serve make-up water requirements for cooling systems, etc. Distribution systems must be isolated from each other and the utility service to the building by backflow prevention devices. Dual back-flow prevention devices (or equivalent piping connections) must be provided since shutdowns are impossible to arrange for routine testing and maintenance of the devices. Generous space provisions must be allowed in such areas for proper testing and maintenance.

2. When incoming water pressure exceeds eighty (80) psig, provide a pressure reducing station with two PRVs (each sized at 2/3 of total flow) in parallel, each valved to operate independently. A minimum pressure of twenty-five (25) psig should be provided at the highest point of the building. The assembly shall include appropriate valves, strainers, gauges, drains, etc., and include a bypass. All work shall be in accordance with WSSC requirements and codes.

3. Each building service shall include a water meter. Each building tenant unrelated to the County (e.g., retail business tenant) shall be sub-metered for water use. It is also recommended to sub-meter any large single uses of water within a building or facility.

4. The building non-potable water headers shall have reduced pressure backflow preventers.

5. The plumbing system should be divided into smaller systems with isolation valves separating them. This will allow a section of the building to be worked on without affecting the remainder of the building.

6. Provide booster heaters for dishwashers and other equipment requiring higher hot water temperatures. Do not raise the temperature of the building system.

7. Provide dielectric unions whenever dissimilar piping materials are used.

8. Provide access doors for all plumbing system components that require maintenance. The access doors should be located on both the architectural and mechanical plans and coordinated.

9. Seismic bracing must be provided and coordinated with the structural engineer.

10. Water piping shall not be installed below slabs on grade except for trap priming lines.

11. The building water header shall be constructed of Type L copper pipe.

12. All building distribution piping shall be Type L copper tubing.

13. Fittings on copper tubing shall be wrought copper or cast brass, solder pattern. All connectors 2-1/2 inches in diameter shall be Victaulic or equivalent.

14. Solder shall be 95-5 tin-antimony or approved equal. No lead-type solders shall be allowed on the job site.

15. All valves or accessories in the building and in line with potable water (direct contact with potable water) shall be stainless steel.

16. Plumbing fixture partition stop connections, through the wall, shall be brass pipe.

17. Domestic CW shall be connected to all general-use-type fixtures. Shock absorbers should be considered for use where flush valves, solenoid valves, or other quick-closing devices occur to

prevent water hammer. Shock absorbers shall be supplied at every bank of fixture containing three or more flush valves. Shock absorbers when installed shall comply with PDI WH201 or ASSE 1010. When installed, shock absorbers must be accessible for maintenance. Domestic CW supplies drinking water, food processes, ice machines, etc., which are intended for human consumption and therefore must be protected from backflow from other systems in strict compliance with code requirements.

18. Domestic Potable Hot Water Recirculating (HWR): Recirculating systems shall be designed specifically for each application to maintain the required HW system temperature. The recirculation rate shall be sufficient to offset system heat losses and adequately cover all pipe runs. Reverse return piping layouts yield better results and are easier to balance. Each recirculating balancing valve shall have adequate flow to control, at least 1 gpm with ½ inch pipe size.

Section 22 13 02 – Waste and Drains

1. The minimum size of side sewers shall be six (6) inches.
2. All waste drains shall be gravity systems. Sump pumps and sewage pumps shall not be used without specific approval.
3. Waste piping and drainage systems under slabs on grade shall be extra heavy cast iron soil pipe.
4. Roof drains shall be cast iron or brass, with cast iron or brass high dome strainers. The first section of pipe below the drain must be cast iron or brass.
5. No PVC, CPVC, ABS, or galvanized piping shall be used within the building envelope.
6. Drainage lines from kitchens, equipment rooms, laundries, and other areas which generate a lot of debris shall be pitched a minimum of 2% and desirably 4%. These lines must have adequate cleanout to facilitate rodding, and cleanouts must occur at each 90-degree change in direction.
7. Condensate drain lines shall also be sloped a minimum of 2% and shall be minimum ¾ inch in size. Cleanouts shall be installed at each 90-degree change in direction. Trap seals shall be equal to air-handling unit static pressure at the trap plus a minimum of 2 inch.
8. All pipes, valves, clean-outs, and particularly waste piping, must be accessible for maintenance. Those recessed in wall cavities must have access doors, removable panels, or other approved methods for access.
9. Food preparation and service areas require extensive piping. Access is extremely important. Such areas shall not be located on a slab on grade. Where located above a suspended ceiling, the ceiling must be 100% accessible.
10. Wastes and clean water drains shall be collected independently in each building and carried separately to the city sanitary sewer and storm drains respectively. If no storm drain exists within 200 feet of the building, connect clean water drains to sanitary sewers and provide for future connection to storm drains.
11. All footings shall have footing drains connected to the storm drain system. Footing drains shall not be connected to an interior sump pump.
12. All area drains, yard drains, window well drains, and the like shall be connected to the storm drain system.
13. Invert elevations of sanitary sewer lines leaving the buildings shall be of sufficient depth to permit future connection of a waste line from any point in the basement area.
14. Drains from transformer vaults having oil-filled transformers and shop areas where oil is present shall connect to sanitary sewers through a WSSC approved oil interceptor.
15. Crosses shall not be used in waste piping.

16. Connections in waste piping for food service areas shall turn down with a 1/8 bend at the connection to the next branch.

17. Waste piping from garbage disposals shall be carried separately to a major waste pipe, with as few bends as possible and completely accessible clean outs.

18. Floor drains shall be connected to the sanitary sewer. Drains for fire sprinkler system shall be six (6) inches minimum and shall be connected to storm drains.

19. Mechanical rooms, pipe trenches, tunnels and other areas with piping shall be equipped with floor drains. Provide primed floor drains, Deep Seal Trap, or approved WSSC fixture.

20. Avoid installing drain lines in complicated architectural work; if installed, use brass pipe with bronze fittings.

21. Provide trap primers for floor drains and funnel drains in mechanical rooms and other places where traps may dry out (use timer type).

22. Waste and drainage piping crossing excavated areas shall be supported on precast concrete beams supported by the building structure and undisturbed earth.

23. Clean outs shall be the full size of the piping served.

24. Drainage from flammable or hazardous chemical or liquid storage rooms must not be connected to the sewer systems. Coordinate a special drainage system with the Fire Marshal.

25. P-traps for all fixtures other than lavatories and similar usage sinks shall have integral clean outs. Drum traps shall not be used.

26. Pipe bedding under floor slabs shall be Type 4 under Concrete Pipe Association classification.

Division 23

Section 23 00 00 - Mechanical System

1. The County's goal in the design of mechanical and electrical systems serving their facilities is to select systems and equipment that are appropriate to the type of space served; give maximum value for their initial costs; are cost-effective to operate, maintain, and repair; provide quality indoor air; and support the sustainability policies of the County. The specifics for the selection and design of these systems are elaborated in this document. The consultant shall review and become familiar with these requirements, which shall not be violated without specific notice and approval.
2. If room data sheets for support spaces (e.g., mechanical and electrical rooms and closets, custodial spaces, loading docks, etc.) have not been completed prior to award of the design contract, the selected consultant must begin by developing room data sheets for all support spaces of this type, involving representatives of the affected Department(s) and the Project Manager. This work must be completed during the schematic design phase.
3. The locker rooms must be dehumidified.

Table 1: Baseline HVAC Air System Requirements

Baseline HVAC Air System Requirements

SYSTEM

COMPONENT

CRITERIA

AIR HANDLER

FAN

Blow-through configuration, backward-curved airfoil (unless cfm < 3,000).

AIR HANDLER

DRIVE

Variable frequency drive on all VAV AHUs. Soft start on all constant volume AHUs.

AIR HANDLER

DISCHARGE

Minimum length of four equivalent diameters before any obstructions or take-offs at discharge of fan.

AIR HANDLER

HOUSING

Double-wall construction; IAQ double-sloped drain pan design.

AIR HANDLER

MOTOR

Premium high efficiency.

Building Design Standards

Table: Mechanical and Air System Design Criteria

General Air Handling Unit (AHU) Requirements

System	Component	Criteria
AHU	Outside Air Intake	Outside air must mix in the return air duct to eliminate temperature stratification prior to entering the AHU.
AHU	Filter and Coil Face Velocity	300 fpm or less maximum design velocity.
AHU	Filtration	Provide minimum MERV 13 filter module with pre-filters. Provide a differential pressure sensor across the filter bank with an analog input point to the BMS. Provide a magnahelic for visual inspection of the filter status via pressure drop. The BMS must be programmed with a change filter alarm activated whenever the differential pressure set point is exceeded; the set point is initially set at 0.60 in-wg.

Duct Work

System	Component	Criteria
Duct Work	Type	Main ducts to be round spiral (preferred) or oval spiral. Do not use rectangular. Branch ducts to be round spiral. Do not use rectangular duct in gymnasiums.
Duct Work	VAV Boxes	Full DDC boxes. Do not use fan-powered boxes.
Duct Work	Diffusers	Lowered cone diffusers, stamped one-piece construction with Coanda pockets—no mitered pieces. Do not use perforated diffusers.
Duct Work	Takeoffs	Minimum straight, unobstructed duct run of 4 to 6 (preferred) duct diameters before any takeoffs, bends, or transitions. Takeoffs require 45-degree boots.
Duct Work	Transitions	Expansions in duct diameter must include a transition not exceeding 20 degrees divergence angle.

System	Component	Criteria
Duct Work	Lining	No interior lining may be used unless contained in double-wall construction.
Duct Work	Flex Duct	Maximum run of 6 feet on flex duct connections. Show hard duct up to 6 feet of any diffuser. Show a segmented elbow detail for connection between flex duct and diffusers.

Outdoor Air Energy Control

On air handlers with greater than 3000 cfm outside air relief requirements, one of the following options must be used:

Option	Method	Criteria
1	Energy Recovery	Desiccant wheel energy recovery system. (Resize heating and cooling capacity to include effect of energy recovery and reduce first cost.)
2	CO Sensing	Modulate AHU outdoor and return air dampers with PID loop to maintain 1000 ppm CO in the return air.

Complete Air System

System	Component	Criteria
Complete Air System	Overall Airflow Efficiency	VAV: less than 1.0 hp per 1000 cfm. Constant volume: less than 0.6 hp per 1000 cfm.
Complete Air System	Controls	Complete DDC for automatic temperature control, valves and actuators, and energy management functions. Provide complete point list on drawings. Specify Siemens control EMS.

Building Design Standards

Table 1: System Component Criteria

SYSTEM	COMPONENT	CRITERIA
VAV Systems	Sequence of Operation	Use owner's standard sequence of operation for VAV systems (see EMS section). Provide a logic diagram on drawings supporting the verbal sequence of operation.

Design Temperature Requirements

Table 2: Design Temperature Requirements

CONDITION	REQUIREMENT
Indoor Cooling	76 °F ± 2 °F
Indoor Cooling for Dormitories (Sleeping Quarters)	68 °F
Indoor Heating	70 °F ± 2 °F
Outdoor Summer	1% design condition or per latest ASHRAE
Outdoor Winter	99% design condition or per latest ASHRAE

Hydronic and Boiler Requirements

4. Hot and chilled water circulation systems must be designed with at least two pumps, one main and one standby. The pump control shall have the capability of cycling on and off between the main and standby pumps.
5. Chilled water systems shall be designed to be drained for winter freeze protection. Glycol shall not be used for freeze protection unless it is absolutely needed for operation of the building to run a specific program.

Electric Resistance Heating Is Not Permitted

6. Do not design the heating system with one boiler. The heating system must be equipped with at least two boilers with a minimum of 20% redundancy.
7. Boilers must be equipped with a boiler management system (BMS) per manufacturer recommendation and with all safety devices. For each boiler, a power cut-off switch must be installed outside the boiler room and adjacent to the boiler room door. The boiler plant shall be designed with reverse return piping unless it conflicts with manufacturer recommendations.

Minimum Performance of Cooling Equipment

Table 3: Minimum Performance of Cooling Equipment

Cooling Equipment Type	Condensing Method	Cooling Capacity (Btu/hr)	Size (Tons)	Minimum Cooling Efficiency	Minimum Heating Efficiency
Air-Conditioners	Air Cooled	< 65,000	0 to 5	11.0 EER	2.2 COP
Heat Pump	Air Cooled	< 65,000	0 to 5	12.5 SEER	2.2 COP

Cooling Equipment Type	Condensing Method	Cooling Capacity (Btu/hr)	Size (Tons)	Minimum Cooling Efficiency	Minimum Heating Efficiency
Split Systems	Air Cooled	$> 65{,}000$	> 5	9.5 EER	2.2 COP
Hydronic Heat Pumps	Water Source	All capacities	All sizes	11.5 EER	4.0 COP
Chillers	Air-Cooled	N/A	< 150	< 1.25 W/ton	N/A
Chillers	Water-Cooled	N/A	> 150	< 0.63 W/ton	N/A

Building Design Standards

Table 1. Minimum Performance Requirements for Heating Equipment

This table defines the minimum thermal and annual efficiency requirements for various types of gas-fired heating equipment based on heating capacity.

Heating Equipment Type	Fuel	Heating Capacity (Btu/hr)	Minimum Thermal Efficiency	Minimum Annual Efficiency
Boilers	Gas	< 300,000	93%	90% A.F.U.E.
Boilers	Gas	> 300,000	93%	N/A
Furnaces	Gas	< 300,000	N/A	90% A.F.U.E.
Service Water Heating	Gas	All	0.90	N/A

Section 23 30 00 - Air Distribution System

1. All return air must be in the duct system.
2. Duct construction details shall conform to the recommendations of the ASHRAE 55 Guide and Data Book and SMACNA (Require Class III leakage rate).
3. Drawings shall show the specific location of fire dampers.
4. Supply outlets shall be suitably located to avoid drafts caused by colliding air patterns or disruption of air flow caused by vertical obstructions in the ceiling such as drop light fixtures, ceiling beams, or proximity to the wall.
5. Rectangular ductwork shall not be used in high velocity air systems.
6. The duct system shall not be internally sound-lined. If sound lining is absolutely necessary to reduce noise level, the designer shall specify perforated galvanized sheet metal lined on top of the internal sound lining. High velocity ductwork leakage shall not exceed eight (8) cfm per 100 square feet of duct surface under a pressure of five (5) inches wg.
7. Rectangular duct shall not be used in the gymnasium.
8. Length of the flex duct shall not exceed 6 feet.
9. Flex duct shall be factory insulated with Mylar lining.
10. The duct connection from main to branch and from branch to sub-branch shall be equipped with a 45-degree boot.
11. Each plenum area shall be provided with a light. All lights in a single fan system shall be switched as a group. The switch shall include an “ON” pilot light.
12. The construction document shall notify the contractor not to hang the duct system from the lower chord of the joist.
13. Perforated plate ceiling diffusers and grills shall not be used without approval from The County. The diffusers and grills shall be louver type.
14. Air deflection must be adjustable for all types of ceiling supply diffusers.
15. The supply, return, and exhaust in the natatorium and high humidity areas such as shower rooms shall be aluminum sheet metal with welded and flanged watertight joints.
16. Angle iron bracing inside plenums shall be galvanized.
17. Access doors to ducts (hinged, latched, with sponge plastic seals) shall be provided upstream and downstream from all coils and elsewhere where frequent access is required.
18. Access doors shall be provided for all plenum areas with latches operative from both inside and outside the plenum.
19. All access doors shall be self-closing due to the direction of air flow and by pressure differential.

Building Design Standards

21. Access panels shall be provided at all fire dampers and elsewhere where occasional access is required. These access panels may be held in place with sheet metal screws with sponge plastic seal for sizes less than 12" x 12". For large size access panel use hinges and/or latches.

Occupancy Sensors

22. Carbon dioxide (CO2) sensors must be used in the conference room and other highly concentrated occupied spaces.

Ventilation

23. Mechanical ventilation shall be provided for all spaces. Even though the exterior rooms may be provided with code-complying ventilation capacity in the fenestration (window/door design), a minimum six air changes per hour ventilation rate shall be mechanically maintained to alleviate the problems of the "air-tight" building and preclude opening windows during the heating season for ventilation purposes, which becomes an uncontrolled heat loss and causes undesirable drafts. However, mixed systems utilizing temperature-controlled exhaust fans with operable windows for ventilation during hot days are recommended where feasible.

24. All interior ventilation shall meet occupancy-driven building code ventilation requirements, maximum internal heat-gain cooling requirements, and fume exhaust make-up air requirements. Supply air ventilation systems shall be variable volume type to assure that minimum amounts of supply air are processed at all times to ensure minimum operating costs throughout the entire system. Heating and cooling energy costs are second only to custodial costs in regard to the annual cost of operating facilities; as such, ASHRAE Standard 90.1 must be observed to ensure energy-efficient mechanical design. Every energy cost reduction resulting from improved design techniques is an investment in the life-long economic value of the building and should be pursued to the maximum extent within the given program and budget.

25. Supply air intakes and exhaust fan discharges are critical issues for the building being planned and for the buildings surrounding the site selected for the new building. Outdoor air intakes must be carefully located to avoid ingesting contaminated air from exhaust air discharges from this or other buildings, vehicles in roadways or at loading docks, etc. Similarly, exhaust air discharges from this building must be carefully located to avoid recirculation into the building and to avoid contaminating the air intakes of adjoining buildings. Experience indicates that mistakes are virtually irreversible or, at best, exceedingly costly to correct. Air intake and discharge requirements must be resolved before almost all other design considerations due to the influence such decisions will have on the rest of the design.

26. The intake air and exhaust air shall be a minimum of 3 ft above finished roof to prevent snow accumulations from blocking the air streams.

Temperature/Humidity Control and Energy Management

27. The building control system must allow for maximum operational efficiency and flexibility as well as competitive pricing on future expansion and upgrades. Building temperature, humidity, and energy management controls shall be direct digital control (DDC) technology utilizing distributed microprocessor-based apparatus. Each building shall be designed to operate in a "stand alone" mode but shall include the necessary features for communication and control with a remote operator's station. Connection to a remote operator's station must be included at the time of bid and construction. The inclusion of such shall have no bearing on the environment control system to be provided.

28. The variable volume requirements are the most sensitive and stringent requirements for the system. Fume exhaust air quantities will vary based on current use; supply air quantities will

vary to match and to accommodate cooling requirements; yet pre-determined differential air conditions must be maintained between adjoining occupancies. These requirements must be automatically sustained.

29. Use Siemens system (proprietary).
30. All thermostats must be installed at center line of thermostat to be 46 inches above finished floor for ADA compliance. This will provide an adequate margin of error since the maximum height is 48 inches.

Testing and Balancing

31. The A/E shall specify a complete and comprehensive total-system balance process that includes testing, adjusting, and balancing of environmental and other systems to achieve the design objectives.
32. The drawings shall indicate the positive and negative pressure relationships of all areas with respect to each other and to the exterior.
33. Buildings shall be maintained at a slightly positive pressure relative to the exterior to minimize outside air infiltration.
34. The A/E shall indicate in the drawings the minimum and maximum cfm for each VAV box and the set point cfm. The cfm for areas served by a specific VAV box shall total to the VAV box cfm setting. The air handling unit serving the VAV boxes shall be balanced to the intended design for all seasons.

Mechanical Rooms and Pipe/Duct Shafts

35. Consultants shall identify an adequate amount of mechanical room space that allows for efficient operation, servicing, repair, and removal of mechanical equipment as part of the Basic Technical Program. Mechanical rooms shall not be planned for any other use; specifically, they shall not be used for janitorial materials storage or rest break areas.
36. The Project Engineer shall ensure that all mechanical equipment room layouts are designed to facilitate maintenance access and replacement of system components. Equipment room layouts shall be designed using the largest physical dimensions possible for all specified equipment. All specified manufacturers' equipment shall fit within the allocated space. When spatial or weight restrictions exist in equipment areas, maximum equipment dimensions and weights shall be indicated in the contract documents.
37. In addition to rooms required for HVAC equipment and distribution, a working room for mechanical equipment, with clear and easy access to the exterior, shall be provided in the basement adjacent to the utility tunnel connection to allow proper management of all central mechanical utilities and their distribution within the building. Distribution within the building shall be via readily accessible pipe and duct shafts.
38. To the maximum extent possible, mechanical equipment shall be located in interior spaces. Interior mechanical rooms shall be planned with adequate sound insulation to mitigate noise generated by mechanical equipment. When rooftop equipment is necessary, the equipment area should be completely enclosed with a louvered wall and covered with a roof structure. Penetrations of the outer roof are discouraged. Use of open-air wells should be considered at strategic locations so that exhaust ducts and plumbing vents can run horizontally under the roof, enter the wells through vertical surfaces, and then turn vertically to discharge to the atmosphere without penetrating the horizontal waterproof roof membrane.
39. Equipment shall be selected for long-term durability, reliability, maintainability, and serviceability.

Magnetic Bearing Chillers

Building Design Standards

40. Magnetic bearing chillers should be considered for every project. Available technology includes centrifugal compressors as small as 75 tons.

41. Unit shall contain multi-stage, oil-free magnetic bearing, hermetical centrifugal compressor. Each compressor shall operate inlet guide vanes in concert with variable frequency drive to optimize part-load efficiency.

42. Performance: The chiller shall be capable of operation down to 10 percent of full load rating with standard ARI entering condenser water relief without hot gas bypass.

Chiller Components

Compressors

43. The unit shall have two-stage magnetic bearing, oil-free hermetic centrifugal compressors. The compressor drive train shall be capable of coming to a complete safe stop in the event of a power failure.

Motor

44. Permanent magnet, synchronous motor of the hermetic type, sized appropriately to fulfill compressor horsepower requirements. Motor shall be liquid refrigerant cooled with internal thermal overload protection devices embedded in the winding of each phase. Motor shall be compatible with variable frequency drive operation.

Chiller Control

45. Microprocessor-based control architecture to include a controller for each compressor and a unit controller. The following parameters shall be displayed:

46. Entering and leaving chilled water temperatures

47. Entering and leaving condenser water temperatures

48. Evaporator saturated refrigerant pressure

49. Condenser saturated refrigerant pressure

50. Percent of 100% speed per compressor

51. Percent rated load amps for entire unit

52. In addition, a complete fault history shall be displayed and downloadable via a USB port drive.

53. Chiller plant architecture software shall be used to display the chiller, piping, pumps, and cooling tower.

54. The control module shall interface with the County's EMS panel.

Section 23 00 02 - Acoustic Control

1. All County facilities must be designed with the comfort of users and occupants in mind. Most often noise pollution inside and outside of the facilities is forgotten during the design and construction process. It is the responsibility of the design team to identify all noise-generating sources and noise-sensitive areas and then create a chart to identify how design will resolve those issues.
2. The following considerations must be adhered to as minimum requirements.
3. Facilities with "heavy" ventilation and air conditioning requirements are becoming too noisy for sustained occupancy. Thus, it is mandatory that careful attention be given to thorough acoustic management of all noise sources. Because of the complexity and the problems (e.g., structural transmission), it is recommended that computerized analyses be employed when there is reason to be apprehensive about acoustic control.
4. Mechanical rooms shall be designed to avoid transfer of sound and vibrations to adjacent rooms.

Acoustic and Noise Control Requirements

5. Vibration isolators must be used for all noise-generating mechanical equipment.

6. Floor isolators and vibration-absorbing supports shall be designed for all floor-mounted vibrating or noise-making equipment.

7. Air handling units inside the building must have acoustical and sound-dampening chambers.

8. Since the use of fiberglass liners is not permitted in ductwork, perforated liners must be considered to reduce the transfer of sound into the facilities.

9. The location of chillers, cooling towers, emergency generators, air handlers, and other noise-generating equipment must be carefully studied to minimize sound transfer to adjacent properties. The dB level at the property line must comply with county requirements.

10. If the heating system design calls for pulse boiler(s), mufflers must be provided on the air intake and boiler exhaust to attenuate the noise.

11. Conference rooms must be well sound-isolated.

12. Elevator shafts must be sound-isolated and not located adjacent to workspaces.

13. All windows must be double-paned.

14. All doors must have noise silencers.

15. Close attention must be given to the design of ductwork to reduce air noise. The A/E must present design concepts in this respect to the county.

16. Interior walls must be designed to minimize sound transfer to adjacent rooms.

17. Ceilings in carpeted spaces shall have a Noise Reduction Coefficient (NRC) of not less than 0.55. Ceilings in offices, conference rooms, and corridors having resilient flooring shall have an NRC of not less than 0.65.

18. Ambient noise from mechanical equipment shall not exceed Noise Criteria Curve (NC) 35 in accordance with ASHRAE in offices, NC 40 in corridors, cafeterias, lobbies, and toilets, and NC 50 in all other areas.

19. Background Noise:

a. The following table presents the recommended NC levels for a variety of spaces. NC levels are based on rooms not being occupied and with all user equipment turned off.

Table 1: Recommended Noise Criteria (NC) Levels for Various Spaces (Unoccupied Conditions)

Auditorium	20–25
Conference Rooms	25–30
Executive Offices	30–35
Classrooms	30–35
Open-Plan Offices	35–45
Dining Rooms, Offices, Lobbies	40
Corridors	45
Kitchen, Lockers, Warehouse, Shops	50

b. The sound levels above apply to these spaces in most common situations. If the users of the space are hearing impaired, the tolerance for high background noise levels is greatly reduced.

c. Systems must be engineered, and sound attenuation must be provided as required to achieve the specified sound levels.

Building Design Standards

Recommended Maximum Air Velocity in Duct System

(Air velocity in ft/min to yield NC indicated)

Table 1: Recommended Maximum Air Velocity in Duct Systems (Air Velocity in ft/min to Yield NC Indicated)

Location

NC-25 Supply

NC-25 Return

NC-30 Supply

NC-30 Return

NC-35 Supply

NC-35 Return

NC-40 Supply

NC-40 Return

NC-45 Supply

NC-45 Return

Air velocity through net free area of terminal device ½ inch minimum slot width

350

420

420

500

500

600

600

720

720

860

10 ft of duct before opening

420

500

500

600

600

700

720

840

860

1000

Next 10 ft

560

630

680

765

800

900

960

1080

1150

1300

Next 10 ft

700

800

850

970

1000

1040

1200

1250

1440

1500

Next 10 ft

900

980

1080

1180

1280

1400

1530

1480

1840

2000

Next 10 ft

1020

1260

1360

1540

1600

1800

1920

3930

2300

2600

Next 10 ft

1400

1540

1700

1870

2000

2200

2400

2600

3000

3170

Note: Velocities for exhaust systems should refer to recommended return velocities.

Section 23 00 03 - Compressed Air

1. Compressed air should be reduced to 30 psig or the minimum pressure needed as required by pneumatic equipment requiring compressed air before distribution within buildings.

Occasionally there is a requirement for higher pressure air, which should be separately served. The pressure requirement should be carefully determined; the operating cost increases by 1% for every 2-psi pressure increase.

Section 23 00 04 - Insulation

1. A vapor barrier jacket is required for chilled water piping, equipment, refrigerant suction piping, domestic cold-water piping, rain leader piping, air handling ducts and equipment with air temperatures of 55°F or less.
2. Pipe insulation in utility tunnels, up to the building service header main valve, shall have a uniformly ribbed, 0.01-inch minimum thickness metallic casing with a vapor barrier lining.
3. Fittings, valves, and flanges shall have an insulation thickness no less than the adjacent piping but must be removable without damage for easy reapplication.
4. Demolition (removal) of carcinogenic insulation containing asbestos shall follow procedures outlined in the Asbestos Abatement chapters of OSHA/WISHA.

5. Pipe insulation in maintenance areas (mechanical rooms, accessible shafts, etc.) is subject to mechanical damage (crushing, abrasion, and laceration) resulting from maintenance activities.

(Continued)

6. **Oversize Pipe Rings, Inserts, and Shields:** Install the pipe insulation and jacket extending through the pipe hanger ring. Provide an extra high-density insulation insert and metal shield within each hanger, except where pipe covering protection saddles are welded to the pipe.
7. **Insulating Inserts:** Extra high density insulating inserts shall be the same thickness as pipe insulation and shall be Pittsburgh-Corning "Foamglas" or Pipe Shields "Thermal Hanger Shield" and shall cover not less than the lower 40 percent of the circumference of the insulation; sizes of section, 6 inches minimum length up to 6 inch outside diameter, 8 inches minimum length for larger sizes. "Foamglas" shall not be used for high pressure steam. Install the insulating insert section to replace a cutout section of insulating material within the insulation jacket, with tightly fitted butt type joints. For pipe on trapeze channel hangers, provide Pipe Shield Model A3000 insulated pipe support which covers 100 percent of the circumference of the pipe.
8. **Metal Shields:** Except where pipe covering protection saddles are specified, provide outside of the jacket and inside of each hanger, a metal shield of 18 gage sheet metal, minimum, covering the lower 40 percent of the circumference of the insulation, length not less than that specified for the cut-in section of high-density insulating insert. On 6 inch and larger pipe, shields shall be 14 gage minimum, two pipe diameters in length.
9. All insulation, facings, coatings, adhesives, and other accessories shall have a fire hazard rating not to exceed 25 for Flame Spread and 50 for Fuel Contributed and Smoke Developed; ratings determined by UL Standard No. 723 and NFPA Standard No. 255. Test results from the approved testing laboratory shall be available to indicate that fire hazard ratings for materials do not exceed the above amounts.

Division 26

Section 26 00 00 - Electrical Requirements General

1. All electrical systems must be designed for an anticipated 30 to 40-year life span before requiring major repairs or replacements.
2. Primary switch cubicles can exceed the height of standard doorways. Allowances should be made for installation, and changes or additions to switchgear sections during the life of the building.
3. Weights of transformers could not exceed floor loadings. Make sure that lifting eye and floor loading are accommodated in the design. Seismic supports and restraints are necessary.
4. In remodel projects, shutdowns of existing feeders and services may be necessary. These shutdowns may have to occur after normal working hours to prevent interruption of critical operations. The cost of such premium working hours can have a major impact on the construction estimate. Also, temporary power may be necessary to maintain service to critical loads.
5. Operation of power tools may have to be scheduled with the owner to reduce the noise impact on day-to-day operations of the facilities.
6. There are several existing control systems on the site from energy management to fire alarm systems. Interfacing new systems into the existing systems needs to be carefully coordinated, both from the installation standpoint of the contractor and the interface with existing systems operated by the County.
7. Abandonment of equipment and raceways in place is not acceptable.

Specification Requirements

8. AE must include the following requirement in the specifications:
9.

   Contractor and manufacturer supplying equipment such as UPS must agree and make available directly to the County all warranties, parts, documentation, training manuals and training, special tools, and software to fully service the equipment under the same terms. The County may choose a Service Agent for this purpose, and the contractor and manufacturer must agree to provide the above-mentioned services and provisions to the County Service Agent.

Section 26 00 01 - Power Distribution

1. Anticipating future loads or special needs is difficult; however, providing flexibility of power distribution within County facilities is imperative. Local distribution must be planned with generous conduit sizing, sleeving, and extra space in principal electrical cabinets or closets. Sleeving and conduit upsizing is a modest-cost investment toward serving unknown future requirements, which can then be accommodated by the relatively inexpensive installation of increased size wiring.
2. Comply with the latest IES light levels, with localized or task lighting.
3. Fluorescent light fixtures shall generally be 2' x 4' with four T-8 lamps. In special areas, 2' x 2' fixtures may be authorized by the County.
4. Downlights shall have fluorescent high-efficiency lamps.
5. Use of incandescent lamps may be authorized by special permission from the County for specialty areas.
6. Lighting control systems shall accommodate use by individuals other than the normal building occupants (e.g., custodial staff, maintenance mechanics, etc.) who may not be familiar with unique provisions. Therefore, a convenient means for on/off control must be provided for service support staff; otherwise, frustrated staff who do not understand normal operation may disable sophisticated control systems.
7. Use of energy-saving switching, such as dual switching, daylight zoning, and occupancy sensors, is required.
8. Light output shall not vary in response to an input voltage variance of less than 10% of rated voltage.
9. Total Harmonic Distortion shall be less than 10%.
10. Ballasts shall be full rapid start.
11. Ballasts shall have a sound rating of A or better.
12. All lighting fixtures shall be of high-quality construction, designed for long life and easy maintenance. The use of high-efficiency metallized reflectors is encouraged for energy conservation and maintenance.
13. Replacement parts shall be readily available and easily secured from the manufacturer or supplier.
14. In fire-rated ceilings, fixture installation must also comply with the U.L. construction requirements of the ceiling listing.
15. In the interest of energy conservation, the lowest reasonable ambient illumination level will be encouraged, with the balance of the volt-amp allowance used for task lighting. Multiple switching and split circuiting will be preferred to constant higher light levels. Task lighting should be maximized.
16. Provide ground fault protection on exterior lighting circuits.

17. Convenient means must be provided for re-lamping, cleaning, repairing, or replacing lighting fixtures. Special consideration must be given to fixtures mounted in high or other inaccessible or hazardous locations by providing chain- or cable-operated disconnecting hangers, winches, catwalks, overhead access, etc.

18. Emergency lighting shall also be provided in mechanical and electrical rooms. Position fixtures over equipment control stations and pathways.

19. All street and walkway lighting fixtures shall be individually protected by an in-line waterproof fuse holder located in the pole base. The fuse shall be on the line side of the ballast.

Section 26 00 02 - Emergency Power

1. Emergency power generating equipment should be designed only when specifically requested in the POR or during the schematic design by the County. Such system should be located in or around the facility with noise and access considerations.

Section 26 00 03 - Electrical Sub Metering System

1. The County's desire is to segregate the electrical power usage, particularly for HVAC, lighting, and general power systems, in all new County facilities.

2. The sub-metering system will allow the County better knowledge of how energy is used within a facility. It allows management to identify opportunities to improve efficiency, minimize waste, and reduce energy consumption. It reveals existing or imminent problems that can negatively affect a facility's operation. It provides accurate evaluation of spare electrical system capacity, determines each system cost portion, and allows facility managers to more effectively target and address equipment that is operating below a predetermined energy efficiency threshold. The system must be capable of interlinking with the County energy management system.

3. At a minimum, power monitoring and metering equipment must record the minimum and maximum of each power usage, keep an event log, and trend voltage, current, kW, kWh, kVA, kVAR, power factor, and current total harmonic distortion, and report it to the County energy management system (EMS) located at the Seven Locks facility.

Section 26 00 04 - Electrical Short Circuit Coordination and Voltage Drop Study

1. The Short Circuit Coordination and Voltage Drop Study are critical parts for the safe, efficient, and economical operation of the electrical distribution system in County facilities. An engineering analysis and coordination study must be performed for all new County facilities. The analysis must include a short-circuit analysis with protective device evaluation, a protective device coordination study, a motor starting study (for larger motors, project specific), and a voltage drop study analysis. The engineering analysis and coordination study must be coordinated as follows:

    a. Provide a short-circuit and protective device coordination study for the County facilities electrical distribution design system. The intent of these studies is to verify that the specified and supplied equipment are properly rated, correctly applied, and within industry and manufacturer's tolerances. The study must include all portions of the electrical distribution system from the normal and alternate sources of power throughout the distribution system down to the electrical panel or disconnect device. The short-circuit study must be coordinated for normal, standby, and emergency power conditions. The study must be in accordance with applicable ANSI and IEEE standards and must be calculated by means of SKM Power Tools or equal. Documentation study submittals must include a summarized final report including the following.

1. Executive summary including introduction and scope of work.
2. Short-circuit methodology analysis results and recommendations.
3. Short-circuit device evaluation table.
4. Protective device coordination methodology analysis results and recommendations.
5. Protective device settings table.
6. Time-current coordination graphs and recommendations.

b. The study must include input circuit data including electric utility system characteristics, source impedance data, conductor lengths, number of conductors per phase, conductor impedance values, insulation types, transformer impedances and X/R ratios, motor contributions, and other circuit information as related to the short-circuit calculations.

c. Tabulations of calculated quantities including short-circuit currents, X/R ratios, equipment short-circuit interrupting or withstand current ratings, and notes regarding adequacy or inadequacy of the equipment rating.

d. One-line riser diagram computer generated clearly identifying individual equipment buses, bus numbers, equipment, and breaker rating in kW and kVA, the ohmic impedance, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location, device numbers used in the time-current coordination analysis, voltage drop at each bus, and other necessary information pertinent to the computer analysis.

e. Interactive alarms for warnings and limit violations.

f. Detailed customizable output reports.

g. Provide voltage drop calculation study. The voltage drop study must be performed to determine the steady-state loading profile of each County facility electrical system. The load-flow study must calculate the voltage drop on each feeder, the voltage at each bus, and the power flow in all branch and feeder circuits. Losses in each branch and total system power losses are also calculated. The recommended sizing for both feeders and branch circuits shall prevent a voltage drop exceeding 3 percent at the farthest outlet, where the maximum total voltage drop of the feeders and branch circuits does not exceed 5 percent.

Section 26 20 00 - Electrical Rooms and Closets

1. Provide separate rooms or closets for communications equipment.
2. Adequate space for electrical equipment shall be provided in the basement utility connection to provide for proper management of all central electrical utilities and their distribution within the building. Distribution within the building shall be via readily accessible electrical rooms or closets. Electrical rooms or closets must be independent from all other types of closets (e.g., communications, telephone, custodial, etc.). Adequate ventilation for heat-producing and/or heat-sensitive electrical equipment must be provided. Piping is absolutely not allowed in transformer vaults and main switchgear areas. The County must not be exposed to the risks that can result from lack of proper design attention to this requirement.
3. Separate rooms shall be designated to accommodate the immediate and/or future installation of on-site co-generation of power (i.e., micro-turbine engines or fuel cells).
4. Provide concrete bases and housekeeping pads for all transformers and equipment, seismically designed with structural connections to the floor slab, and channel or angle iron frames for welded equipment fastening.

(Continued from previous page)

5. Design for future removal or replacement of transformers and provide ventilation for removal of heat generated by the transformers.

6. Install all medium voltage services for buildings in rooms or spaces with concrete or solid masonry walls and ceilings.

7. In general, allocate floor space for future switchgear.

8. The room design shall take into consideration the possibility of flooding when below grade.

9. Provide adequate doors, hatchways, etc., to permit ready installation or removal of major equipment.

10. Provide ventilation completely separate from the building ventilating systems.

11. Mechanical piping and ductwork must not be installed in electrical equipment and transformer rooms except where required for operation of the electrical equipment.

12. Piping and ductwork must never be installed directly over any transformer or switchgear. Sprinklers are the only exception, if installed to protect electrical equipment.

13. Adequate lighting, ventilation, and sound control must be provided, including emergency lighting and receptacles, if an emergency system is available.

14. In shops or similar areas, branch panels may be mounted on or in walls.

15. Special attention must be given to the design of the floor structure to permit future openings in the slab without weakening the structure. Provide capped sleeves, knockouts, and floor space for future conduit.

Section 26 30 00 - Electrical UPS System

1. Provide a double conversion UPS system manufactured by a reputable manufacturer such as Schneider Electric, APC, Mitsubishi, GE, ABB, or equivalent.

2. Historically, the most common backup source for uninterruptible power supply batteries has been VRLA (valve regulated lead acid). VLA (vented lead acid) is not allowed. The expected life of a lead acid battery plant is about 5 years and requires extended maintenance. However, a lithium-ion solution provides many features and benefits and a longer life (10 to 15 years) that greatly exceed those of traditional lead acid batteries. If a lithium-ion battery plant is used instead of lead acid, it must comply with the most recent safety standards for lithium-ion batteries.

3. Specify low harmonic content. Modular UPS systems (plug-and-play modules) are preferred.

4. The UPS must include internal bypass and maintenance bypass. Provide event recording capabilities to allow troubleshooting in case of malfunctions.

5. The UPS system and related batteries must be connected to the Building Automation System and monitored, diagnosed, and controlled from the County central location.

6. For large UPS systems having lead acid batteries with 50 gallons or more of electrolyte substances, hydrogen detector(s) must be installed. In addition, exhaust fan(s) in the UPS room(s), or where the batteries are located, must be installed. Use appropriate standards and building codes for other types of batteries to ensure safe operation of the UPS systems.

Section 26 00 00 - Teleconferencing and Video Facilities

Version 2022.1

Division 27 – Communications

All major County facilities will have at least one conference room with interactive video equipment. This will be used for videoconferences, training, and long-distance interviews. Besides security on the room, it will also need storage and wiring provision for the equipment.

A dedicated cable TV room shall be provided in each building required to be wired for cable TV access.

Section 27 00 00 - Communications

General Considerations

1. The Consultant shall include a Communications engineer in the design of any new building to ensure telecommunications requirements are considered.
2. The sizes and configurations of communications rooms in a building will depend upon several factors, chiefly:
    1. The number of people (workstations) in the building;
    2. The number of people (workstations) on each floor;
    3. The nature of technology in use in the building, e.g., number of personal computers, number and kind of mid- and mainframe computers, printers, interactive-voice-response systems, application servers, and so forth.
3. Security. In general, access to all telecommunications rooms should be controlled by proximity cards rather than keys. This method allows a log of everyone who entered such rooms and allows quick and simple shutdown of access when a card is lost or an employee (County, contractor, US West, or other) leaves service.

Communications Rooms

1. Main Distribution Frames (MDF) – usually a large room in the basement or on a lower level where fiber optic and copper cables from outside the building enter and can be cross-connected to the internal wiring plant. Considerations:
    1. Space, power, and HVAC for main telephone switch.
    2. Vented battery plant in a separate room from the communications room. See also OSHA requirements for such rooms.
    3. Space, power, and HVAC for main building County data communications devices (switches, routers).
    4. UPS (uninterruptible power supplies) for most telephone and data communications equipment.
    5. Backup generator. Such a generator may be required based upon the importance of the building and the communications requirements of the building tenants. Such a generator could be located in a separate room near the MDF or in another part of the building.
    6. Wall board – punch down block field.
2. Intermediate Distribution Frames (IDF) – a room on each floor where fiber optic and copper cables that run vertically inside the building from the MDF can be cross-connected to the floor distribution cabling.
    1. IDFs could be located on every floor, or, if properly designed, perhaps every third floor.
    2. Wall board – punch down block field.
    3. Space, power, and HVAC for each floor's data communication switches.
3. Wiring Infrastructure Considerations (including Workstations):
    1. Wiring from outside the building:

Building Design Standards

County Communications Requirements

1. Dual entrances to the building (from two separate directions).
2. Fiber optic cable will need to enter the building, as CCTV requires fiber optic cable for real-time monitoring.
3. Copper cable.

Telecommunications Companies Requirements

1. Provision for multiple companies.
2. Cable television. Connect to CATV vendors, probably via fiber optic cable to the MDF, with CATV distributed to certain floors and rooms via coaxial cable.
3. Vertical wiring from MDF to IDFs on each floor.
4. Provide four empty conduits with pull line, 4 inches in diameter, from the MDF to each floor IDF.
5. Later fiber optic or copper cable will be pulled inside the conduits.

Floor Distribution Wiring

1. Four-pair (eight-wire) twisted pair cables to each jack.
2. Category 6 wire.

Workstation Requirements

1. Four jacks in a quad-plex wall plate at each workstation.
2. RJ45 jacks.
3. One telephone and one data jack at each workstation, plus considerations for other devices—fax, second phone, second computer, modems, etc.
4. Plan an additional 15% quad-plex outlets per floor to cover fax machines, printers, etc., in common work areas.
5. Plan at least one power-fail phone per 10 workstations, including one power-fail phone in each conference room.

Conference Rooms

1. Plan one quad-plex every six linear feet—a minimum of two per room.
2. Plan one telephone instrument per room.
3. Consolidated server and computer room considerations.
4. Plan one major computer/server room for the building, located adjacent to, but separate from, the MDF. The separate room is for security and fire suppression.
5. Additional rooms may be required on other floors depending upon user requirements.
6. See considerations for UPS, battery, and generator backup under item #2 above.

Radio Requirements

1. Some facilities may require an inside antenna (e.g., “leaky coax”) to ensure proper 800 MHz public safety radio coverage inside the building.
2. Some facilities may require BDAs to amplify or repeat outside radio signals (800 MHz or other) and rebroadcast them inside the building.
3. The roofs of some facilities may be appropriate for supporting antennas for 800 MHz public safety or other radio broadcast.

Section 27 00 04 – Access Control Systems & Security

1. An integrated access control and alarm monitoring system with the capability of alarm graphics, integrated badging, and CCTV monitoring, using the County's MS Windows Operating System (as approved by DTS) for multiple workstations is required. The system must be compatible with the existing County security system and must be configured for multiple site codes and multi-

2. Provide a complete building access control system for the entire facility. System design must consist of all conduits, raceways, cables, back-boxes, card readers, cards, controllers, printers, alarm contacts, glass break detectors, programming, software, and power needed to achieve a complete and functional system. Also included are all required power supplies, power filtering, mounts, housings, equipment stand, and interfaces to equipment furnished by others. System must be easily programmable to allow use by multiple users to grant or deny access depending upon building schedules and events. System must have multiple zones to allow limited or full access to the facility. Proximity readers must be located at various locations. Each proximity reader must have a distinctive code to identify the user and a log must be kept in memory. The log within the panel can be accessed through a computer. The alarm condition must also initiate real time recording on the integrated CCTV System. The system may be programmed with graphic maps allowing the end-user to quickly identify alarm conditions and lock/unlock doors. The facility must be integrated into the Montgomery County security system. Specific requirements for the system shall be determined during the early stages of Facility design. Panic alarms and security system keypads shall be located on drawings. A locking system with card reader, compatible with the County Access Control System over the County LAN, is required. The intrusion alarm shall be separate from the Access Control and be compatible with the Security Command Center hardware/software.

3. Intrusion Alarm Systems

Provide fully functional intrusion detection system for the entire facility. System design must consist of control panel(s), sub-panels, door switches, passive infrared detectors, access keypads, conduits and wires, power, and multiple zones to allow limited or full access. The access control system shall consist of electric locks and proximity type card readers compatible with the county security system. System shall be easily programmable to allow use by multiple users and to grant or deny access depending upon building schedules and events. System shall have multiple zones to allow limited or full access to the facility. Designer shall coordinate security requirements and design with the County's Security consultant. Badge ID access systems will be installed on all entrances to

4. Provide a complete Network based Closed Circuit Television Surveillance System design that covers the entire facility. Design of the system must consist of all cables, wires, fiber, backboxes, POE/IP color cameras, enclosures, digital CCTV Network Video Recorders/servers, networking equipment, software, equipment power requirements, and programming needed to achieve a complete and functional system. Also included are all required mounts, housings, and interfaces to equipment furnished by others. The combined building design shall enhance supervision and minimize security problems by providing maximum visual access and sight lines to all main entrances/activity spaces and eliminating blind corners, hallways, and exterior recesses as much as practical. Surveillance cameras, monitors, and recorders shall be in the administrative control area. Two security system monitors are to be placed on each end of the customer service counter. Security cameras should be placed to monitor building entrances, exits, program spaces, and parking lot. A digital video recorder with 30-day capacity and access from the County LAN is included to record and monitor areas on a 24-hour cycle.

Section 27 00 05 - Closed Circuit Television (CCTV) Systems

1. Where programmed, an integrated CCTV system with digital recording, fiber optic capability, internet viewing capability, fixed color cameras, color pan tilt cameras, motion detection, and

ability to interface with the existing County system. Panic alarms and intrusion detection alarms shall be provided. The system must have the ability to print out clear, color CCTV photos of on-screen images. Systems will also include 21-inch color monitors, Internet viewing, fixed color cameras, and digital recording. The CCTV system must be designed to handle further expansion.

Division 32

Section 32 00 00 - Site

Site disturbance

1. Building location must be coordinated with the topography so that minimum area of the site is disturbed (minimum cut and fill). (Green)

2. In design of site, natural topography of the land must be respected to the maximum level possible. (Green)

3. Valuable natural resources must be protected. (Green)

Building location

4. Orientation of the building must be in relation to the sun movement and energy calculations. (Green)

Accessibility

5. All site functions must be accessible.

6. Site circulations must be efficient.

Vehicular Access

7. A comprehensive analysis of the vehicular circulation and its interaction with pedestrian movement must be provided.

8. In order to service any facility, it is imperative that service vehicles have direct access to the facility. Early in the design process, the amount of service vehicle traffic to be generated by the facility must be identified and accounted for in the plan. A dedicated vehicular access for delivery and service vehicles is mandatory and should be thoughtfully integrated into the overall design philosophy for the building and the site. It is not unusual for service, delivery, or construction vehicles to access buildings in ways different than planned; therefore, pedestrian pathways, plazas, etc., shall be designed for vehicular loads just the same as all streets.

Serviceability

9. Every building built in the County is intended to serve its purpose over a long period of years. The initial design and construction is only a brief moment in time and cost for the facility. The true value and quality of a building is measured over the years by its ability to adjust to the needs of the end-users and the cost of servicing the components and systems within the building. A building cannot function if it cannot be serviced. Although it is important to get the “front door” right, it is the “back door” that determines how well the building will work. When building services can be provided to meet all requirements and be virtually transparent to the end users, then the building is most likely a success.

Safety and security

10. Site must be pedestrian friendly and safe.

11. Provisions of Crime Prevention Through Design must be considered.

12. Separation of vehicular and pedestrian access must be maintained, and their relationship must be analyzed for maximum safety.

Section 32 00 01 - Side walk

1. Sidewalks to be 5 feet wide minimum. Finishes shall be as bright as possible. (Green)

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2. Use of pervious materials for onsite sidewalks is promoted. [**Sustainability Requirement**]

Division 33

Section 33 00 02 - Natural Gas

1. Natural gas, if available, shall be utilized where appropriate in mechanical spaces. For remodel projects, verify adequacy of service.
2. Connections to existing lines and activation of all new lines shall be performed under the supervision of the utility provider company.
3. All welds must be inspected.

Section 33 10 00 - Water Service

1. Water service to the facility shall be provided from the adjacent central water distribution mains in accordance with the utilities drawing provided for the project. Separate services shall be provided for fire protection where utilized. For remodel projects, verify adequacy of service.
2. Gate valves eight (8) inches in diameter and larger shall be fitted with an auxiliary bypass line and valve. Gate valves four (4) inches in diameter shall be provided as specified in the project requirements.
3. All water mains shall be installed in accordance with WSSC requirements, except for connections to existing water mains owned and maintained by municipal jurisdictions outside of the WSSC region.
4. At the entry to buildings and at other locations where a water main crosses backfill, provide a concrete grade beam to support the pipe. Support shall be provided from the building and/or firm soil.
5. Provide flexibility in piping on unstable earth and provide a flexible joint at the building entry.
6. Test pressure shall not be less than 50 psi above static pressure, but not less than 200 psi and not more than 200 percent of the working pressure for the class and size of pipe tested.
7. The line shall be filled between valves with all air expelled at high points. Test pressure shall then be applied and maintained for at least 2 hours. The test pressure must be maintained without pumping for 15 minutes with a pressure drop of less than 15 psi.

Section 33 40 00 - Sanitary Sewer and Storm Drainage

1. Sanitary sewer and storm drainage systems shall be separated. Corrosive waste may require a dilution or neutralizing tank. Hazardous wastes shall be disposed of by a collection service. Roof drains, footing drains, and area drains shall be connected to the storm drainage system. All active and/or inactive sanitary or storm piping within the footprint of the facility shall be removed and relocated as appropriate. All systems shall be designed for gravity conveyance. Pumping of sewage or storm drainage is not permitted without specific approval of the County. For remodel projects, verify adequacy of service.
2. All lateral and trunk sanitary sewers shall be sized to flow full under maximum anticipated flow while maintaining minimum velocities under average flow conditions. In general, design flow velocities shall be maintained within the range of 3 to 8 feet per second.
3. No pipe smaller than 6 inches in diameter shall be used.

Division 34

Section 34 00 00 - Parking

General

1. Provide the required number of parking spaces designated for hybrid cars. [**Sustainability Requirement**]
2. If possible, investigate the use of pervious parking surfaces. [**Sustainability Requirement**]
3. Provide the required number of bicycle racks. [**Sustainability Requirement**]
4. Provide the required number of lockers for bicyclists. [**Sustainability Requirement**]

Building Design Standards

5. Provide shower facilities for bicyclists. (Sustainability Requirement)

Open Parking Area

6. Parking must be asphalt with 6 inches of gravel base, 4 inches of base course, and 2 inches of top course.

7. Parking spaces must be striped with white paint.

8. Parking lighting must use fixtures with a cutoff glare angle of not more than 60 degrees from the center line of the light fixture. (Sustainability Requirement)

9. Lamps must be High Pressure Sodium (HPS), with a maximum of 3 foot-candles at the bottom of the fixture and not less than 1 foot-candle at the border with adjacent fixtures. (Sustainability Requirement)

Parking Garage

10. Parking surfaces must be concrete coated with a special epoxy nonskid texture. Color must be medium warm gray.

11. Parking spaces must be striped with white paint.

12. Parking lighting located at the edge of the garage and visible from outside must use fixtures with a cutoff glare angle of not more than 45 degrees from the center line of the light fixture. (Sustainability Requirement)

13. Lamps must be Metal Halide, with a maximum of 10 foot-candles at the bottom of the fixture and 5 foot-candles at the border with adjacent fixtures. (Sustainability Requirement)

14. The top level, if open, must be off-white concrete. (Sustainability Requirement)

Bike Rack

15. Bike racks must be provided for all facilities.

16. Bike racks must provide two points of contact to stabilize bicycles and enable locking of both the frame and one wheel.

17. Use U-shaped bike racks.

18. Because bicycles are valuable assets, racks must be located in highly visible, well-lit areas near building entrances to enhance security.

19. Preferably, bike racks should be placed under covered areas for weather protection.

20. Bike lockers provide both security and protection from weather.

21. A general rule of thumb is one rack per 25 vehicle parking spaces at a facility.

22. Spacing requirements are approximately 7 feet long by 4 feet wide per rack. A stable concrete or asphalt surface is required. A specialized security bolt must be utilized.

23. Bike rack placement must maintain required Americans with Disabilities Act (ADA) compliant accessible routes, including minimum clear width and turning space in accordance with ADA standards.

Section 34 00 00 - Service Areas

Loading Dock

1. Where necessary to provide for the safe and efficient transfer of large quantities or sizes of material in and out of County facilities, a loading dock must be provided. It is the consultant's responsibility to identify the extent of requirements during the schematic and design development phases of each project and to incorporate all associated provisions into the contract documents. In general, the program will dictate whether a separate service entrance with a loading dock is required. If required, it shall accommodate custodial service deliveries; mail delivery and pick-up; waste collection and removal; recycling; facility maintenance; delivery services (e.g., United Parcel Service (UPS), Federal Express); general contractors and subcontractors; movers; and similar functions. In some cases, mail and package screening may be required. Care must be exercised to minimize conflicts with accessibility requirements for persons with disabilities.
2. A loading dock must be provided for all buildings unless otherwise noted. The loading platform must be 4 feet high with levelers for 55-foot trucks, or as identified in the Program of Requirements (POR).

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Vehicle & Loading Access Doors

3. Building interior vehicle access, some loading areas, "Sally Ports", and other building interior areas are generally accessed through large door systems. In all cases possible, such doors are to be "Overhead Panel" or "Horizontal Sliding" rather than "Overhead Coiling" door systems. In new buildings, early design consideration is to be given to providing sufficient overhead clearance and sufficient horizontal clearance from the door and inside the space to allow for "Overhead Panel" doors. The doors are to have oversized, or the heaviest possible, operating hardware to provide both operational reliability and durability.

Service Areas

4. Service areas and loading docks must be carefully located in consideration of other design features of the building and adjoining existing buildings. This area must accommodate various functions such as waste management, recycling, chemical waste, pickup, and delivery. All-weather access must be provided. Verify sizes of waste and recycling containers with the Project Manager.

Waste Handling

5. Effective waste management must be carefully considered at the very beginning stages of design. Some facilities may have waste that is considered hazardous or waste that requires special handling by designated regulatory agencies. Waste handling provisions must be carefully developed in such a way as to not negatively affect or diminish the aesthetics or functional provisions required for site standard presentation. (Green – Sustainability Requirement)
6. Effective recycle management provisions, consisting of workspace for waste management staff and retention space for segregated waste awaiting routine pickup, must be included in the waste handling area of all facilities. If Green Chutes are installed in all new buildings greater than one story in height (in consultation with the Division of Operations), the chutes should be installed in pairs, with one chute connected to a two cubic yard dumpster for commingled recycling and another dumpster for glass. (Green – Sustainability Requirement)

Trash Area

7. An area must be provided to accommodate trash bins, one for each of the following: general waste, glass, plastics, paper, and metal. (Green – Sustainability Requirement)

Custodial Provisions

8. Designers must make adequate provisions for the receipt, storage, and redistribution of custodial supplies for the building and for the efficient operational servicing of the building. Custodial closets for local storage and control of supplies and equipment, in close proximity to the freight elevator, should be included on every floor.

Attic Stock

9. Provide a storage area for attic stock to satisfy the requirements set by the project and related specifications. Provide appropriate shelving to accommodate the attic stock materials.

Division 41

Section 41 22 00 – Hoists and Cranes

10. Provide portable man lifts for all facilities in areas where ceiling height is 18 feet and above. The portable lift shall be specified per intended use and equipped with AC power, narrow base, air motor power, and gated narrow platform.

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Chapter 2: Sustainable Design

Background

Since 1994 Montgomery County Maryland has been enforcing the "Design Guideline" and the "Energy Design Guideline", two documents that assure high quality of design, maintainability and energy conservation in County owned facilities. Between 1994 and 2003 the County has saved millions of dollars by enforcing the requirements of these two Guidelines and by incorporating an Energy Management System. This manual incorporates and enhances the two guidelines into a more comprehensive manual for planning, design, and construction of County owned facilities.

Why Sustainable Design?

The purpose of a County-wide sustainable building is to demonstrate the County's commitment to environmental, economic, and social stewardship, to yield cost savings to the County taxpayers through reduced operating costs, to provide healthy work environments for staff and visitors, and to contribute to the County's goals of protecting, conserving, and enhancing the region's environmental resources. Additionally, the County helps to set a community standard of sustainable building.

What Is Sustainable Building?

Sustainable building integrates building materials, systems, and methods that promote environmental quality, economic vitality, and social benefit through the design, construction, and operation of the built environment. Sustainable building merges sound, environmentally responsible practices into one discipline that looks at the environmental, economic, and social effects of a building or built project as a whole. The entire life cycle of the built environment is included (planning, design, construction, operation and maintenance, and demolition or disassembly). Sustainable building design encompasses the following broad topics: efficient management of energy and water resources; management of material resources and waste; protection of environmental quality; protection of health and indoor environmental quality; reinforcement of natural systems; and integrating the design approach. Sustainability is "meeting the needs of the present without compromising the ability of future generations to meet their own needs." The concept of sustainable building is derived from this broader definition of sustainability. Sustainability seeks to balance concerns for continuing growth and human development with concern for the well-being of the planet.

Life Cycle Cost Analysis is an inclusive approach to costing a program, facility, or group of facilities that encompasses planning, design, construction, operation and maintenance over the useful life of the facilities and finally any decommissioning or disassembly costs. Life Cycle Cost Analysis looks at the net present value of design options as investments. The goal is to achieve the highest, cost-effective environmental performance possible over the life of the building.

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Why Is Sustainable Building Important?

The building industry is the nation's largest manufacturing activity, representing 13% of Gross Domestic Product. In addition, buildings represent more than 50% of the nation's wealth. The design, construction and maintenance of buildings has a tremendous impact on people and nature. Structures also impact areas beyond their immediate location, affecting the watersheds, air quality, and transportation patterns of communities. Buildings consume or are responsible for:

- 40% of the world's total energy use
- 25% of timber harvest
- 16% of fresh water withdrawal
- 50% of ozone-depleting CFCs still in use
- 30% of raw materials consumption
- 35% of the world's CO emissions
- 40% of municipal solid waste destined for local landfills

Benefits of Sustainable Building

1. Reduce operating costs.

a. Energy Efficiency

- Climate-sensitive design and energy technology use can cut heating and cooling energy consumption by 60 percent and lighting energy requirements by 50% in U.S. buildings.
- Returns on investment for energy-efficiency measures can be higher than rates of return on conventional and even high-yielding investments.
- Widespread participation in the U.S. EPA's Green Lights program has saved over 65 million kilowatts of electricity and reduced the nation's electric bill by $16 billion annually. This is an old program implemented in 1991. Montgomery County has already retrofitted, and savings have been accomplished. (T-12 bulbs are now considered obsolete). Energy efficient lighting is part of ASHRAE 90.1 already invoked in LEED guidelines as the minimum standard.

b. Water Efficiency

- Water-efficient appliances and fixtures, behavioral changes, and changes in irrigation methods can reduce consumption by up to 30% or more.
- A typical 100,000 square foot office building can yield annual savings of $4,393 by installing high efficiency measures and reducing water consumption by 30%.

c. Waste Reduction

- Construction and demolition waste equals from 35% to 40% of Municipal Solid Waste.
- Construction and demolition waste recycling can result in significant savings of not only landfill space but waste hauling and tipping fees. The Portland Trailblazers Rose Garden arena construction/demolition project saved an estimated $186,000 through waste diversion and recycling.
- Recycling creates jobs. Diverting these materials to local processors instead of local landfills creates new economic opportunities.[1] *** Version 2022.1
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Reduce Some First Costs

- Rehabilitating an existing building can lower infrastructure and materials costs.
- Integrated design can use the payback from some strategies to pay for others.
- Energy-efficient buildings necessitate sound engineering design and making good equipment choices in order to reduce their equipment needs—downsizing some equipment, such as chillers, pump and fan motors, or eliminating equipment, such as perimeter heating.
- Using pervious paving and other runoff prevention strategies can reduce the size and cost of storm water management structures.

Expand Timeframe to Create Return on Investment

Life Cycle Cost Analysis looks at the net present value of design options as investments. The goal is to achieve the highest, most cost-effective environmental performance possible over the life of the project. Within a building's total life span, initial building costs account for approximately 2% of total life cycle costs, while operations and maintenance costs account for 6%, and personnel costs account for 92%.

Many green building measures make good long-term economic sense if the first cost is subtracted from all future savings, and savings are calculated with market capitalization rates. In other words, many green building measures can be thought of as investments that will gain value over time, over and above investments at market interest rates. Low up-front expenditures can often result in much higher costs over the life of a building.

Help Protect Chesapeake Bay

This document indicates several specific areas of human activity that threaten Chesapeake Bay. Four of these areas—land use decisions, storm water management, water use, and water pollution—are directly impacted by building and development. Sustainable building techniques that address these and other areas include:

- Preserve existing vegetation and cluster development to preserve streamside habitat.
- Minimize impervious surfaces to decrease flooding and protect base stream flows.
- Install water-efficient building systems to protect area water supplies and habitat areas.
- Use low-toxic building materials that reduce water pollution during manufacturing and installation.

Improve Productivity and Human Health

- Improved indoor environments can increase employee productivity by up to 16%.
- Employees in buildings with healthy interiors have less absenteeism and tend to stay in their jobs.
- The U.S. Environmental Protection Agency ranks indoor air pollution among the top five environmental risks to public health. One third of all buildings have poor indoor air quality.
- Sick Building Syndrome and Building Related Illness are estimated to cost $60 billion per year in medical expenses and lost worker productivity in the United States. *** Version 2022.1
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- Benefits to tenants of green buildings with good overall environmental quality include reduced absenteeism, better employee morale, and community recognition.

- Ensuring healthy indoor air can reduce insurance and operating costs and reduce liability risks. The U.S. EPA faced a lawsuit from employees who became ill after new carpet was installed during a renovation. The employees won the lawsuit, worth approximately $1 million.

Provide Community Benefits

Sustainable building can help to support and/or protect:

- The local economy through demand for local building materials, jobs, and industries

- Area environmental quality such as clean air and water

- Longevity of public infrastructure, such as power plants, landfills, and water treatment plants

- Social equity through the inclusion of community groups and special populations in the design process

- Global climate change mitigation by lowering energy and material consumption in building construction and operation, which can contribute to climate change

Compliance with Green Requirements

1. Although LEED certification is not required and compliance with IGCC is required, the Montgomery County Sustainable Building Policy will benefit from all green design guidelines and codes.

2. The goal of the project shall not be merely to score more points, but to understand the potential of the building and its systems design and strive to achieve the highest possible green and sustainability goals.

3. All new facilities must be designed to be Net Zero. All major renovations must be studied for Net Zero and must be at least Near Net Zero. All other renovations and building systems replacements must be designed so that components meet the standards of a Net Zero design.

4. Flood prevention must be included in all new facilities and studied for all renovations.

The Project Manager and the A/E must initiate a Charrette workshop before commencing concept design development to determine the project's green goals.

- The Charrette must be conducted prior to concept design development.

- Project green goals must be clearly defined during the workshop.

- These goals must be monitored and maintained throughout the design and construction phases of the project.

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Chapter 4: Indoor Air Quality Standards

General

The following guidelines are intended to outline processes and methods to minimize adverse Indoor Air Quality (IAQ) conditions on the occupants of buildings. These guidelines shall be met by both the Architect/Engineer (A/E) consultant and the contractor to assure acceptable IAQ conditions are provided to the initial occupants of the building and over the life of the building. Compliance with this guideline is considered to be a basic service.

IAQ Considerations

The A/E shall incorporate the following IAQ considerations into the design and construction documents:

1. Maintain strict pollutant source control by specifying materials and substances which are designed, manufactured, handled and installed in such a manner that they will produce the least harmful or annoying effect on the occupants of the building.
2. Provide an adequate outdoor air supply to the building which is protected from exterior pollutant sources, including the building's own exhaust and venting systems, cooling tower mist, parking areas, loading docks and smoking areas. Consider 3-stage intake air filtration consisting of pleated pre-filters, charcoal, and bag/box filters to take out a high proportion of the 1 um + aerosols. Provide minimum MERV 13 filters.
3. Provide floor coverings appropriate for areas of use based on potential exposure to water, foot traffic, food spills and other contaminants.
4. Provide adequate and effective fresh air delivery to occupants and including special purpose areas.
5. Provide properly designed exhaust systems to remove pollutants generated within the building before they are redistributed through the occupied space. The exhaust systems shall be designed for compatibility not only with the building's air intake system(s), but also for compatibility with adjacent buildings and with future development in accordance with the site master plan.
6. Provide building design which will protect building occupants from infiltration, both natural and stack effect, of carbon monoxide, particulates and other pollutants from external sources, and radon from ground sources.
7. The design of the internal Heating, Ventilating, and Air Conditioning (HVAC) delivery systems shall incorporate the ability to redirect, without great expense, the internal air flows as occupancy and activity patterns change over the life of the building.
8. Acoustical insulation on the interior wall of the ventilation ducts shall not be used to achieve noise level of the ventilation system at or below 45 dBA in all work areas.
9. Provide documentation describing:
    a. The amount and type of chemical vapors or particles which may be emitted from materials introduced into the workspace; and

    b. The building design with the mechanical HVAC systems design including zoning.

10. Provide training to the building maintenance and operations personnel to ensure a thorough understanding of the IAQ goals, their role in meeting the goals, and how the HVAC systems should be operated to meet the goals.

Indoor Pollutant Source Control Plan

The A/E shall develop and implement an Indoor Pollutant Source Control Plan indicating how the Emission Rate Standards that follow will be implemented. The Plan shall apply to all interior construction materials, finishes and furnishings including partitions, wall coverings, flooring, floor coverings, ceiling tiles, adhesives, paints, sealants, glazes, insulation, duct work, wiring and other materials which may have chemical content.

1. Design documents shall require that all appropriate suppliers be made aware of the IAQ goals and the requirements to comply with the Emission Rate Standards.
2. Where possible, materials used shall emit the lowest, yet technologically achievable, emissions of chemical vapors and particles.
3. Emission Rate Standards: The following are performance based, after the fact with the ventilation system operating:
    a. **Formaldehyde Emission Rate Standard:** The product emission rate shall not result in an indoor air concentration level of formaldehyde greater than the NIOSH Recommended Exposure Limit of 0.016 parts per million.
    b. **Total Volatile Organic Compound (VOC) Emission Rate Standard:** The product emission rate shall not result in an indoor air concentration level greater than 0.5 mg/m^3 of total volatile organic compounds.
    c. **4-Phenyl Cyclohexene (4-PC) Emission Rate Standard:** The carpet emission rate shall not result in an indoor air concentration level greater than 1 part per billion.
    d. **Total Particulates Emission Rate Standard:** The product emission rate shall not result in an indoor air concentration of greater than 50 ug/m^3 total particulates in non-office areas and 10 ug/m^3 for 8-hour TWA in office areas.
    e. **Regulated Pollutant Standard:** Any pollutant regulated as a primary or secondary air pollutant shall meet an emission rate standard that will not generate an air concentration greater than that promulgated by the National Ambient Air Quality Standard (USEPA, Code of Federal Regulations, Title 40, Part 50).
4. Other Pollutant Standard: Any pollutant not specifically mentioned in subparagraphs 3.a through 3.d shall meet an emission rate standard that will not produce an air concentration level greater than one-tenth (1/10) of the Threshold Limit Value – Time Weighted Average (TLV-TWA) industrial workplace standard or 0.5 mg/m^3 of total VOCs, whichever is less.
5. As part of the Shop Drawing process, the A/E shall include a requirement that the contractor provide compliance information and Material Safety Data Sheets (MSDS) on all indoor construction material. Additionally, the contractors shall disclose, in writing and prior to installation, information on those VOCs found to be emitted by the products and known to be carcinogens, mutagens, reproductive toxins, or compounds emitted to cause an air concentration of not greater than 0.1 ppm or one-tenth (1/10) of the TLV, whichever is less.
6. All emission rate testing pertinent to air quality shall be done in accordance with ASTM D5116-90, *Small Scale Environmental Determination of Organic Emissions from Indoor Materials/Products.* All test data shall be made available to the County at its request.
7. The least amount feasible of "wet" materials (such as adhesives, sealants, glazes, caulks, paints, etc.) shall be used during construction and product applications. The Plan shall include control strategies for achieving this minimal use requirement.

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7. "Dry" furnishing materials (such as carpet, acoustical panels, textiles, etc.) shall not be installed until "wet" materials have been applied and allowed to dry to the extent feasible and in accordance with other good building practices. Drying times should be chosen so that pollutant emission rates as set forth above are achieved prior to installation of the "dry" furnishings. Dry furnishings such as carpeting and floor tile shall not be applied to the cement floors until the moisture content of the cement is below 16%.

    a. All dry furnishing and materials (such as carpet, floor tile, acoustical tile, textiles, office furniture, wood shelving, etc.) shall be allowed to "air-out" in clean environments prior to installation in a building.

    b. All indoor construction material shall be protected from contamination by construction dust, debris, and fumes during all phases of construction, both before and after installation.

Ventilation Control Plan (ensure full compliance with ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Standard 62 (1999))

The A/E shall develop a Ventilation Control Plan, which includes an analysis of the adequacy and effectiveness of the proposed mechanical HVAC system covering the following factors:

8. Location of building outdoor air intakes to ensure an acceptable quality of outdoor air.
9. Location of building exhausts, plumbing vents, and other pollutant sources to prevent reentry of exhausted or polluted air back into the building.
10. Integration of building air intake and exhaust locations with the overall site master plan to optimize the quality of outdoor air intake for all buildings on adjacent sites.
11. The ability of the building exhaust system to ensure external exhaust of pollutants and odors created in laboratories, building support areas, cafeteria, break rooms, printing areas, photocopy areas, and other special purpose areas; and treatment of those exhausts, if appropriate, to eliminate particles and toxic pollutants from the air before exhausting it.
12. The ability of the HVAC system to provide:
13. An adequate ventilation rate of outdoor air to the ultimate expected building population and usage.
14. Adequate make-up air, as appropriate, for special purpose areas.
15. The ability to achieve acceptable ventilation effectiveness in the occupied zones with a maximum CO level of less than 600–700 ppm under maximum normal loading.
16. The ability to effectively integrate the air delivery system with the occupied space activities and space design.
17. The ability of the building to provide protection of its occupants against infiltration, both natural and stack effect, of the following:

    a. Carbon monoxide, aerosols, and other pollutants from the parking areas, loading dock areas, smoking areas, and other pollutant sources external to the building.

    b. Radon from ground sources.

Additional Environmental Controls

1. To prevent and/or inhibit the degradation of IAQ in adjacent occupied buildings during construction, the following shall be observed:

    a. Minimize the amount of construction dust, vapors, and fumes generated at the construction site.

    b. Provide temporary source of outdoor air, if required, to prevent construction dust and fumes from infiltrating into the adjacent building's mechanical system.

c. Recondition the air systems of adjacent buildings affected by the construction project to at least the pre-construction cleanliness conditions.

d. During construction, the site shall be maintained so that there is no moisture infiltration that could cause future problems (e.g., wet insulation, wet flooring material, wet sheet rock, etc.).

e. Before any material is placed on a concrete surface, the moisture content shall be measured to ensure that it is within specification.

2. To prevent and/or inhibit the degradation of indoor air quality in occupied portions of buildings during renovation projects, the following shall be observed:

    a. If possible, schedule renovation projects to occur during favorable weather seasons and/or conditions.

    b. Separate and section off the area where renovation is to be performed from the remaining space, or perform work during non-operating hours. The space shall be thoroughly cleaned and flushed with outdoor air prior to occupancy.

    c. Prevent construction dust and fumes from infiltrating into the building's mechanical system.

Indoor Air Quality Operations Plan

1. Ensure full compliance with ASHRAE Standard 62, 1999.

2. The Architect/Engineer (A/E) shall provide a building indoor air quality operations plan, which includes, but is not limited to, the following:

3. HVAC design and operating documentation as recommended by the equipment manufacturers and the design engineer:

    a. Information on the daily operation and management of the building systems, including a description of normal operating procedures; special procedures such as seasonal start-ups and shutdowns; and a list of operating performance criteria including, but not limited to, minimum outside air ventilation rates, special space relative humidity requirements, and pressurization requirements.

    b. A general description of the building and its function including, but not limited to, work activity, number of employees and visitors, hours of operation, weekend use, and potential air contaminants that could be released into the space.

4. The scope of work for the initial balancing of the HVAC system at the occupied zone before Substantial Completion and before Final Acceptance.

5. A recommended program for re-balancing of the HVAC system at seasonal changes.

6. A recommended building flush-out period of high ventilation at ambient temperatures (100% outside air), which shall take place after completion of all interior construction and prior to placing any furniture in the ventilated space, and another flush-out period after all furniture has been unpacked and placed in the ventilated space. All flush-out periods shall be scheduled and occur prior to Substantial Completion. (Balancing and Commissioning may take place during this flush-out period.)

7. The requirements for an extended ventilation flush period after Substantial Completion and occupancy at the normal ventilation rate, including the length of time for 24-hour-per-day operation and the length of time and duration for early start-up of HVAC systems.

8. The scope and content of a training program for the County's maintenance staff to properly operate and maintain the HVAC systems under all operating conditions to meet IAQ goals and ventilation standards.

Chapter 5: International Performance Measurement & Verification Protocol (IPMVP) Indoor Air Quality Standards

The IPMVP is a document which discusses procedures that, when implemented, allow building owners, energy service companies (ESCOs), and financiers of building energy efficiency projects to quantify energy conservation measure (ECM) performance and energy savings. The procedures also provide for measurement and verification of ECM performance over time to ensure predicted savings are maintained. The IPMVP provides an overview of current best practice techniques available for verifying savings from both traditionally- and third-party-financed energy and water efficiency projects.

Purpose

The purpose of the IPMVP is to:

- Increase certainty, reliability, and level of savings.
- Reduce transaction costs by providing an international, industry consensus approach and methodologies.
- Reduce financing costs by providing project measurement and verification (M&V) standardization, thereby allowing project bundling and pooled project financing.
- Provide a basis for demonstrating emission reduction and delivering enhanced environmental quality.
- Provide a basis for negotiating the contractual terms to ensure that an energy efficiency project achieves or exceeds its goals of saving money and improving energy efficiency.

Measurement and Verification Options

Each of the four M&V options defined in the IPMVP is applicable to different types of performance contracts, project values, and risk sharing between the energy service company (ESCO) and the owner. The purpose of defining several M&V options is to allow for variations in the cost and methods for assessing savings. Consequently, the M&V options described within the IPMVP vary in accuracy, cost of implementation, strengths, and limitations.

M&V Option	Description	How Savings Are Calculated	Cost
Option A	Focuses on physical assessment of equipment changes to ensure the installation is to specification. Key performance factors (e.g., lighting wattage or chiller efficiency) are determined with spot or short-term measurements, and operational factors (e.g., lighting operating hours or cooling ton-hours) are stipulated based on analysis of historical data or spot/short-term measurements. Performance factors and proper operation are measured or checked annually.	Engineering calculations using spot or short-term measurements, computer simulations, and/or historical data.	Dependent on number of measurement points. Approximately 1–5% of project construction cost of items subject to M&V.
Option B	Savings determined after project completion by short-term or continuous measurements taken throughout the term of the contract at the device or system level. Performance and operational factors are monitored.	Engineering calculations using metered data.	Dependent on number and type of systems measured and the term of analysis/metering. Typically 3–10% of project construction cost of items subject to M&V.
Option C	After project completion, savings determined at the whole-building or facility level using current year and historical utility meter (gas or electricity) or sub-meter data.	Analysis of utility meter (or sub-meter) data using techniques from simple comparison to multivariate (hourly or monthly) regression analysis.	Dependent on number and complexity of parameters in analysis. Typically 1–10% of project construction cost of items subject to M&V.
Option D	Savings determined through calibrated simulation when base-year data are unavailable or when interactive effects are significant.	Calibrated energy simulation/modeling using measured data to adjust model parameters.	Dependent on number and complexity of systems evaluated.

Option	Method Description	Typical Cost
Option D	Savings determined through simulation of facility components and/or the whole facility with hourly or monthly utility billing data and/or end-use metering	Typically 3–10% of project construction cost of items subject to M&V

Generic Monitoring and Verification Steps

M&V Basic Steps – All Methods. M&V of new buildings differs fundamentally from retrofit projects in that performance baselines are hypothetical rather than actual and are therefore generally not physically measurable or verifiable. The implications of this increase with the complexity of measures and strategies to be monitored and verified. Yet the basic steps in new building M&V do not vary significantly in concept from retrofit M&V. These steps are as follows:

1. Define Baseline. Definition of baseline is actually a two-part process. First, a design baseline must be developed and defined. This can range from the stipulation of specific baseline equipment to specifying whole-building compliance with energy codes or standards. Once the design baseline has been established, computer-aided analytical tools are used to estimate the associated energy performance baseline.

2. Define Energy Efficient Design and Projected Savings. The energy efficient design is defined through the building design process and is the natural outcome of that process. Computer-aided tools (such as DOE-2) are then used to estimate performance of the energy efficient design, which is subtracted from the baseline energy performance to generate projected savings. The estimation process should also include the identification and, if possible, quantification of factors that could affect the performance of both the baseline and energy efficient design.

3. Define General M&V Approach. Section 6.2.2 of the IPMVP presents new building M&V methods that are roughly analogous to the M&V retrofit Options A, B, and C presented in Section 3.10 of the IPMVP and reproduced above. The A and B analogs are directed at end-use measures, and C addresses whole-building M&V methods. The relative suitability of each approach is a function of the following:

- The M&V objectives and the requirements of any related performance contracts.
- The number of ECMs and the degree of interaction with each other as well as with other systems.
- The technical practicality and issues associated with M&V of particular ECMs or broader whole-building ECMs and strategies.
- Current trends toward more integrated and holistic new building design that are moving M&V requirements more to the Option C end of the Option A-B-C spectrum.

4. Prepare Project-Specific M&V Plan. Development of an effective and efficient M&V plan for new buildings tends to be more involved than retrofit projects since performance strategies are usually more complex and the technical issues more challenging. Development of an M&V plan should begin during the early design phases of the project for the following reasons:

- Technical analyses that are performed in support of design decisions concerning energy performance during the building design process provide a starting point in defining the M&V objectives and approach. The key elements of energy analysis are also usually key factors in M&V. Therefore, the energy analyses and projections should be well documented and organized with this in mind.
- M&V considerations can, and should, affect certain design decisions such as instrumentation, building system organization, etc.

5. Verify Installation and Commissioning of ECMs or Energy Efficient Strategies. Installation and proper operation is verified through site inspections as necessary combined with review of commissioning

reports, fluid balancing reports, etc. Any deviations should be noted and addressed through adjustment of the affected performance projections.

6. Determine Savings Under Actual Post-Installation Conditions. Virtually all energy performance projections are predicated upon certain assumptions regarding operational conditions, e.g., occupancy, weather, etc. This affects both the baseline and energy efficient design estimations. Deviations from the operational assumptions must be tracked by an appropriate mechanism (site survey, short- and/or long-term metering, etc.) and the baseline and energy efficient projections modified accordingly to determine actual savings.
7. Re-evaluate at Appropriate Intervals. Ongoing performance of ECMs or energy efficient strategies and the associated energy savings must be re-evaluated and verified at intervals and over a time frame appropriate to measurement and verification (M & V) and related performance contract requirements. This also allows ongoing management and correction of significant deviations from projected performance.

Summary of IPMVP Option B for New Buildings

To use IPMVP Option B for new buildings, parties typically stipulate baseline energy consumption using a computer software energy simulation tool such as DOE-2.1. Projected energy savings are then developed based on proposed energy conservation measures and design strategies incorporated into the simulation tool analysis. After the building is built and occupied for a specified period of time, energy savings projections are adjusted by calibrating the simulation tool analysis to actual operating conditions using data from metered energy conservation measures.

Energy efficiency measures chosen to be metered can be any factor that materially affects the generation of savings. Operating hours and power draw over a period are typical examples of measured variables. Increased metering complexity produces higher verification accuracy at the expense of measurement and verification (M & V) cost. Using statistical sampling of similar multiple end-use points (such as motors or lamps) may be more appropriate for simple systems. Use of short- or long-term metering data typically depends on the constancy and/or predictability of the load. Another valuable aspect of metering to consider is that metering provides long-term persistence operation data that can be used to improve or optimize the operation of equipment on a real-time basis.[^1]

Basic Steps to Implementing the IPMVP Option B

In addition to the information provided above under the generic monitoring steps, the following apply specifically to IPMVP Option B:

1. Define baseline and estimate energy performance. For LEED purposes, this is a building complying with ASHRAE/IESNA Standard 90.1-1999 or the local code, whichever is stricter.
2. Define energy efficient design (energy conservation measures (ECMs)) and calculate initial savings estimate. This is a comparison of energy performance of baseline building and energy efficient building using the estimating tool/software.
3. Define general measurement and verification approach (data collection plan) during early project design phases. LEED specifies use of Option B for new buildings (see IPMVP Chapter 6). *** [^1]: By using metering data to commission and optimize the performance of building systems, the City of San Diego's 73,000 square foot Ridgehaven office building has been able to reduce its kWh per square foot load from an already phenomenal 9 kWh at initial occupancy in 1996 to an amazing 6.5 kWh in 1999, saving the City over $80,000 per year in energy costs.

$

4. Verify installation and commissioning of ECMs.

5. Determine savings under actual post-installation conditions. Initial savings estimates are modified to account for as-built verified conditions and calibrated with monitoring data of operating conditions.

6. Re-evaluate at appropriate intervals. Typically performed annually after the first year of operation.

Additional Notes on Successful Specification and Use of the IPMVP

Successful use of the IPMVP and the specification of a M&V method (e.g., IPMVP Option B) requires at least the following:

- State the document to be referenced, e.g., the IPMVP.
- State which option and method from the document will be used, e.g., Option B with post-installation metering of operating hours.
- Indicate who will conduct the M&V.
- Define the details of how calculations will be made.
- Specify metering to be conducted including information on the equipment, calibration, location of measurements, metering period, etc.
- Define key assumptions to be made about significant variables or unknowns.
- Define the level of accuracy to be achieved, if not for the entire analysis, at least for key components.
- Indicate how quality assurance will be maintained and repeatability confirmed.
- Indicate reports to be prepared, their contents, and when they are to be provided.

Note on Energy Estimating/Simulation Tools

It is expected that mutually agreed upon, widely accepted, and validated computer-based estimating tools will be used. Typically, more complex or demanding analysis will produce more precise analyses upon which to measure energy conservation measure and design strategy performance.

Read the IPMVP

At a minimum, project participants should read IPMVP Sections 3.0, 6.0, and Appendix II in order to become familiar with M&V concepts and approaches to implementing M&V.

M&V is analogous to building commissioning but is intended to help preserve energy and water usage efficiency gains over the long term. The IPMVP suggests parties enter into performance contracts, where the M&V contractor is paid based on the amount of energy and/or water saved, rather than typical fee-for-service contracts where a contractor's payments are not related to the performance of the installed systems. The IPMVP not only provides guidance on how to implement M&V, but it also provides guidance on establishing and carrying out contractual relationships related to M&V.

The latest version of the IPMVP and drafts of new sections to be added may be downloaded from the IPMVP official website.

End of Section

Chapter 6: Construction Sign Standard

Figure 1: Standard Montgomery County construction sign layout displaying project title, County Executive (Isiah Leggett), Department of Recreation, County Council member placeholders, Manager (Department of General Services, Office of Special Projects, 240-777-6126), Architect and Contractor placeholders, overall dimensions of 4'-0" height by 8'-0" width, and required white text on blue background.

Name of the Project

Montgomery County Maryland
Isiah Leggett, County Executive

Department of Recreation

County Council

- Council Member Name Placeholder
- Council Member Name Placeholder
- Council Member Name Placeholder
- Council Member Name Placeholder
- Council Member Name Placeholder
- Council Member Name Placeholder

Project Contacts

Manager
Department of General Services
Office of Special Projects
Phone: 240-777-6126

Architect
[Architect Name Placeholder]
[Architect Firm Placeholder]

Contractor
[Contractor Name Placeholder]

[Contractor Firm Placeholder]

Sign Dimensions

- Height: 4’-0”
- Width: 8’-0”

Color Requirement

White text on a blue background. The selected blue background color must provide a minimum contrast ratio of 4.5:1 against white text (3:1 for large-scale text) to meet WCAG 2.1 contrast requirements.

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Chapter 7: SPACE MEASUREMENT STANDARDS

The following standard describes the requirements to be followed when undertaking space measurements or planning and design of facilities.

Recognized Standards

The only acceptable method for measuring floor areas is the method described in the American National Standards Institute, Inc. (ANSI) standard Z76.1-1996, created by the Building Owners and Managers Association International (BOMA) and available in their publication *Standard Method for Measuring Floor Area in Office Buildings*; hereinafter referred to as the BOMA Standard.

For architectural programming purposes, measurement of floor areas shall adhere to the BOMA standard and shall also be subject to the supplementary definitions and qualifications which follow.

General Guidelines

No terms shall be used in place of those defined in either this document or in the BOMA standard. When necessary, additional terms may be used, but these must be explicitly defined in relation to the BOMA standard. Under no circumstances shall such additional terms be employed if such use has the potential to adversely affect the accuracy or reliability of the BOMA standard. For example, the term "square footage" shall not be used in place of more specific terms such as "rentable square footage" or "usable square footage" as defined in the BOMA standard.

Wherever suitable, floor area figures related to leasing shall be provided in the Global Summary of Areas format, described in the BOMA standard.

Where it is necessary to employ conversion factors (such as grossing factors) in the calculation of areas, the source or derivation of said conversion factors shall be provided along with the figures calculated.

Definitions

Montgomery County, Department of General Services (DGS) uses the full BOMA standard for leased spaces and the following simplified method for Capital Improvement Projects. All other material in the following section consists of summaries based on DGS interpretation of the BOMA standard. These are meant to supply a context for the supplementary material and are provided for general reference only; these summaries should not be considered a replacement for the BOMA standard.

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Programmable Area

Programmable area consists of all spaces that are required for operation of a facility and are identified in the POR as such and are measured from the face of the finished walls excluding circulations.

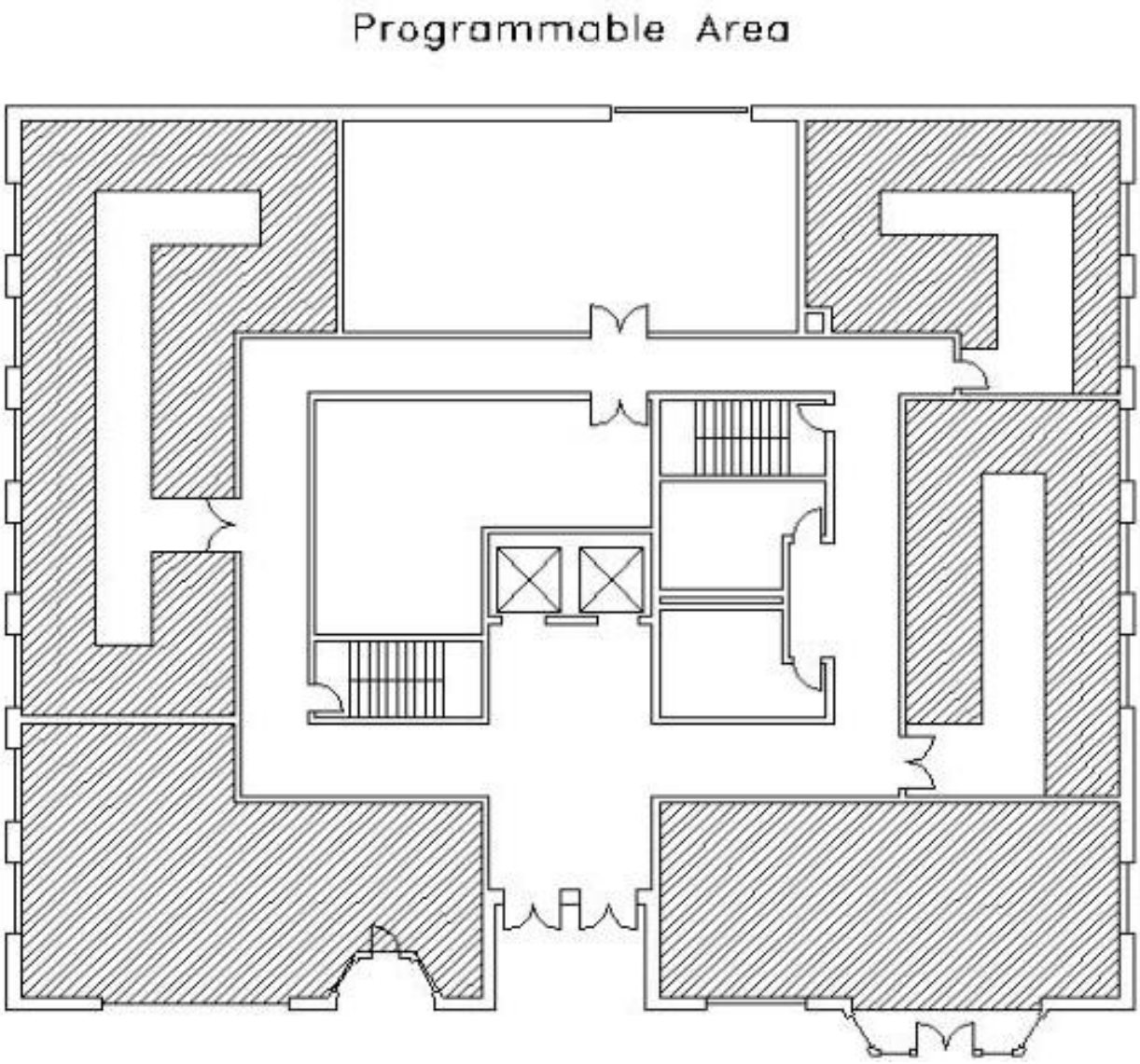

Figure 1: Diagram illustrating programmable area. The floor plan shows multiple rooms shaded with diagonal hatching to indicate program spaces. The shading stops at the interior face of finished walls, while central corridors, stairs, and circulation zones remain unshaded, demonstrating that circulation areas are excluded from the programmable area calculation.

Circulation

The picture below shows only internal suite circulation. For our use, Circulation is the total area of all corridors. If lobby is asked for in the program and as part of the Program Area then Lobby should not be calculated as circulation, otherwise, it should be included in the Circulation Areas.

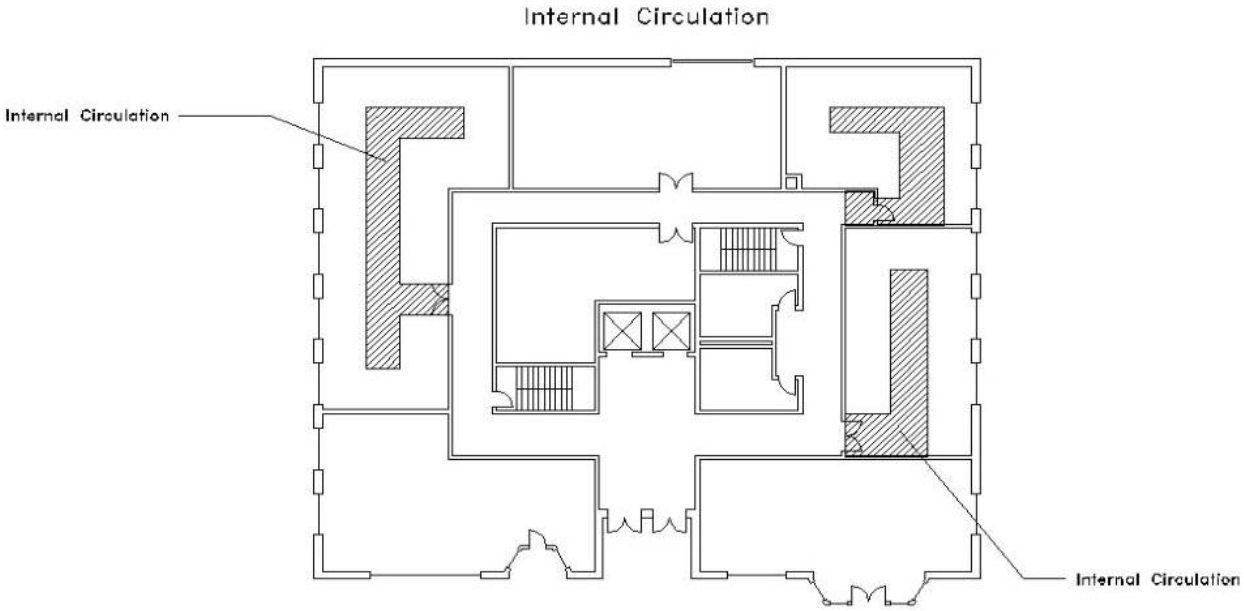

Figure 2: Diagram illustrating internal circulation. The floor plan highlights corridors and passageways with diagonal hatching to identify internal suite circulation only. Rooms and other spaces are left unshaded, clarifying that circulation refers specifically to corridor areas unless a lobby is explicitly programmed as part of the program area.

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Vertical Circulation Areas

Vertical Circulation Areas include stairs, elevator shafts, flues, pipe shafts, ducts and the like, as well as their enclosing walls. Atria, lightwells, and other penetrations above the finished floor are included. Vertical penetrations built for the private use of a tenant shall not be included, nor shall penetrations smaller than one square foot in area.

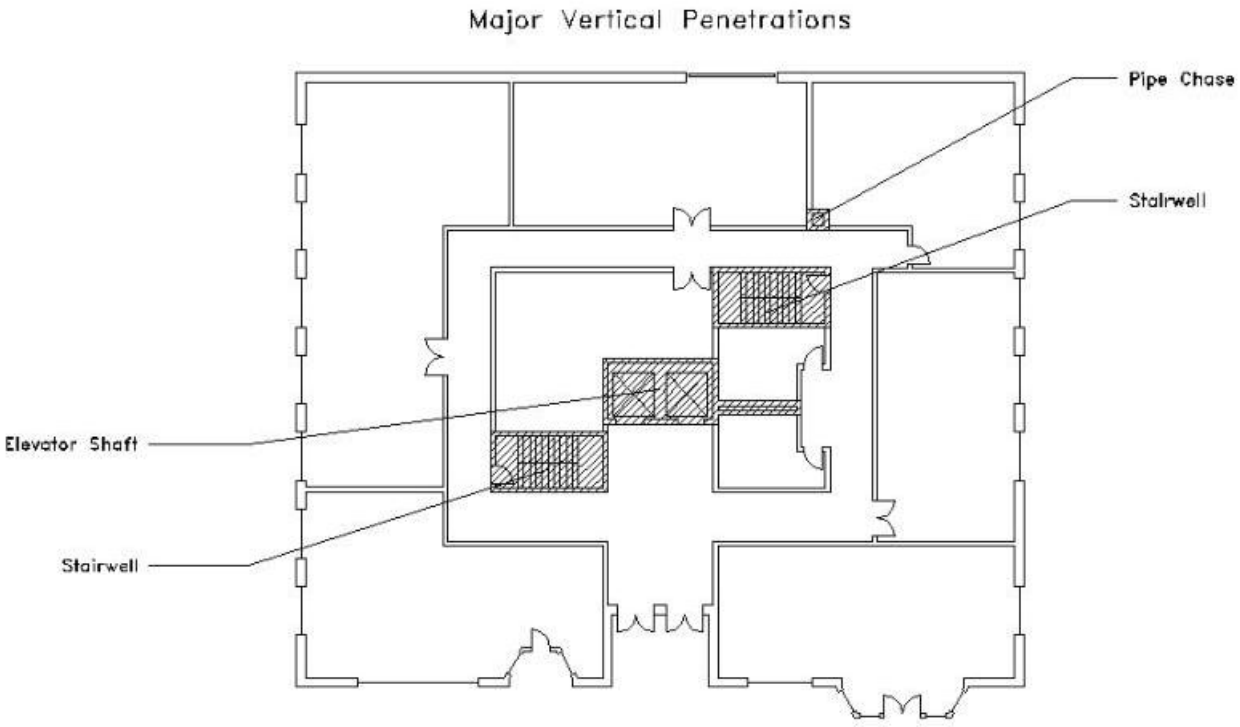

Figure 3: Floor plan labeled "Major Vertical Penetrations" showing a building layout with shaded areas indicating stairwells, an elevator shaft, and a pipe chase. The diagram outlines enclosing walls and vertical shafts penetrating multiple floors, distinguishing these elements from surrounding rooms and corridors.

Usable Area

Usable Area consists of the Programmable areas plus Circulations.

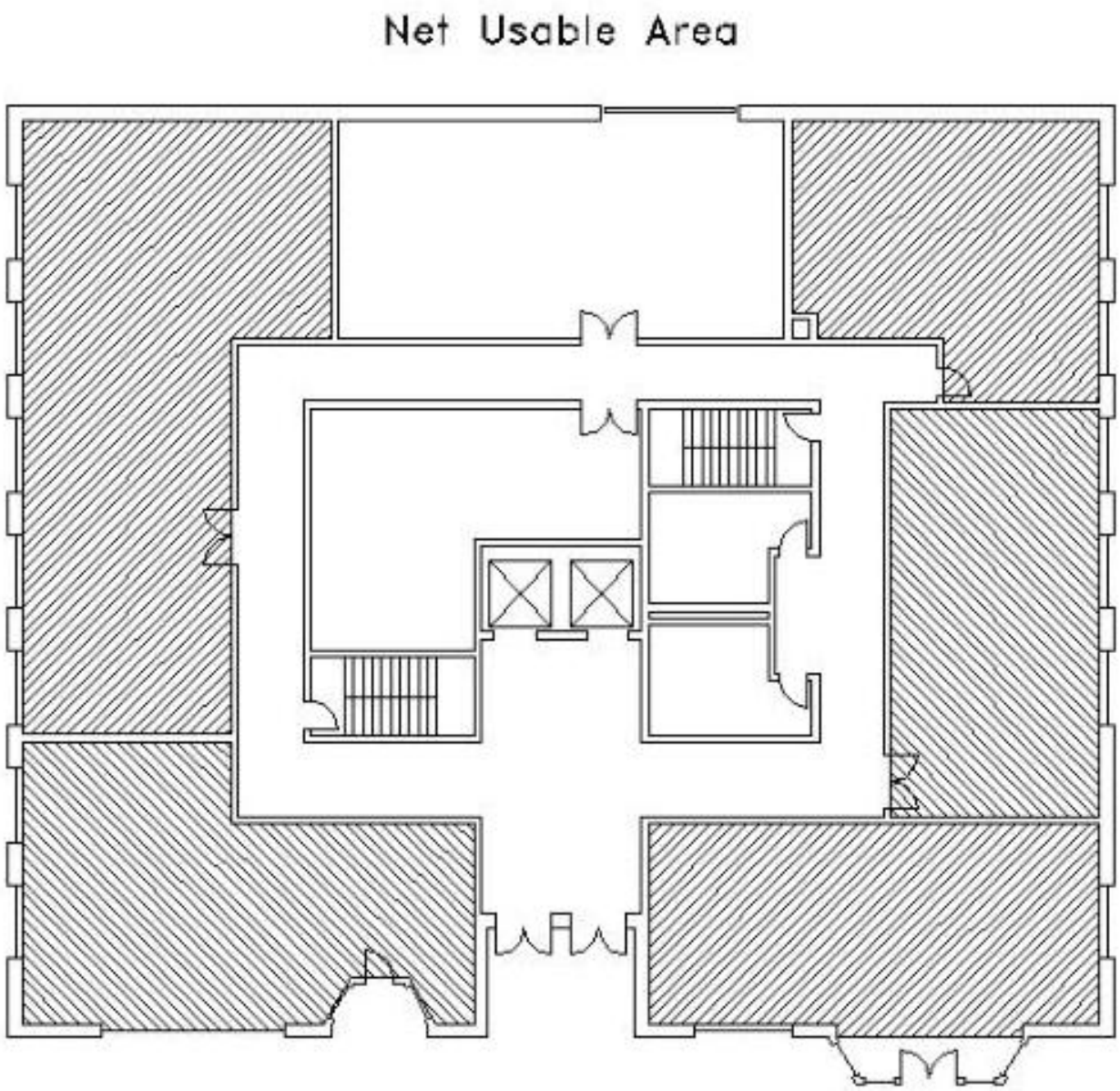

Figure 4: Floor plan labeled "Net Usable Area" showing a central service core with elevators, stairs, and corridors, surrounded by diagonally hatched perimeter spaces representing the net usable area. The diagram visually distinguishes usable rooms from circulation and service elements within the building footprint.

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Building Areas Definitions

Building Common Area, Shared Spaces

Building Common Areas are those areas in the building which provide services to all building tenants. These areas may include, but are not limited to, lobbies, conference rooms, GYM, training areas, etc. These areas are generally asked for in the POR as Shared Program areas.

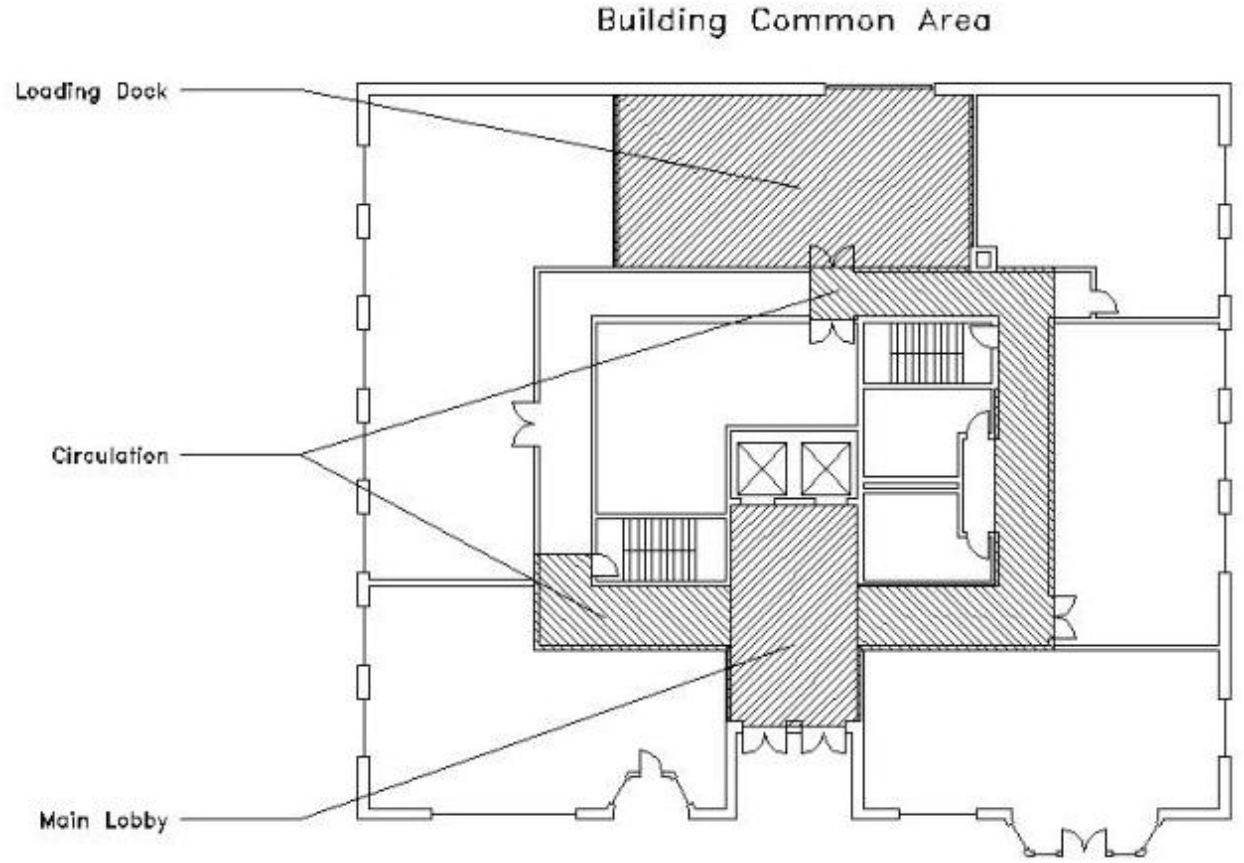

Figure 5: Diagram of Building Common Area showing shared spaces including Main Lobby, Circulation routes, and Loading Dock, with hatched areas indicating common zones accessible to multiple tenants.

Building Core Areas

Core Areas are all building support spaces such as restrooms, mechanical rooms, electrical rooms, custodial spaces, IT closets, attic stock area, etc. Normally tenants do not include these spaces in program areas. In cases that some of these spaces are specialized for the tenant's use such as a requested IT room, UPS room, server room, storage, special closets, or special mechanical rooms for a specific tenant use, then such spaces shall be counted as Program Areas and not Building Core. Category of these spaces must be verified before design.

Gross Building Area

Gross Building Area is the total constructed area of a building, measured to the exterior surface of permanent outer building walls, and includes all enclosed areas.

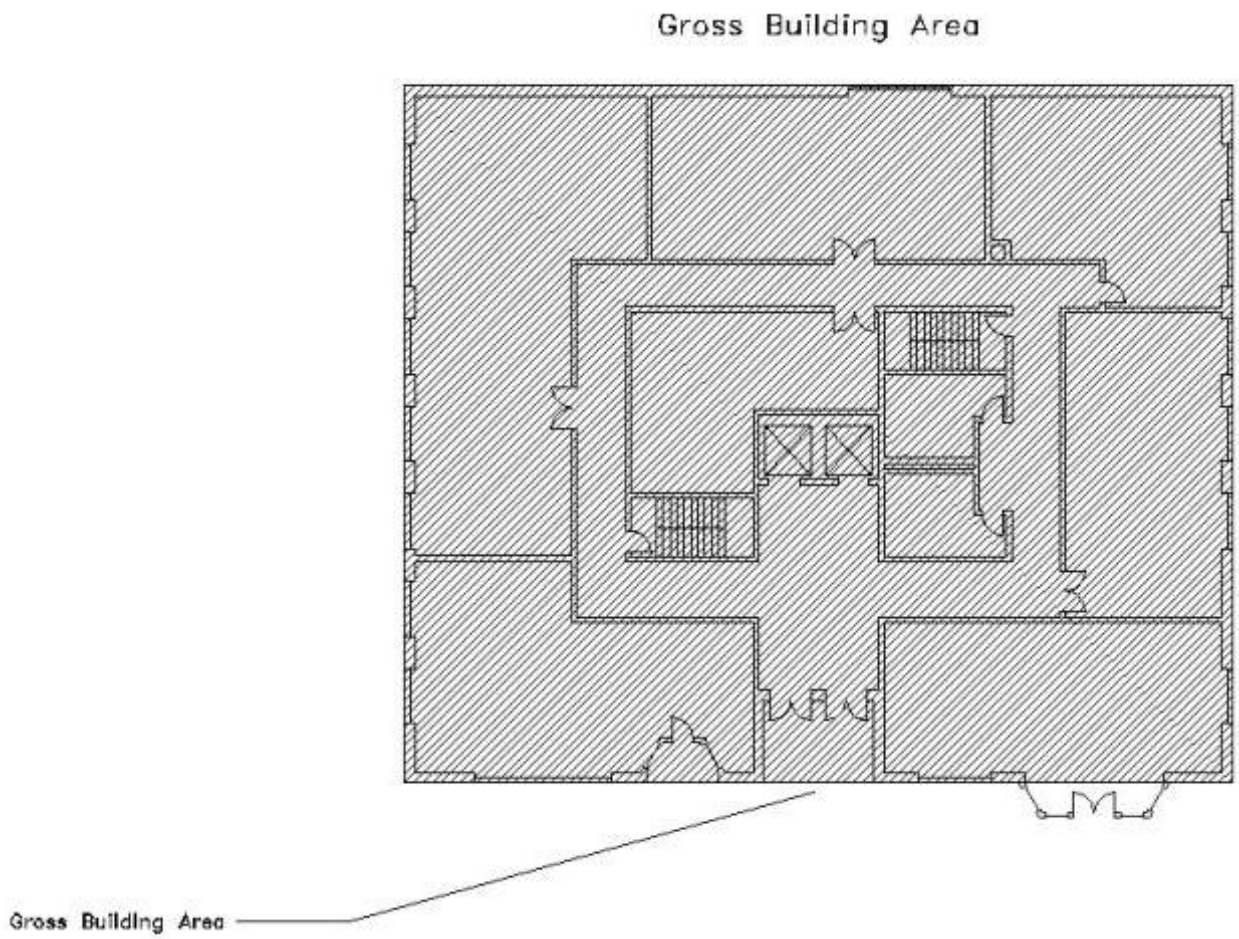

Figure 6: Diagram of Gross Building Area measured to the exterior surface of permanent outer walls, with the full enclosed building footprint shaded to indicate total constructed area.

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Building Area Report Charts

The following chart includes numbers that are only intended to show the relationship of various areas in calculations. It is normally used for planning purposes when a design layout has not yet been generated. After the layout is generated, the design team should use actual design square footages and calculate the actual percentages.

Therefore, starting with the first design layout, only actual areas should be used in the charts. Two Excel charts are available to help plan for the building size and to track the design throughout the design process.

The calculations below reference the following terms:

- **Program Areas (PA)**
- **Building Core (BC)**
- **Circulation (CR)**
- **Grossing Factor (GF)** – under-wall areas percentage

- **Gross Square Footage (GSF)**

Percentages in the "% of GSF" column refer to the percentage of the total Gross Square Footage.

Table 1: Building Areas Calculation Chart – Planning Phase
Note: All spaces are examples.

Category	Space	Size (SF)	% of GSF	Notes
Program Areas – Tenant 1	Office 1	100.00		
Program Areas – Tenant 1	Office 2	120.00		
Program Areas – Tenant 1	Conference room	300.00		
Program Areas – Tenant 1	Print area	250.00		
Program Areas – Tenant 1	Engineer office	120.00		
Program Areas – Tenant 1	UPS room	60.00		
Program Areas – Tenant 1	IT room	80.00		
Program Areas – Tenant 1	Evidence storage room	120.00		
Program Areas – Tenant 1	Lounge	200.00		
Program Areas – Tenant 1	Dedicated restroom	80.00		
Program Areas – Tenant 1	Other spaces to be listed	200.00		
Program Areas – Tenant 2	Office 1	100.00		
Program Areas – Tenant 2	Office 2	120.00		
Program Areas – Tenant 2	Conference room	300.00		
Program Areas – Tenant 2	Print area	250.00		

Category	Space	Size (SF)	% of GSF	Notes
Program Areas – Tenant 2	Engineer office	120.00		
Program Areas – Tenant 2	UPS room	60.00		
Program Areas – Tenant 2	IT room	80.00		
Program Areas – Tenant 2	Evidence storage room	120.00		
Program Areas – Tenant 2	Lounge	200.00		
Program Areas – Tenant 2	Other spaces to be listed	200.00		
Shared Spaces	Training room	300.00		
Shared Spaces	Fitness room	400.00		
Shared Spaces	Lobby	200.00		
Shared Spaces	Shared storage	100.00		
Shared Spaces	Shared reception	60.00		
Total Program Areas (PA)	PA	4,240.00	62.5%	
Building Core	Mechanical room	200.00		
Building Core	Electrical room	100.00		
Building Core	Public restrooms	300.00		
Building Core	Custodial room	60.00		Both percentages are assumed
Building Core	Telecommunication room	100.00		
Building Core	Attic stock room	80.00		
Building Core	Other	50.00		
Total Building Core (BC)	BC	890.00	13.1%	
Total Program + Core (PA + BC)	PA+BC	5,130.00	75.6%	
Circulation (CR)	CR = 15% of PA+BC	769.50	11.3%	
Total Net Square Footage (CR + PA + BC)	Total Net SF	5,899.50	87.0%	
Grossing Factor (GF)	GF = 15% under wall areas	884.93	13.0%	
Gross Square Footage (GSF = Total Net + Walls)	GF+CR+PA+BC	6,784.43	100%	

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Table 1: Building Areas Calculation Chart – Design Phase

Note: All spaces are for example.

#	Category	Space	Size (SF)	% of GSF	Notes
1	Program Areas – Tenant 1	Office 1	100.00		
2	Program Areas – Tenant 1	Office 2	120.00		
3	Program Areas – Tenant 1	Conference room	300.00		
4	Program Areas – Tenant 1	Print area	250.00		
5	Program Areas – Tenant 1	Engineer office	120.00		
6	Program Areas – Tenant 1	UPS room	60.00		
7	Program Areas – Tenant 1	IT room	80.00		
8	Program Areas – Tenant 1	Evidence storage room	120.00		
9	Program Areas – Tenant 1	Lounge	200.00		
10	Program Areas – Tenant 1	Dedicated restroom	80.00		
11	Program Areas – Tenant 1	Other spaces to be listed	100.00		
12	Program Areas – Tenant 2	Office 1	100.00		
13	Program Areas – Tenant 2	Office 2	120.00		
14	Program Areas – Tenant 2	Conference room	300.00		
15	Program Areas – Tenant 2	Print area	250.00		
16	Program Areas – Tenant 2	Engineer office	120.00		
17	Program Areas – Tenant 2	UPS room	60.00		
18	Program Areas – Tenant 2	IT room	80.00		
19	Program Areas – Tenant 2	Evidence storage room	120.00		
20	Program Areas – Tenant 2	Lounge	200.00		
21	Program Areas – Tenant 2	Other spaces to be listed	60.00		
22	Program Areas – Shared Spaces	Training room	300.00		
23	Program Areas – Shared Spaces	Fitness room	400.00		
24	Program Areas – Shared Spaces	Lobby	200.00		

#	Category	Space	Size (SF)	% of GSF	Notes
25	Program Areas – Shared Spaces	Shared storage	100.00		
26	Program Areas – Shared Spaces	Shared reception	60.00		
27	Total Program Areas	PA	4,000.00	60.6%	
28	Building Core	Mechanical room	150.00		
29	Building Core	Electrical room	80.00		
30	Building Core	Public restrooms	310.00		
31	Building Core	Custodial room	60.00		
32	Building Core	Telecommunication room	90.00		Both telecommunication rooms are actual measured spaces.
33	Building Core	Attic stock room	80.00		
34	Building Core	Other	230.00		
35	Total Building Core	BC	1,000.00	15.2%	
36	Total Program + Core	PA + BC	5,000.00	75.8%	
37	Circulation	CR (14% of PA + BC)	700.00	10.6%	
38	Total Net SF	CR + PA + BC	5,700.00	86.4%	
39	Grossing Factor (under wall areas %)	GF (16%)	900.00	13.6%	
40	Gross Square Feet	GSF = Total Net + Walls	6,600.00	100%	

Chapter 8: Station Alert & PA System

Department of Technology Services
Radio Communication Services Section

Station Alerting and Public Address (SA/PA) System for Fire/Rescue Stations

RCS Document 0601
Revision 1
August 18, 2006

Prepared by:
TELTRONIC, Inc.
7501E Muirkirk Meadows Drive
Beltsville, Maryland 20705

Version 2022.1

Building Design Standards

Adoption Statement

This specification and standard is adopted and promulgated this date. It supersedes and replaces RCS Document 0401, which was promulgated to limited distribution on December 3, 2004.

Gene Cummins
Chief, Radio Communications Services Section
Department of Technology Services, Montgomery County

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Section 1: General System Description

It is the jointly adopted goal of the Montgomery County Fire and Rescue Service and the Department of Technology Services to adopt and maintain a set of technical and operational standards for the alerting systems and public address systems in Montgomery County's fire and rescue stations. This document provides a specification which sets forth these technical and operational standards.

Strictly speaking, the Fire Station Alerting system has four primary components: the ECC, the two station radio transceivers, and the remote terminal unit. Each of these will be described in further detail. The public address system could be considered technically to be a separate system, but it functions with the station alerting system so integrally that, for purposes of this specification, it will be considered as the fifth primary component. This specification will discuss an integrated Station Alerting/Public Address system, which will be referred to by the acronym, the SA/PA System.

The first component of the SA/PA System is the Public Safety Communications Center (PSCC). This document does not specify the functional aspects of the PSCC, but only addresses those portions of the station alerting system located within the fire-rescue stations themselves. It is important to consider the PSCC in this discussion, however, since this is the origin of the station alerting signals.

The second and third components are the 800 Megahertz (MHz) trunked radio transceivers at the station. The first transceiver receives and decodes the data signals transmitted by radio from the PSCC. This also provides data signals to perform other automated functions, such as triggering the tone generators which create the alert sounds that are heard throughout the station for the various types of alerts. A second transceiver provides the fire dispatch audio (the verbal messages) to alert the personnel in the station. There are two transceivers in each fire-rescue station.

A third radio, typically but not necessarily, a receive-only scanner, will provide a second source of audio to be amplified and sent to loudspeakers throughout the station via a separate secondary audio distribution system. This secondary system gives station personnel the opportunity and the means to listen to other communications, such as a fireground talkgroup, or other communications of interest. This secondary audio system is collocated with, but is not part of, the Fire Station Alerting system. It is part of the SA/PA system, inasmuch as it is a public address system.

The fourth component of the Fire Station Alerting system is the Remote Terminal Unit. Technically termed the Motorola Systems Control and Data/Remote Terminal Unit (MOSCAD/RTU), this component will commonly be referred to as, simply, the RTU.

There is one RTU in each fire-rescue station. It both receives and transmits. It receives signals from the first trunked radio transceiver, decodes the signals, and provides relay closures (switching) to activate lights, doors, and other alarm-related functions within the station. It also generates the alarm sounds to be distributed throughout the station by the public address amplifier. The RTU also receives information from various sensors in the station (e.g., smoke detectors, emergency generator status and control panels, etc.) and encodes and transmits signals back to the PSCC, via radio, about conditions in the station. In this way the PSCC dispatcher personnel can monitor certain functions within the stations.

The fifth component is the two public address system (also called the audio systems). The public address systems are comprised of high-quality audio amplifiers, audio system wiring, volume controls, loudspeakers, and related components. Most MCFRS fire stations were built with only one public address system, but since the implementation of the 800 MHz trunked radio system, a requirement has been determined for a second audio channel. Therefore, new fire stations are now being built and older stations may be retrofitted to have two public address systems.

The audio heard by personnel in the stations, consisting of the primary (7A) dispatcher's voice, will hereafter be referred to as Fire Dispatch Audio.

The audible alerting sounds, which are generated within the station's RTU and amplified and distributed within the station by the primary public address system, will hereafter be referred to as alerting audio.

With reference to the main system and secondary system, the term main system shall refer to the Fire Station Alerting system, which is used to supply the alert sounds and the main fire dispatch audio throughout the station. The term secondary system shall refer to the secondary audio system, which is used to distribute audio from a scanner radio or other secondary audio source device.

The following sections of this specification document will define the standard system for all fire-rescue stations within the Montgomery County Fire and Rescue Service.

Section 2: Audio, Lighting, and Signaling Systems

This section will describe general aspects and functionality of the audio system, its inputs, and its outputs.

Audio Amplifier System(s)

The audio amplifier system(s) shall have a 70-volt nominal distribution voltage. All equipment shall be exactly according to this specification and, unless specifically stated otherwise, no other equipment is to be substituted without the approval of the Section Chief, Radio Communications Services, Department of Technology Services.

Separate speaker wiring runs will be required for different areas or zones of the station. Wiring runs for separate areas can share a common conduit but are not to be electrically interconnected. Speaker wiring for all areas/zones shall be home runs all the way back to the demarc. (The demarc or demarcation point is defined as the wiring connection panel co-located with the SA/PA equipment cabinet.) These different areas will hereafter be referred to as speaker zones. While fire-rescue stations differ in style and construction, the speaker zones have been designated so as to apply to any station, regardless of layout. Care and attention must be exercised before, during, and after installation of the speaker wiring to ensure a reliable system, conforming exactly to this specification.

Audio equipment is specified in Section 4; requirements for wiring, cabling, and conduit are specified in Section 5.

The following is a list of speaker zones for wiring to be provided within the fire-rescue station. Not all stations will have all zones, but where these listed areas exist, each shall be provided with its own wiring as a separate zone, and they shall be numbered according to this listing:

1. **Zone 1:** Apparatus bays (engine rooms)
2. **Zone 2:** Administrative areas (regardless of floor location)
3. **Zone 3:** Exterior speakers (outdoors)
4. **Zone 4:** General Areas, Floor 1
5. **Zone 5:** General Areas, Floor 2
6. **Zone 6:** General Areas, Floor 3
7. **Zone 7:** Fire (suppression) dormitories (male/female, as applicable)
8. **Zone 8:** EMS dormitories (male/female, as applicable)
9. **Zone 9:** Duty Officer dormitory and/or office
10. **Zone 10:** Basement and/or workshops
11. **Zone 11:** Outbuildings (optional)

Note: General areas are defined to include hallways and corridors, exercise and similar activity rooms, day rooms, lounges, kitchens, etc.

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- **Zone 12:** Large ballrooms or conference centers (optional)
- **Zone 13:** Station Watch Office

The alerting audio and fire dispatch audio will be provided to all areas of the fire/rescue station, including administrative areas and workshop areas, and also including significant outbuildings. Ballrooms, conference centers, and facilities typically made available to the general public or outside users may or may not be wired, at the discretion of the local fire-rescue department. If wired, a switch may be used to disable alerting in these areas.

Local Alarm Feeds to ECC/PSCC

The MOSCAD RTU provides a means of connecting a variety of switches or sensors, such as alarms and equipment status indicators or monitors, to a display system that can be remotely monitored at the Emergency Communications Center (ECC). The MOSCAD RTU used in Montgomery County's fire-rescue stations is designed with an input module to connect to various in-house contact points, to monitor equipment and activity within the fire-rescue station, and to report that activity back to the ECC. Also, within the RTU are two output modules, each with 8 outputs. These are dry contact outputs (also called switch or relay closures) which can trigger lighting or other controls, and the tone generators that create the various alert sounds heard throughout the station. The input module and both output modules are controlled by a CPU (central processor unit) module.

MOSCAD Inputs

The MOSCAD digital input module has a total capacity of 16 inputs. Thirteen inputs may be connected, if desired and if contacts are available within the station. Two will be spares. The remaining input, digital input #16, is an internal tamper switch on the RTU door and will be connected by Radio Shop personnel. The thirteen inputs, if used, may be connected in the demarc cabinet, terminal block TBE, using contacts 20 through 32. See Drawing 6.

- Digital inputs 1 and 2 will monitor activity within the fire alarm control panel.
- Digital inputs 3, 4, 5, 6, 12, and 13 will be initiated in-house by manual pushbuttons located in the Watch Office Console.
- Digital inputs 7, 8, 9, and 10 will monitor the activity and status of the station's emergency generator.

The complete list of input and output functions is in Tables 1 and 2 below.

Table 1. MOSCAD Digital Inputs

Digital Input	Function	Comments
1	Smoke Detector	Smoke detector activation at station
2	Sprinkler	Sprinkler system activation at station
3	Manual Activation, Fire	Manual activation of Fire sequence
4	Manual Activation, BLS	Manual activation of BLS sequence
5	Manual Activation, ALS	Manual activation of ALS sequence
6	Manual Activation, Duty	Manual activation of Duty sequence
7	Station Gen. Input 1	Commercial AC power failure
8	Station Gen. Input 2	Generator running
9	Station Gen. Input 3	Generator on-line
10	Station Gen. Input 4	Generator failure
11	Spare: Future use	Spare for future use
12	Manual Activation, Squad	Manual activation of Squad sequence
13	Manual Reset	Manual reset of RTU and all relays
14	Spare: Future use	Spare for future use
15	Spare: Future use	Spare for future use
16	Tamper Switch	RTU tamper switch

Table 2. MOSCAD Digital Outputs

Digital Output	Function	Comments	Duration (secs)
1-1	General area lights	Closed = ON, Open = OFF	60
1-2	Amplifier	Closed = ON, Open = OFF	60
1-3	Alert, Fire	Momentary closure for Fire calls	3
1-4	Alert, BLS	Momentary closure for BLS calls	3
1-5	Alert, ALS	Momentary closure for ALS calls	3
1-6	Alert, Duty	Momentary closure for Duty calls	3
1-7	Alert, CAD Down	Momentary closure when CAD is down	3
1-8	Alert, Squad	Momentary closure for Squad calls	3
2-1	Tone, Fire	Tone activation for Fire calls	3
2-2	Tone, BLS	Tone activation for BLS calls	3

Digital Output	Function	Comments	Duration (secs)
2-3	Tone, ALS	Tone activation for ALS calls	3
2-4	Tone, Duty	Tone activation for Duty calls	3
2-5	Tone, CAD Down	Tone activation for CAD Down calls	3
2-6	Fire dorm lights	Closed = ON, Open = OFF	60
2-7	EMS dorm lights	Closed = ON, Open = OFF	60
2-8	Duty dorm lights	Closed = ON, Open = OFF	60

CUSTOM ACCESSORIES

While not specifically addressed in this publication as a standard, an individual fire/rescue station may elect to connect external devices such as lighting controls or external sirens to the SA/PA System. These external devices are not part of the SA/PA System itself and are not intended to be part of this specification. This specification, however, does govern their connection to the SA/PA System if such devices are used. Except for a house siren in stations that use them, no audible warning or alert devices such as horns, bells, buzzers, or any other sound-producing devices are to be connected to the SA/PA System, directly or indirectly.

HOUSE SIREN

If a house siren is used, a relay to activate it may be connected in the external devices terminal box referred to as the demarc, to terminal block TBA, terminals 9 & 10. See Drawing 3.

HOUSE LIGHTING

If automatic control of house lighting is used, relays to activate the various lighting circuits may be connected in the demarc terminal box to terminal strip TBA, terminals as follows (see Drawing 3):

- Terminals 1 & 2 for engine bays and/or general station lighting
- Terminals 3 & 4 for suppression bunk room
- Terminals 5 & 6 for EMS bunk room
- Terminals 7 & 8 for duty officer bunk room

TRAFFIC LIGHTS

If traffic lights are to be controlled automatically by signals associated with the fire station alerting (i.e., by the SA/PA System), relays to activate them may be connected in the demarc terminal box to terminal strip TBA, to terminals as follows (see Drawing 3):

- Terminals 11 & 12 for traffic light #1
- Terminals 13 & 14 for traffic light #2

The SA/PA System will provide 24 volts AC to activate the above-listed relays. The maximum load that may be connected to these terminals is 2 amperes AC.

Section 3: Equipment

SYSTEM EQUIPMENT

The following equipment is considered to comprise the SA/PA System:

- 800 MHz trunked radio voice transceiver
- 800 MHz trunked radio MOSCAD transceiver
- 800 MHz MOSCAD RTU (remote terminal unit)
- Antennas and antenna cables
- Uninterruptible power supply (UPS) system
- Tone generators
- Audio amplifiers
- Loudspeakers
- Relay/power supply controls
- Wiring and conduits
- Equipment cabinet
- Secondary radio

A block diagram of the SA/PA system is shown in Drawing 1.

The transceivers, remote terminal units, UPS, tone generators, amplifiers, relays, and their associated circuitry are to be mounted in a standard electronic equipment cabinet within the fire-rescue station.

The antenna cables connect the antennas, which are generally mounted on the roof of the station or an adjacent tall structure, to the equipment mounted in the equipment cabinet.

The equipment cabinet is to be installed in a space to which access is restricted. Station personnel are not to have access to the space. If this is not possible, the equipment cabinet must be designed and installed such that station personnel do not have access to the equipment mounted within the cabinet. There can be no exceptions to this restriction.

The 800 MHz trunked radio transceivers and the MOSCAD RTUs, provided by Motorola under a Montgomery County contract, are generally installed by a local Motorola field service organization or by the technicians of the Radio Communications Services (RCS) Section of DTS.

The antennas and cabling may also be provided and installed by Motorola and/or its field service organization or by RCS. For audio and control cables, conduit or wiring raceways will be required (see Section 5). The antenna cables will often be of a semi-rigid type (such as Andrew LDF4-50A Heliax). Any conduit, cable trays, or raceways for antenna cables must accommodate, at a minimum, two runs of semi-rigid 1/2-inch diameter antenna cable with a minimum 2-foot bending radius. These conduits, cable trays, or raceways may be provided and installed by any qualified contractor. Flexible coaxial jumpers may be used at the equipment cabinet's antenna inputs to facilitate movement without damaging the cables.

A UPS system shall be installed inside the equipment cabinet to provide uninterrupted power during emergency generator starting and stopping and during power transfers between the

emergency generator and the local power utility. This equipment provides power for the radio transceivers, the RTU, the audio amplifier, and peripheral equipment such as power supplies and controls. This UPS shall provide a minimum of 2000 VA (volt-amps) and have a run time of not less than 5 minutes at full load.

The audio amplifier(s) shall be rack mounted with the appropriate mounting kit. One perforated rack spacer plate at least 1 inch high shall be installed above and another below the amplifier to ensure adequate ventilation for the amplifier.

Several special-purpose control circuits will be mounted in a sliding drawer, 5½ inches high. These will provide for such functions as a time clock for turning off the outdoor paging speakers at night, internal station lighting relays, and power supplies. (This drawer will be referred to as the Control Shelf in the future.)

Secondary Radio

The secondary radio shall be a Uniden model BC785D, model BCD-996T, or equivalent trunk-tracking scanning receiver. However, the technology of these radios changes rapidly, so the substitution of an equivalent or better model scanning radio is permitted, with the approval of the Chief of the Radio Communications Services Section of the Department of Technology Services.

Mounting Racks & Cabinets

The equipment described above is to be housed in a 19-inch EIA standard electronic equipment rack cabinet, fully accessible from both the front and rear. This cabinet shall have and will be installed so as to provide adequate ventilation for all equipment mounted within. The doors shall be able to swing open to no less than 90 degrees to provide 100% outward travel of internal shelf sliders. This cabinet must also have lockable solid front and rear doors. (This requirement may be dispensed with if the cabinet is located in a room or space within the station to which station personnel do not have access.) The cabinet may be permanently mounted, floor standing, or mounted on wheels. Any component not available in a 19-inch direct-mount configuration can be installed on a 19-inch shelf.

If a rack on wheels is used, all cables into and out of the cabinet must have a minimum 40-inch service loop. In this case, to provide strain relief for all cables, an umbilical support cord made of steel wire rope of at least 1/8-inch diameter and of length at least 4 inches shorter than the shortest cable service loop is to be installed between the cabinet and an adjacent wall. If cable entry is made from above, there will be a minimum 4-foot service loop of semi-rigid 2-inch flexible conduit (Greenfield or equivalent). Extreme care must be taken not to crimp or bend to an unacceptably small radius any semi-rigid antenna cables.

DEMARCATION BOX (DEMARC)

The demarcation box (demarc) is a County-supplied medium Type 1 enclosure with a key lock and a number of terminal blocks mounted inside (see Drawing 10). The dimensions of the cabinet are nominally 30 inches high by 24 inches wide by 8½ inches deep. The demarc box is to be mounted to a plywood sheet of not less than ¾ inch thickness, which shall, in turn, be mounted to a masonry or drywall surface. It is to be securely mounted or anchored so as to support its nominal weight of 52 pounds, plus the weights of the conduits which terminate at the box. The mounting height shall be such that the bottom of the cabinet is 44 to 48 inches above the floor. The left-hand opening door must be able to swing open to no less than 90 degrees in order to ensure access to the internal panel and the terminal blocks.

All wires and cables entering the demarc cabinet shall be in conduit.

CENTRAL ELECTRONICS CABINET

The cabinet housing the transceivers, remote terminal units, tone generators, amplifiers, relays, and associated circuitry shall be a standard electronic equipment cabinet. The cabinet is referred to as the Central Electronics Cabinet. A single conduit of 2-inch diameter EMT or flexible Greenfield-type conduit shall interconnect this cabinet and the demarc cabinet. If the cabinet is mounted on wheels, a minimum of four feet of the total conduit run must be the flexible type of conduit. When installed in its normal, permanent location, the location shall be such that the front and rear doors can be opened to at least 90 degrees, and the internal sliding shelves must have sufficient room to slide 100% of their depth out of the cabinet for service.

ELECTRICAL REQUIREMENTS

A dedicated 20-amp, 120-volt, single-phase AC circuit shall be provided for this equipment and terminated in a quad or double-duplex receptacle. Receptacles shall be red in color. These receptacles shall be powered from a panel which provides power from the station's emergency generator in case of a commercial power failure. The panel designation and circuit number must be shown clearly on a plate mounted in a conspicuous place at or near the equipment cabinet with an adhesive label. No marker or handwritten labels are permitted. The feed panel directory must list "Station Communications System" as the load being served.

The cabinet shall be grounded by a stranded copper, green-insulated conductor no smaller than #6 AWG and terminated to the building's grounding system, in conformance with the National Electrical Code, Article 250-50, and Motorola's R-56 grounding standard. Single-hole mechanical lugs are acceptable for this purpose.

Section 4: Public Address Audio Subsystem Equipment

The following equipment is to be used in the public address portion of the SA/PA system. Only where specifically noted are substitutions allowed.

Equipment type	Manufacturer	Model
Audio amplifiers	Peavey	PZS 140
Interior speakers	Atlas Soundolier	HD-70W or VP-14
Exterior speakers	Atlas Soundolier	AP-15T
Volume controls	Atlas Soundolier	AT 10-PA orAT 35-PA (See below)
Back boxes for interior speakers	Atlas Soundolier	95-8

Enclosures and back boxes for indoor speakers, when used above a suspended ceiling, shall be supported by either an all-thread steel rod of at least 3/16 diameter or by a hanger wire suspended from a solid connection to a structural ceiling. If mounted in a fire-resistant partition, wall, or ceiling, an enclosure site-built with fire-rated drywall is required.

When the total connected wattage of any group of parallel-wired speakers that will be controlled by a single volume control does not exceed 10 watts, a model AT 10-PA volume control may be used. When the total connected wattage exceeds 10 watts but does not exceed 35 watts, a model AT 35-PA volume control will be used. This pertains to both indoor and outdoor speakers. Drawing 11 provides details of speaker wiring.

When the station is alerted, the main system will send 24 VDC over the white and green pair of the 4-conductor cable to each volume control. A relay within the volume control will automatically bypass the selected level setting and will provide full volume for the timed duration of 60 seconds. After that time, the volume control will revert to the normal level set by the volume control knob.

The secondary audio system will be a more basic public address audio system, with the levels being controlled by individual volume controls. The secondary audio system will be a duplicate of the main system (identical wiring, identical materials, identical installation practices) except that automatic step-up for alerting will not be used.

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Both the primary system and secondary system exterior (outdoor) speakers are to be clock controlled, to silence them during a night-time period to be specified at each station. This will help prevent complaints at those stations located in proximity to residential neighborhoods.

All speakers are similarly connected, as shown in Drawing 11.

Section 5: Wiring, Cables, and Conduits

All wire shall be installed exactly in accordance with this specification and, unless specifically stated otherwise, no other type of wire is to be substituted. All wiring associated with the primary fire station alerting and secondary audio systems, including speaker, control, and alarm wiring, shall be installed in metallic conduit only. Acceptable types and sizes of conduit are specified below.

Inside Speakers

For interior wiring, EMT (electrical metallic tubing) conduit or FMC (flexible metallic conduit) may be used. Conduit sizes will be determined according to the paragraph on conduit capacities, below. Wiremold-type surface-mounted conduit may be used in the rehabilitation of older construction stations in interior areas normally visible to personnel (i.e., not in utility areas, above ceilings, in other normally unseen areas, or on the exterior of a building). Surface-mounted conduits may only be used with prior approval by the Montgomery County project manager supervising the construction project.

- Note 1: No PVC conduit is permitted.
- Note 2: No 1/2-inch EMT conduit shall contain more than one speaker wire.
- Note 3: No Wiremold-type or other surface-mount conduit may be used in new construction.

Outside Speakers

For outdoor wiring, Liquidtite metallic conduit, EMT, or rigid pipe may be used. Conduit sizes will be determined according to the paragraph on conduit capacities, below.

- Note 1: No PVC conduit may be used in any SA/PA installation.
- Note 2: No 1/2-inch EMT conduit shall contain more than one speaker cable. No other wires may be run in 1/2-inch EMT conduit.
- Note 3: No Wiremold surface-mount conduit is permitted to be used in new construction.

Conduit and Antenna Standards

Conduit Capacities

Conduits may contain not more than the following quantities of cable, in any combinations of Belden type 8770 or type 9402.

Table 1: Maximum Number of Cables Allowed per Conduit Size (Belden 8770 or 9402)

Conduit size	Max. number of cables
½”	1
¾”	2
1”	3
1½”	6
2”	12

Antenna Conduits

A minimum 2-inch EMT conduit per cable is required for a single antenna cable. A 4-inch EMT conduit may be used to accommodate up to three one-half-inch antenna cables. Any 90-degree bends must be at a minimum two-foot bending radius. After any combination of two 90-degree bends, a minimum 24 by 24 by 6 pull box must be installed.

- **Note 1:** All conduits shall be installed in the building to minimize the number of bends to four or fewer per cable run.
- **Note 2:** All conduit runs shall be planned and installed so as to minimize overall length.
- **Note 3:** All conduit runs with pull boxes shall have nylon nipples installed in the pull boxes and at each end to minimize damage to the antenna cables during installation.
- **Note 4:** All conduits shall have nylon pull string(s) installed within them.
- **Note 5:** All antenna cables installed within the conduits shall be treated as coiled soft copper pipe and shall be rolled off the coil or spool with great care to prevent kinking or crimping of the coaxial cable.
- **Note 6:** Conduits installed outdoors shall bear the same identification markings as indoor conduits.
- **Note 7:** All conduit shall be installed in accordance with the current version of the National Electrical Code.

Conduit Capacities

Conduits may contain not more than the following quantities of cable, in any combinations of Belden type 8770 or type 9402.

Table 2: Maximum Number of Cables Allowed per Conduit Size (Belden 8770 or 9402)

Conduit size	Max. number of cables
½”	1
¾”	2
1”	3

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ANTENNA CONDUITS

A minimum 2-inch EMT conduit per cable is required for a single antenna cable. A 4-inch EMT conduit may be used to accommodate up to 3 one-half-inch antenna cables. Any 90-degree bends must be at a minimum two-foot bending radius. After any combination of 2 bends of 90 degrees, a minimum of a 24 by 24 by 6 pull box must be installed.

- Note 1: All conduits shall be installed in the building so as to minimize the number of bends to 4 or fewer per cable run.
- Note 2: All conduit runs shall be planned and installed so as to minimize overall length.
- Note 3: All conduit runs with pull boxes shall have nylon nipples installed in the pull boxes and at each end to minimize damage to the antenna cables during installation.
- Note 4: All conduits shall have nylon pull string(s) installed within them.
- Note 5: All antenna cables installed within the conduits shall be treated as a coiled soft copper pipe and shall be rolled off the coil or spool with great care so as to prevent kinking or crimping of the coaxial cable.
- Note 6: Conduits installed outdoors shall bear the same identification markings as indoor conduits.
- Note 7: All conduit shall be installed in accordance with the current version of the National Electrical Code.

CONDUIT CAPACITIES

Conduits may contain not more than the following quantities of cable, in any combinations of Belden type 8770 or type 9402:

Conduit size	Max. number of cables
½”	1
¾”	2
1”	3
1½”	6
2”	12

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degree bends must be at a minimum two-foot bending radius. After any combination of 2 bends of 90 degrees, a minimum of a 24 by 24 by 6 pull box must be installed.

- Note 1: All conduits shall be installed in the building so as to minimize the number of bends to 4 or fewer per cable run.
- Note 2: All conduit runs shall be planned and installed so as to minimize overall length.
- Note 3: All conduit runs with pull boxes shall have nylon nipples installed in the pull boxes and at each end to minimize damage to the antenna cables during installation.
- Note 4: All conduits shall have nylon pull string(s) installed within them.
- Note 5: All antenna cables installed within the conduits shall be treated as a coiled soft copper pipe and shall be rolled off the coil or spool with great care so as to prevent kinking or crimping of the coaxial cable.
- Note 6: Conduits installed outdoors shall bear the same identification markings as indoor conduits.
- Note 7: All conduit shall be installed in accordance with the current version of the National Electrical Code.

CONDUIT CAPACITIES

Conduits may contain not more than the following quantities of cable, in any combinations of Belden type 8770 or type 9402:

Conduit size	Max. number of cables
1/2 in.	1
3/4 in.	2
1 in.	3
1 1/2 in.	6
2 in.	12

ANTENNA CONDUITS

A minimum 2-inch EMT conduit per cable is required for a single antenna cable. A 4-inch EMT conduit may be used to accommodate up to three one-half-inch antenna cables. Any 90-degree bends must be at a minimum two-foot bending radius. After any combination of two 90-degree bends, a minimum of a 24 by 24 by 6 pull box must be installed.

The following installation notes also apply to antenna conduits:

- Note 1: All conduits shall be installed in the building so as to minimize the number of bends to 4 or fewer per cable run.
- Note 2: All conduit runs shall be planned and installed so as to minimize overall length.
- Note 3: All conduit runs with pull boxes shall have nylon nipples installed in the pull boxes and at each end to minimize damage to the antenna cables during installation.

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- Note 4: All conduits shall have nylon pull string(s) installed within them.
- Note 5: All antenna cables installed within the conduits shall be treated as a coiled soft copper pipe and shall be rolled off the coil or spool with great care so as to prevent kinking or crimping of the coaxial cable.
- Note 6: Conduits installed outdoors shall bear the same identification markings as indoor conduits.
- Note 7: All conduit shall be installed in accordance with the current version of the National Electrical Code.

Where multiple lighting circuit relays are to be controlled from a single contact pair in the demarc cabinet, the sum of the activation currents for those lighting circuit relays shall not total more than 2 amps.

General Lighting

Where applicable, all engine rooms (apparatus bays), hallways and common areas, and other areas of the station where automatic control of lighting by the alerting system is deemed appropriate, control wiring and conduits shall be installed and connected following the same specifications as given above for bunk room lights.

Loudspeakers

All ceiling-mounted loudspeakers shall be installed in drop ceiling tiles, where drop ceilings exist, and installed as specified in Sections 3 and 4. Drop ceiling mounted speakers shall be neatly installed in ceiling tiles with a metal speaker can on the top side of the ceiling tile. The speaker shall be fed by flexible (Greenfield) electro metallic tubing conduit of at least a 3 foot length, connected to a ceiling-mounted type 1900 junction box. The speaker back can shall be secured by means of a hanger wire, minimum 14-gauge, from the suspension tab of the can to a solid structure above.

Volume Controls

All volume controls shall be installed in deep, type 1900 or type 11B boxes with 1-inch knock-outs. These boxes shall each be fed with two one-inch EMT conduits. These boxes shall be supplied with Raco type 778 (or equivalent) two-device raised mud rings.

All wall-mounted volume controls shall be mounted at the standard height of a normal wall-mounted light switch. They shall be installed immediately to the left of the room's light switch, as you enter a room where the light switch is to the right side of the doorway, as you enter. They shall be installed immediately to the right of the room's light switch, as you enter a room where the light switch is to the left side of the doorway, as you enter. If it is impractical to locate the volume control in this location, the Montgomery County project manager in charge of the work may approve an alternate location. Such approval shall be in writing.

All volume controls shall be fed by conduit of minimum diameter of one inch, the other end of which shall connect to the demarc cabinet.

Apparatus Bay/Engine Room Speakers

Apparatus bays shall have a minimum of two speakers. In most situations four to six speakers will be required. The exact number of speakers required will be dictated by the floor area, the height of the space, and other environmental factors. The determination of the number of speakers required will be made by a contractor experienced in the placement of loudspeakers in apparatus rooms of fire/rescue stations and will be approved by the Montgomery County project manager supervising the construction project.

Exterior Speakers

All horn-mounted speakers on the exterior of a building shall be mounted a minimum of 8 feet off the ground. Speakers shall be mounted to a blank two-gang cover plate and attached to a two-gang box, either externally mounted or countersunk in the outside wall of the building. This box is to be fed by 1-inch diameter conduit from the volume control.

Shields and Grounds

All speaker wires and cables shall be shielded as follows.

Cables from the demarc to volume controls: the outer jackets and shields shall be stripped back a minimum of 6 inches from the end of the cable. All bare shields shall be insulated to within ½ inch of the end of the conductor.

In the wiring of the SA/PA system, shields are not to be considered as ground conductors. They are to be considered as conductors that are used to reduce excess crosstalk due to inductance between adjacent or parallel lines in the same pipe or when bunched together in the same confined space (such as conduits and cabinets).

In the cables from the demarc to the volume control and from the volume control to the speakers, the shields shall be treated as shown in Drawing 11 (Shield Termination Diagram). The shields are to be kept insulated from the metallic conduit or box. A service loop of approximately 8 inches is to be provided. At the speaker end of a single cable from a volume control to a single speaker, the shield is to be trimmed back, cut off to a length of approximately 12 inches, and insulated. In the case where there is a second cable being fed in parallel from that speaker's enclosure, the shield will not be cut off. Instead, it is to be trimmed as above, connected to the shield of the 2-conductor cable feeding the next speaker, and so on. At the end or last speaker, the shield is to be trimmed back, cut off, and insulated as described above. A service loop of approximately 12 inches shall be left in the speaker enclosures.

Only shrink tubing of the proper size is to be used for insulating the shields. The use of electrical or other tape is not permitted.

Section 6: Watch Office Console

The watch office console is a custom-built device which permits fire rescue personnel to initiate an in-house fire/EMS dispatch alarm. If, for example, a citizen walks into the fire-rescue station and needs emergency assistance, personnel within the station can manually initiate a local emergency alarm. They can also make a local announcement of the nature of the situation.

The console will provide a series of pushbuttons as shown in Drawing 12. These pushbuttons will provide the capability of manually initiating the following alarm sequences:

- Fire
- BLS (Basic Life Support)
- ALS (Advanced Life Support) Duty Officer

The console will also provide two buttons which can be connected to control up to two traffic light signals, independent of each other.

The pushbuttons of the Watch Office Console are color-coded, for ease of identification and use, as follows:

Function	Color
Fire	Red
BLS	Blue
ALS	Yellow
Duty Officer	White
Traffic Control(s)	Black

Along with the manual pushbuttons, a voice handset is to provide a means to make voice announcements over the SAPA system. This handset shall employ a push-to-talk (PTT) switch to disable the microphone when not in use. An additional relay disables the watch office speaker zone, thus preventing audio feedback during a local announcement.

The Watch Office Console sends voice audio via a 4-pin Amphenol connector, part number 206060-1, and a 2-conductor shielded microphone cable, Belden part number 8762, via the demarc cabinet to the PA amplifier located within the Central Electronics Cabinet. The Watch Office Console also receives 24 volts DC and sends switched 24 volts DC from its PTT and function buttons via an Amphenol 24-pin connector, part number 206837-1, and a 20-conductor cable, Alpha part number 5060/20C, back through the demarc cabinet to the Central Electronics Cabinet.

Building Design Standards

The cables described above are to be installed in a conduit of not less than 2 inches diameter EMT. The conduits shall be run from a point under the counter or desk in the watch office to the demarc cabinet. The wires of this cable will be terminated on terminal block TBE inside the demarc cabinet. (See: Drawing 6.) Under the watch office counter/desk, there shall be a service loop of not less than 10 feet of both the microphone and control cables.

Section 7: Drawings

Starts on next page

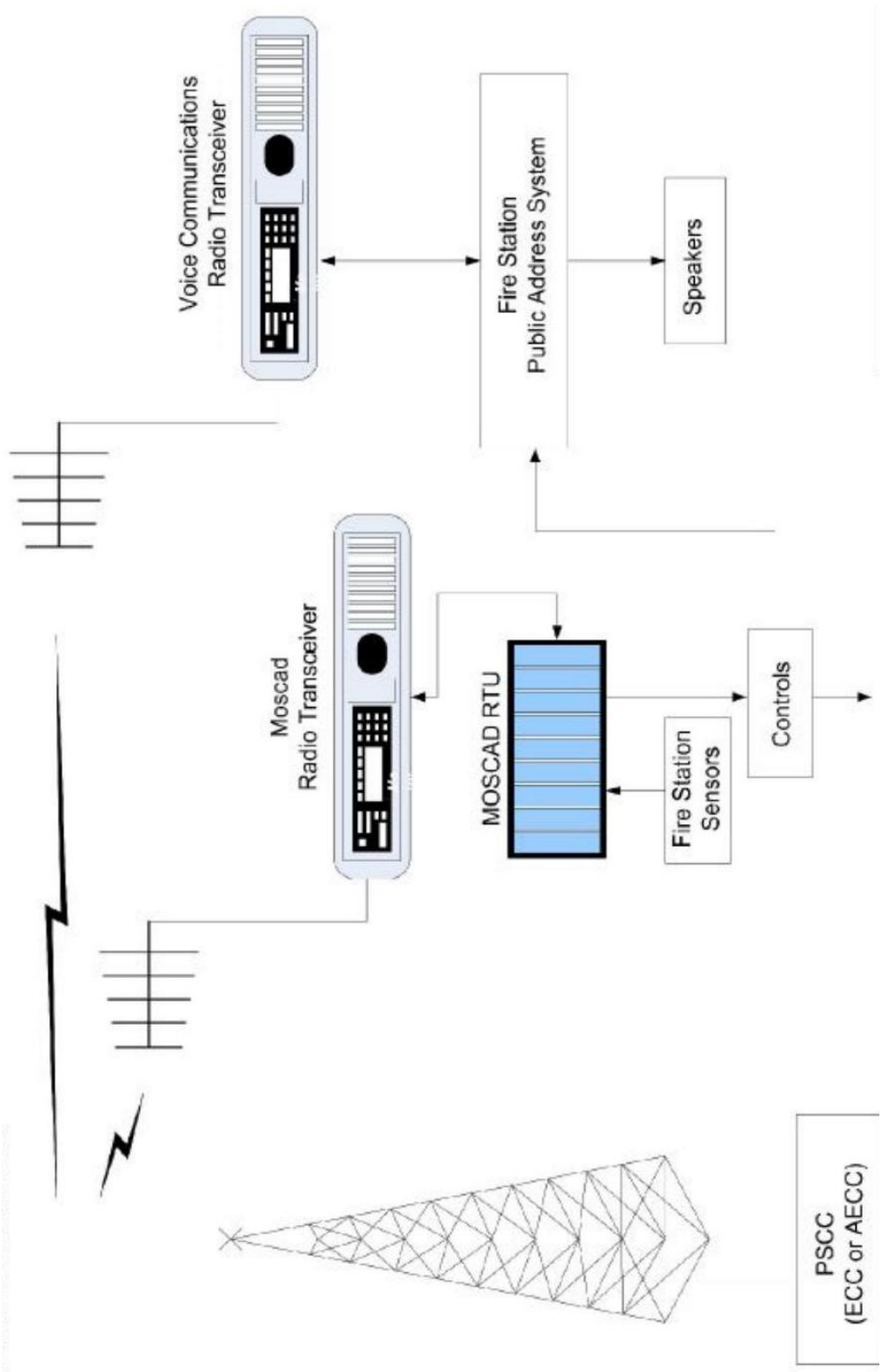

Figure 7: MCFRS Functional Block Diagram of Fire Station Alerting and Public Address System – Drawing 1. The diagram illustrates a voice communications radio transceiver connected to the Fire Station Public Address System, which outputs to speakers. A MOSCAD radio transceiver interfaces with a MOSCAD RTU (remote terminal unit), which connects to fire station sensors and control systems. The system communicates with the PSCC (ECC or

AECC), and antenna symbols indicate radio transmission links.

Field	Value
Description	MCFRS Functional Block Diagram of Fire Station Alerting and Public Address System – Drawing 1
Engineer	—
Drawn By	Ted Weitzel
Revised	06/18/06
Revision	1
Filename	Montgomery County Drawing 1 VSD
Scale	None
Size	A

Version 2022.1

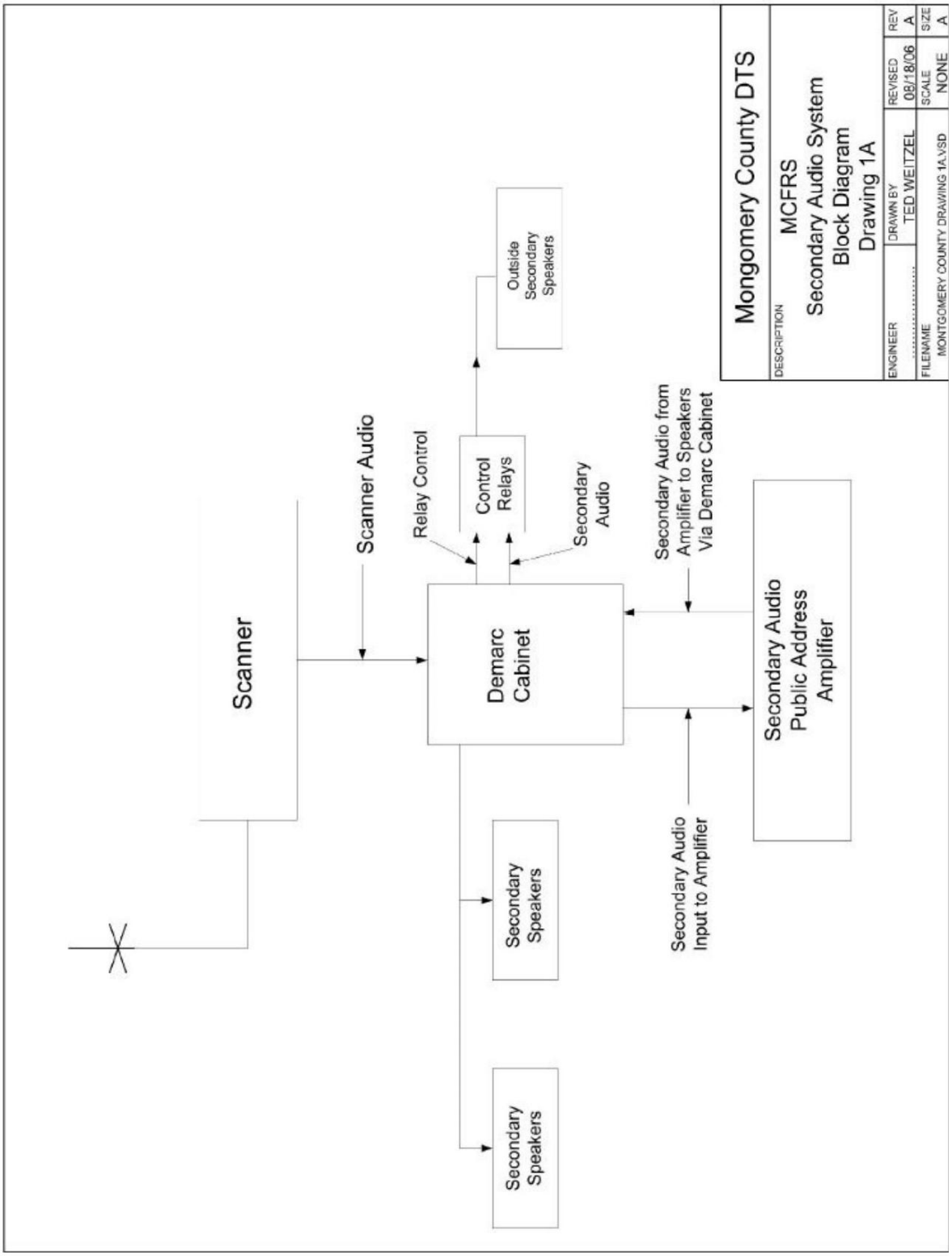

Figure 8: Cover page graphic illustrating a secondary audio public address system block diagram. The diagram shows a scanner feeding audio and relay control signals into a demarcation

cabinet. From the demarc cabinet, connections run to control relays, a secondary audio public address amplifier, and multiple secondary speakers (including cabinet speakers). The layout represents signal flow and system interconnections for Montgomery County DTS MCFRS Secondary Audio System, Drawing 1A.

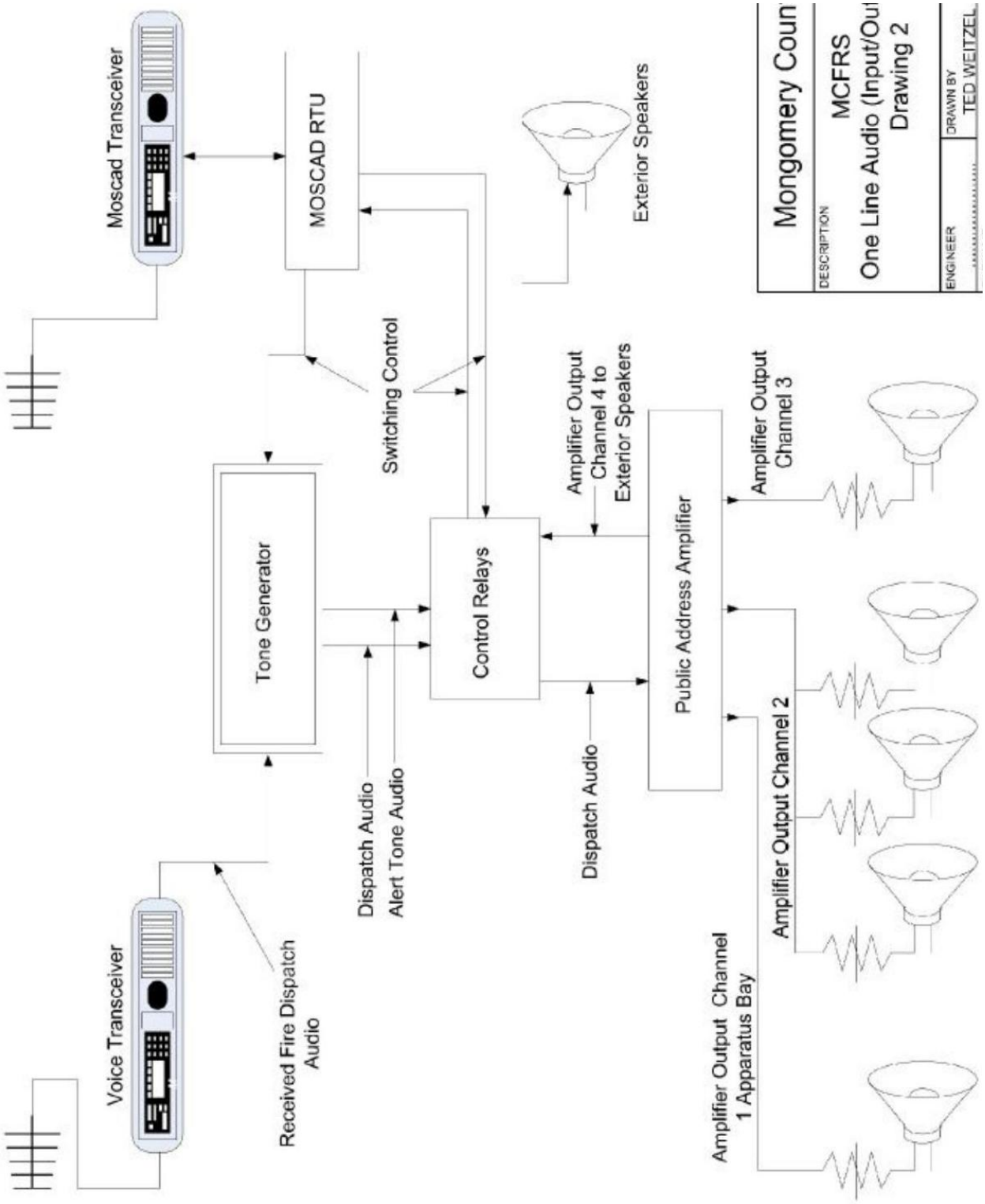

Figure 9: MCFRS One Line Audio (Input/Output Control) – Drawing 2. Block diagram illustrating system components and signal flow between dispatch inputs, control relays, amplifiers, and speaker outputs.

Description: MCFRS One Line Audio (Input/Output Control) – Drawing 2

Engineer: Ted Weitzel
Revised: 08/18/06
Revision: 1
Scale: None
Size: A
File Name: Montgomery County Drawing 2 VSD

Version 2022.1

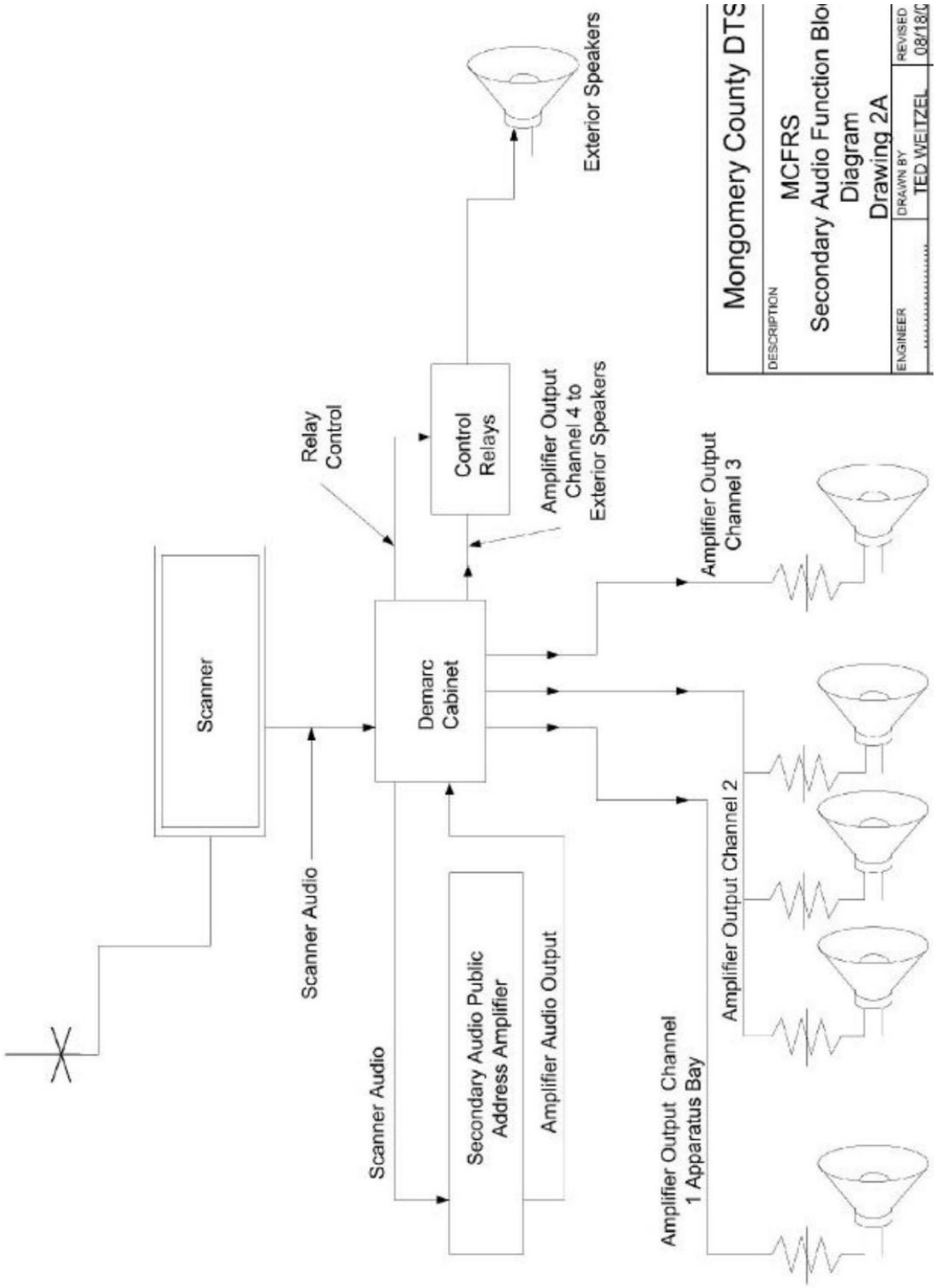

Figure 10: MCFRS Secondary Audio Function Block Diagram (Drawing 2A). The diagram shows a scanner providing audio to a demarc cabinet. From the demarc cabinet, signals are routed to control relays and a secondary audio public address amplifier. The control relays feed amplifier output channel 4 for exterior speakers. Additional amplifier outputs (Channels 1, 2, and 3) distribute audio to speakers located in the apparatus bay and other

areas. Arrows indicate signal flow between the scanner, demarc cabinet, relays, amplifier outputs, and connected speaker loads.

Table 1: Drawing metadata for MCFRS Secondary Audio Function Block Diagram (Drawing 2A)

Field	Value
Jurisdiction	Montgomery County DTS
Description	MCFRS Secondary Audio Function Block Diagram, Drawing 2A
Engineer	Ted Weitzel
Drawn by	Ted Weitzel
Revised	08/18/06
Revision	1
Filename	Montgomery County Drawing 2A VSD
Scale	None
Size	A

Version 2022.1

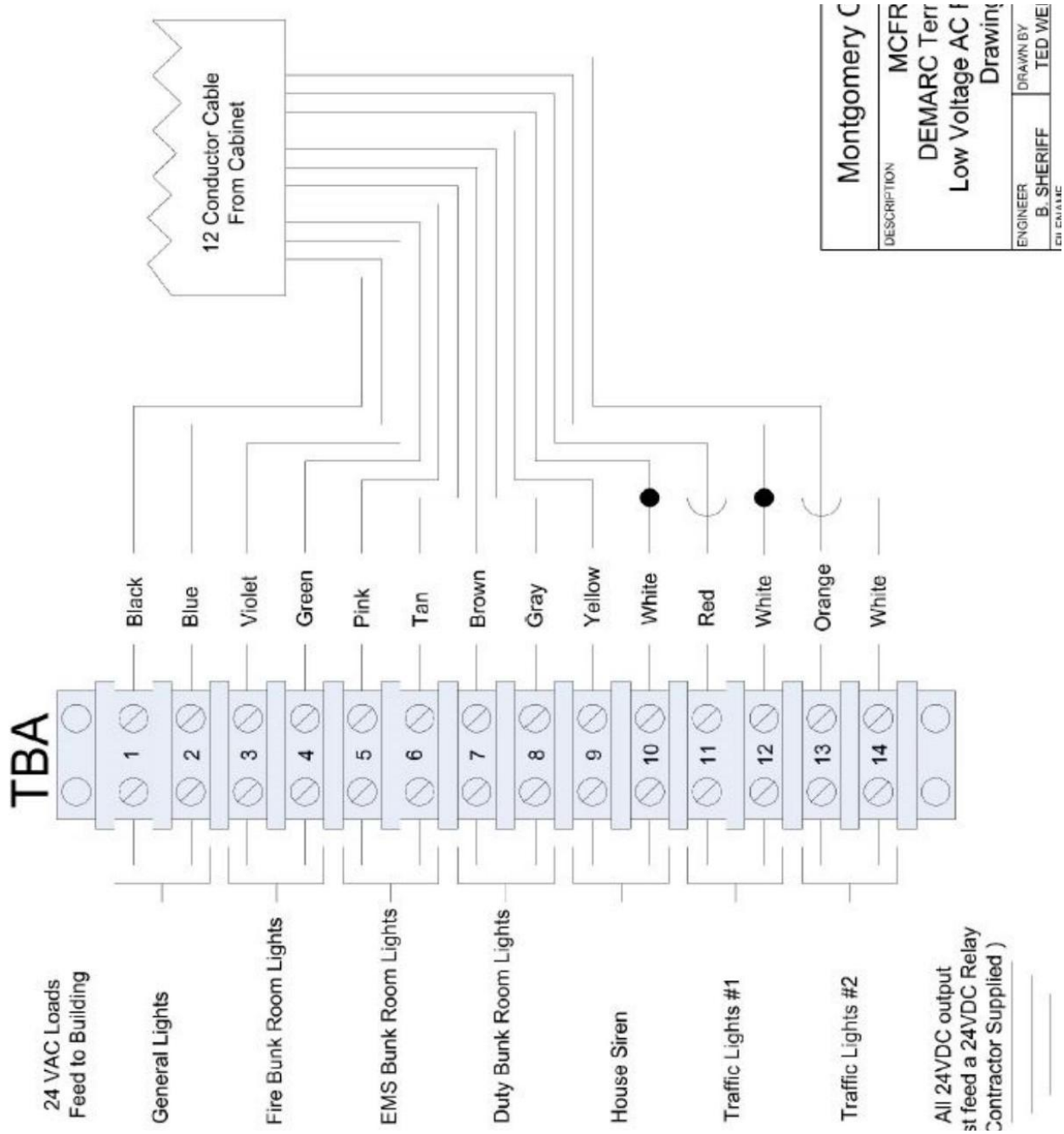

Figure 1: Low Voltage AC Relay Output wiring diagram for MCFRS Demarc Terminal (TBA), showing a 12-conductor cable from cabinet terminated on a 14-position terminal block with labeled color-coded wires (black, blue, violet, green, pink, tan, brown, gray, yellow, white, red, white, orange, white) and field connections including general lights, fire bunk room lights, EMS bunk room lights, duty bunk room lights, house siren, traffic lights #1 and #2, and 24VAC outputs. Title block indicates Montgomery County DTS, Drawing 3, Engineer B. Sheriff, Drawn by Ted Weitzel, Revised 08/18/06, Rev 1, Scale None, Size A.

Table 1: Drawing Title Block Information

Field	Value
Organization	Montgomery County DTS

Field	Value
Description	MCFRS Demarc Terminal TBA – Low Voltage AC Relay Output – Drawing 3
Engineer	B. Sheriff
Drawn By	Ted Weitzel
Revised	08/18/06
Revision	1
Filename	Montgomery County Drawing 3.vsd
Scale	None
Size	A

Version 2022.1

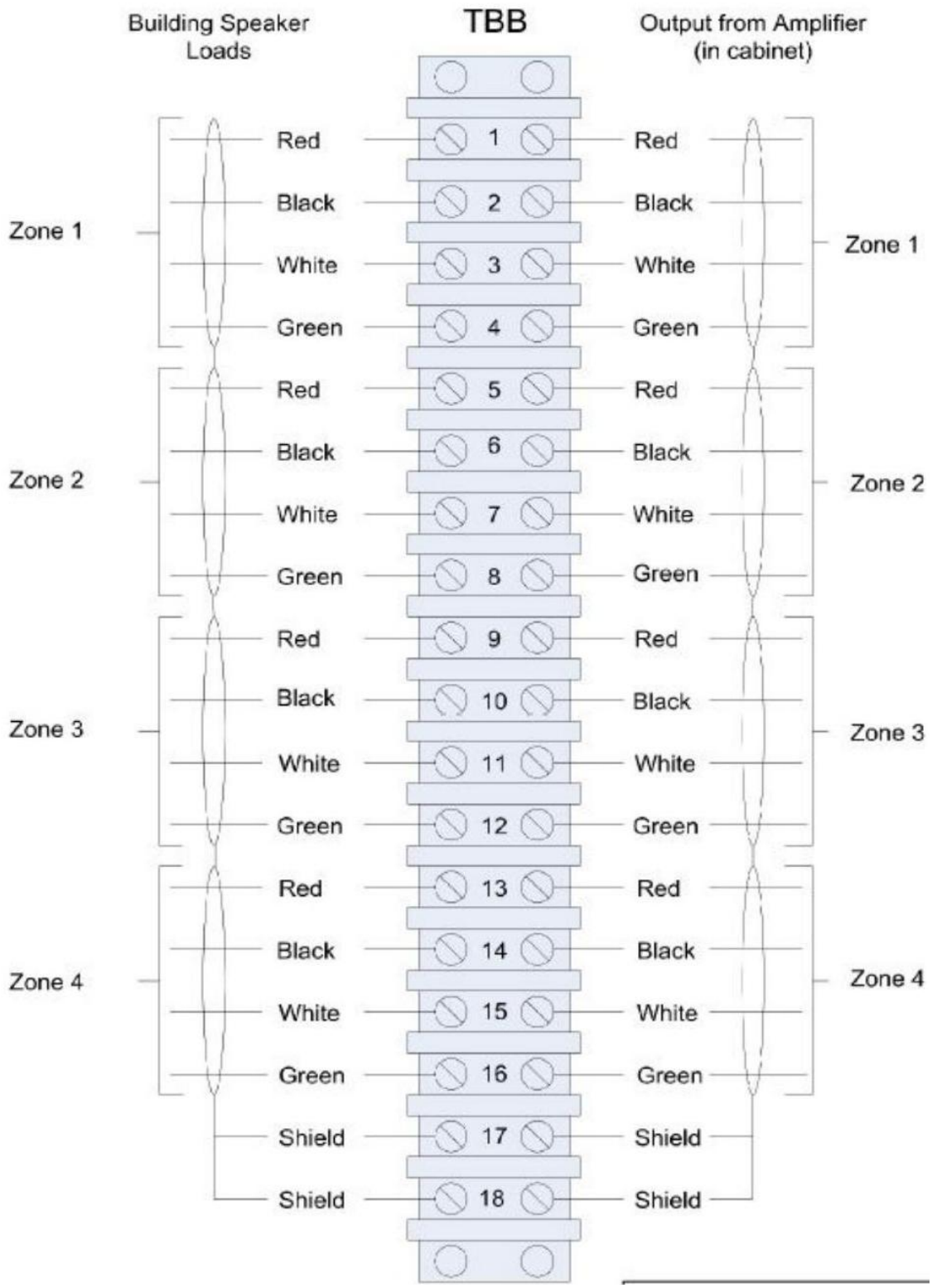

Figure 1: MCFRS demarc terminal block (TBB) wiring layout for fire station alerting speaker Zones 1–4. The diagram shows a vertically oriented terminal block numbered 1 through 18. For each zone (1–4), four conductors—Red, Black, White, and Green—are landed on paired terminals, with corresponding outputs from the amplifier cabinet shown on the right. Zones are grouped in sets of four terminals (1–4 for Zone 1, 5–8 for Zone 2, 9–12 for Zone 3, and

13–16 for Zone 4). Terminals 17 and 18 are designated for shield connections. The left side indicates building speaker loads; the right side indicates output from the amplifier.

Note 1: All shields are to be insulated.
Note 2: Zone 4 to be used for outside speakers only.

Figure 2: Supplemental schematic detail illustrating 70-volt line connections and relay interface. The diagram identifies a 70-volt line with Red (+) and Black (−) conductors as the feed from the amplifier to the TBB, and a relay connection with White (+) and Green (−) conductors as the feed from the equipment shelf. Volume control and feed paths are labeled to clarify signal routing to the terminal block.

Field	Value	Field	Value
Description	MCFRS Demarc Terminal TBB Fire Station Alerting Speaker Zones 1–4 Drawing 4	Engineer	B. Sheriff
Drawn by	Ted Weitzel	Revised	06/18/06
Revision	1	Scale	None
Filename	Montgomery County Drawing 4	Size	A

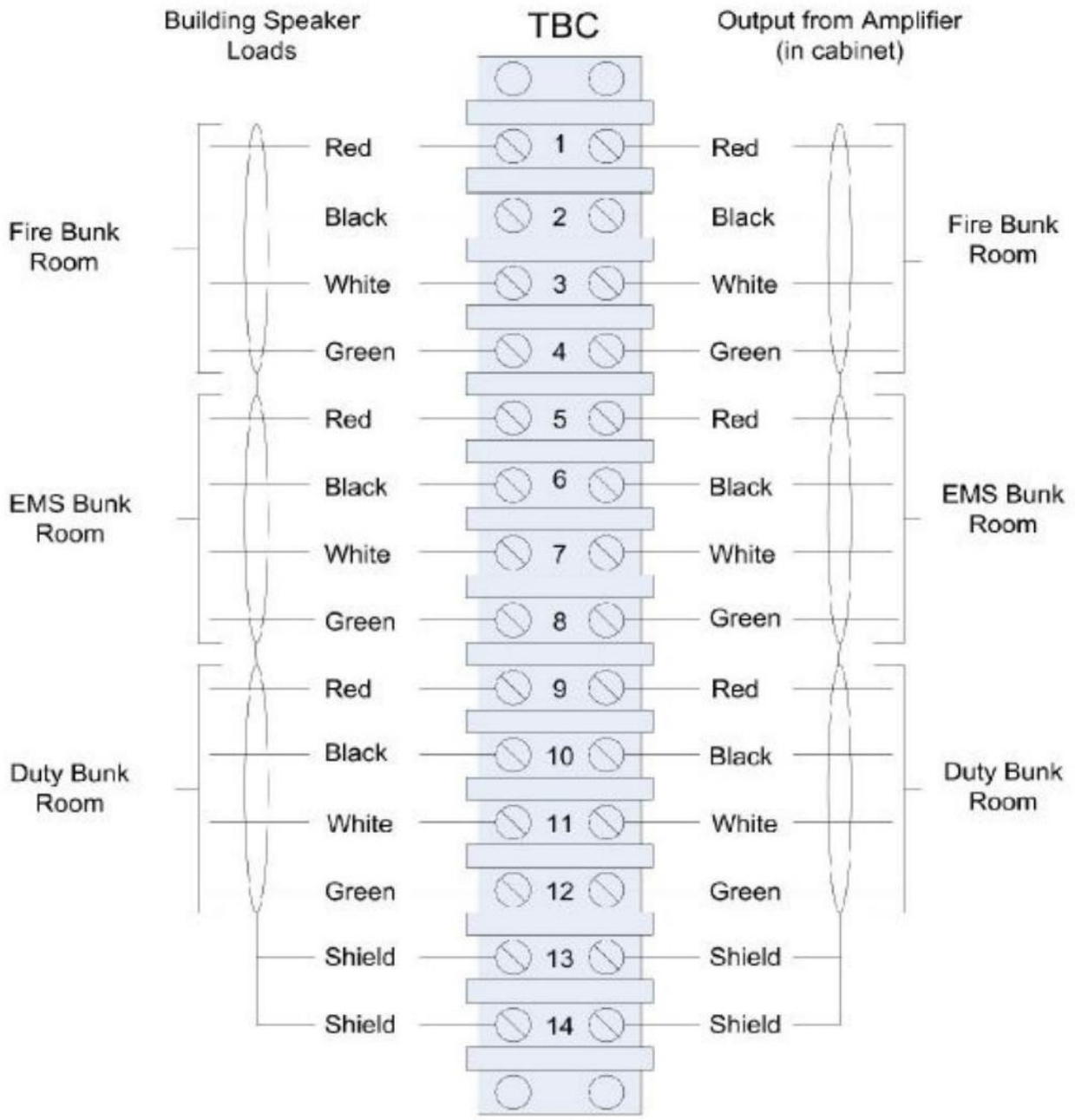

Figure 4: Fire Station Alerting Bunk Room Speaker Terminal Connections (Montgomery County DTS Drawing 5). The diagram shows a central TBC terminal block with 14 numbered screw terminals. On the left, "Building Speaker Loads" are grouped by Fire Bunk Room, EMS Bunk Room, and Duty Bunk Room, each using four color-coded conductors (Red, Black, White, Green). On the right, matching color-coded conductors connect to the "Output from Amplifier (in cabinet)." Terminals 13 and 14 are designated for shield connections.

1. All shields are to be insulated.

2. The above speaker feeds are to be used when there are separate bunk rooms.

Description: MCFRS DEMARC Terminal TBC – Fire Station Alerting Bunk Room Speakers (Drawing 5)
Engineer: B. Sheriff

Drawn By: Ted Wsitzel
Revised: 08/18/06
Revision: 1
Filename: Montgomery County Drawing 5
Scale: None
Size: A

Version 2022.1

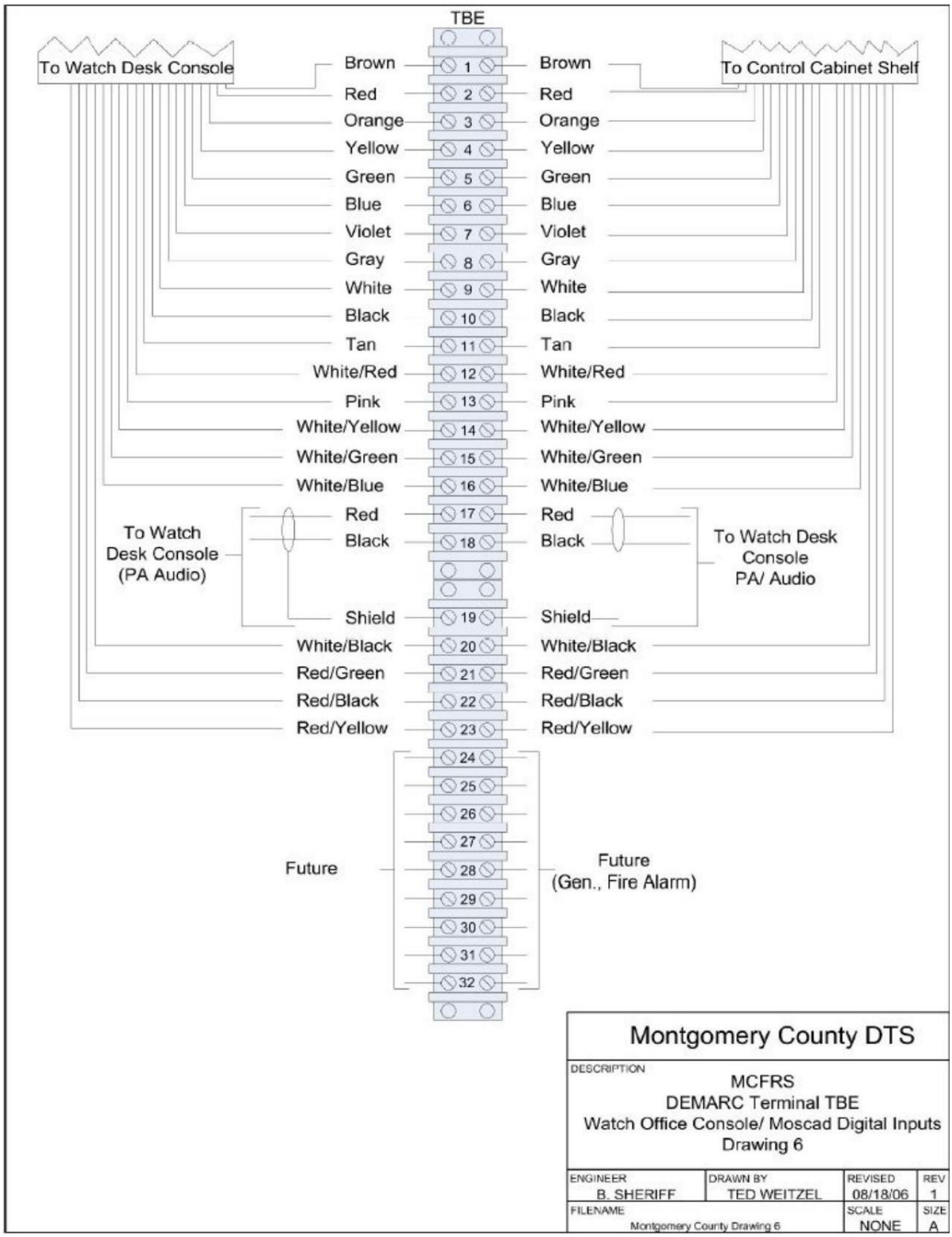

Figure 5: MCFRS DEMARC Terminal Block (TBE) wiring diagram showing color-coded conductor terminations between the Watch Desk Console and the Control Cabinet Shelf. The central vertical terminal block is numbered 1 through 32, with paired screw terminals. Each numbered position is labeled with corresponding wire colors (Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White, Black, Tan, and various white-striped combinations). Con-

nections are shown branching left to the Watch Desk Console and right to the Control Cabinet Shelf. Terminals 17 and 18 are designated for PA audio (Red and Black), with shielding indicated at terminal 19. Lower terminals (24–32) are marked for future use, including General and Fire Alarm connections. The title block identifies Montgomery County DTS, MCFRS DEMARC Terminal TBE, Watch Office Console/Moscad Digital Inputs, Drawing 6, engineered by B. Sheriff and drawn by Ted Weitzel.

Feed From Shelf (PA/Mute Relay)

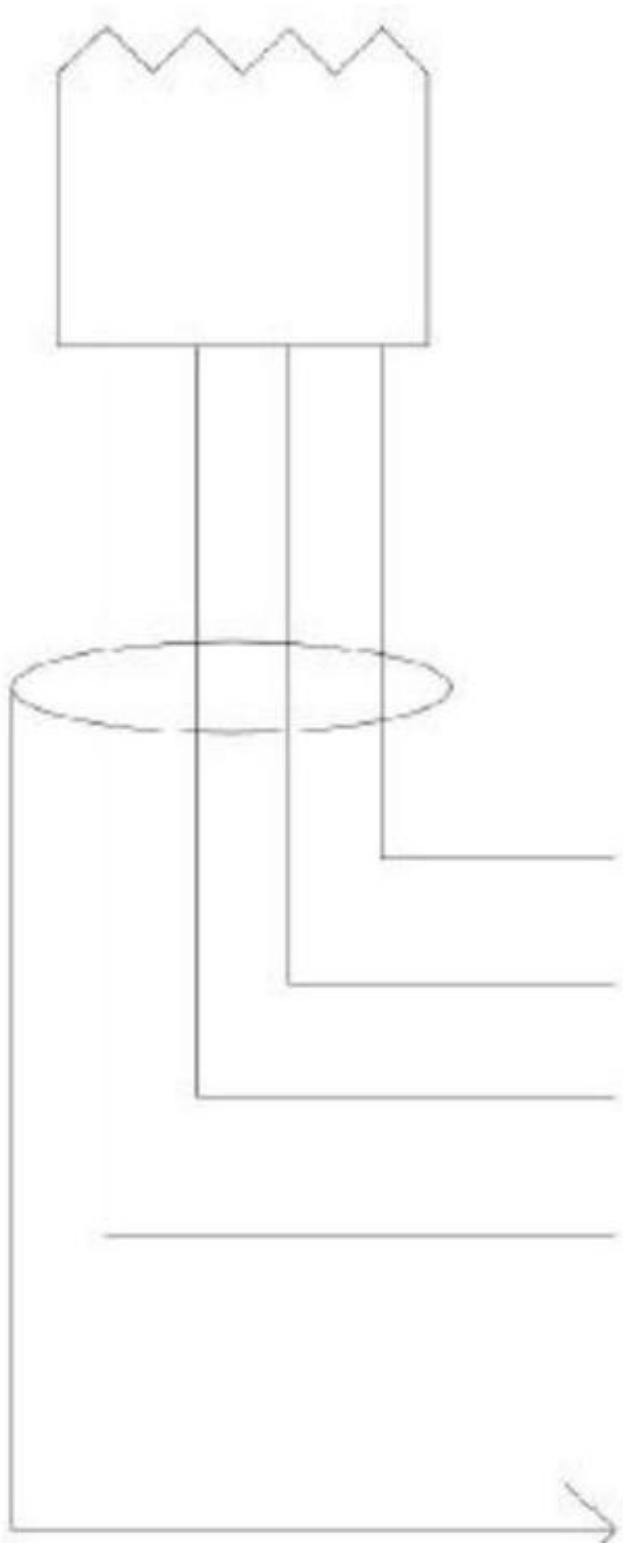

Figure 6: Wiring diagram illustrating feed from shelf (PA/Mute Relay) connections, showing multiple conductors routed downward through a conduit into a connected device enclosure.

Terminal Block (TBF)

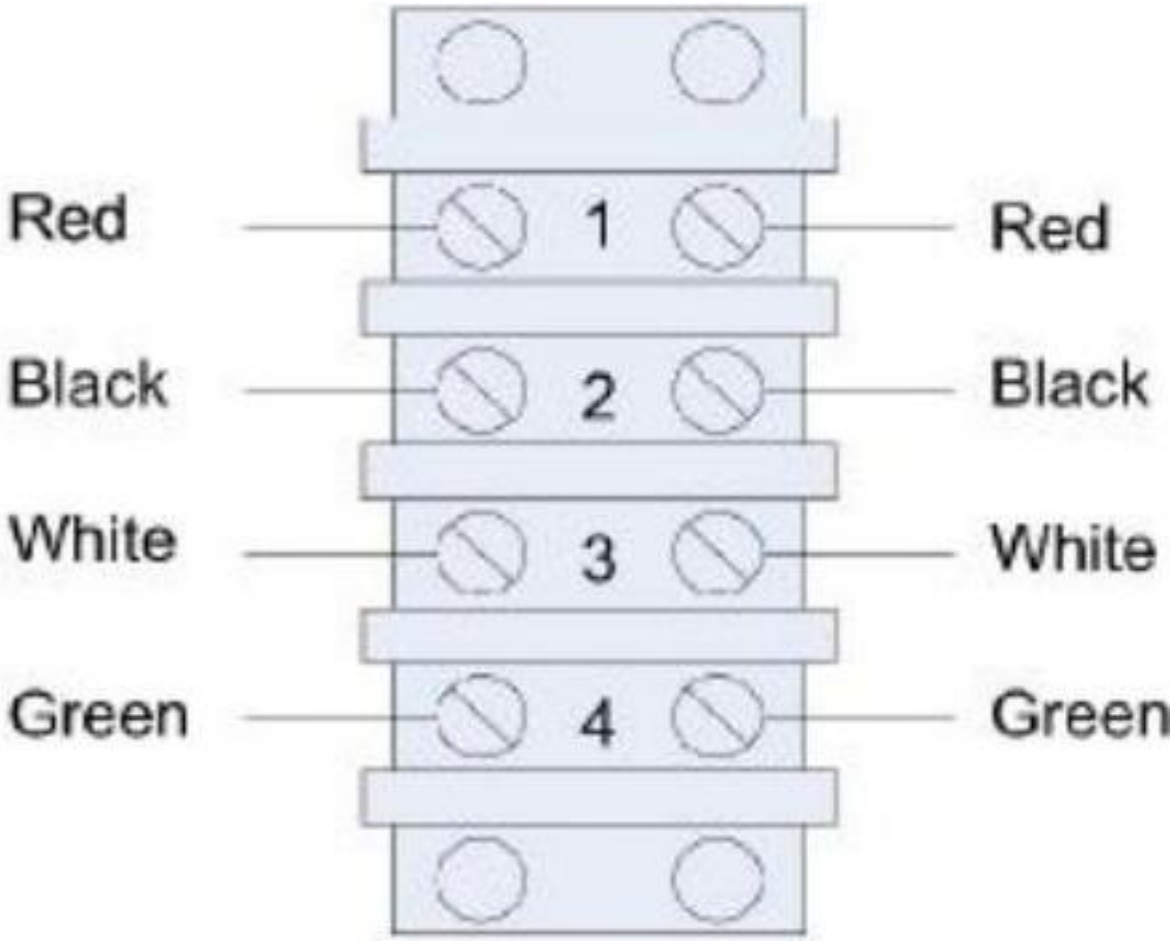

Figure 7: Terminal Block (TBF) with four numbered terminals (1–4). Each position is labeled with corresponding conductor colors on both sides: Red (1), Black (2), White (3), and Green (4).

Watch Desk Relay and Speaker Configuration

Watch Desk Relay –
Watch Desk Relay +
Watch Desk Speaker –
Watch Desk Speaker +

To Volume Control
Watch Desk Speaker Only

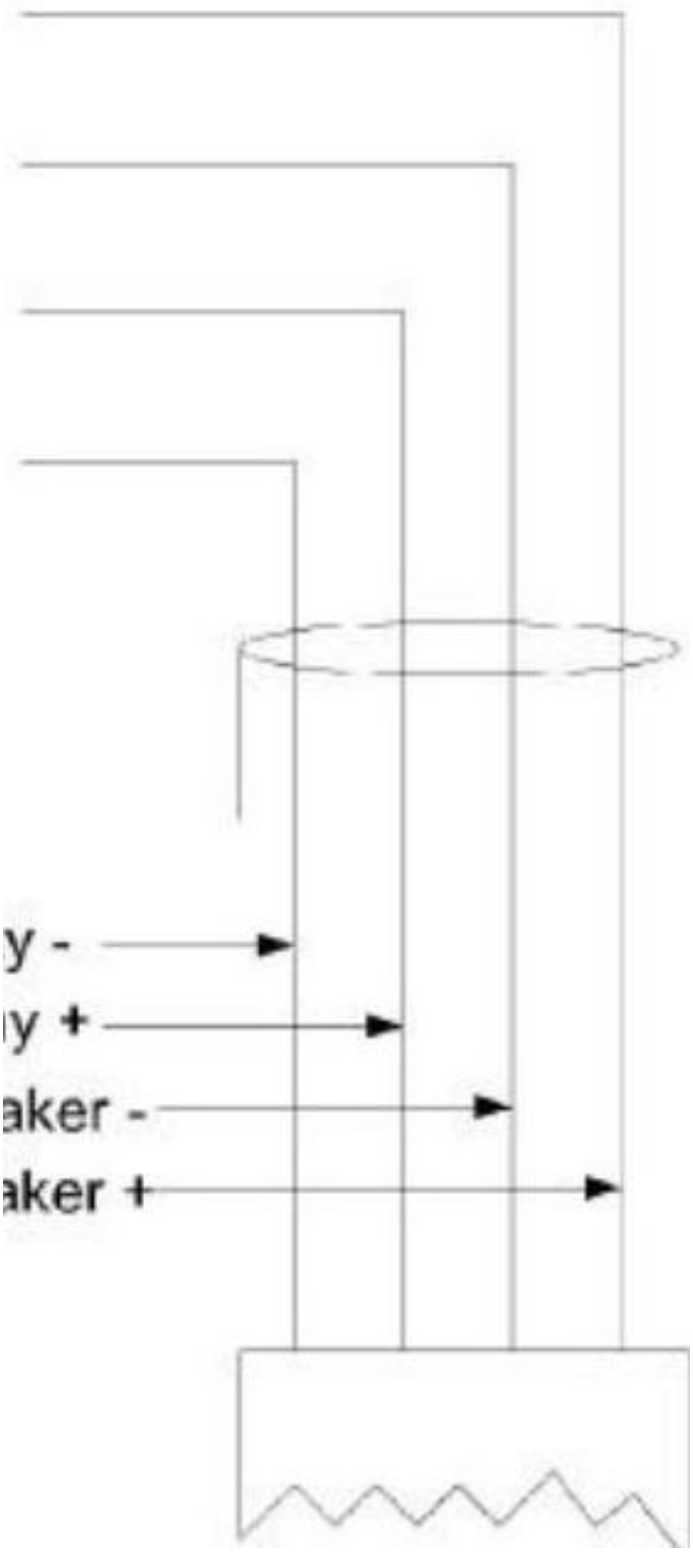

Figure 8: Wiring diagram showing Watch Desk relay and speaker connections. Conductors labeled for relay and speaker positive and negative leads are routed through conduit to a lower device enclosure, including connection to a volume control and speaker-only configuration.

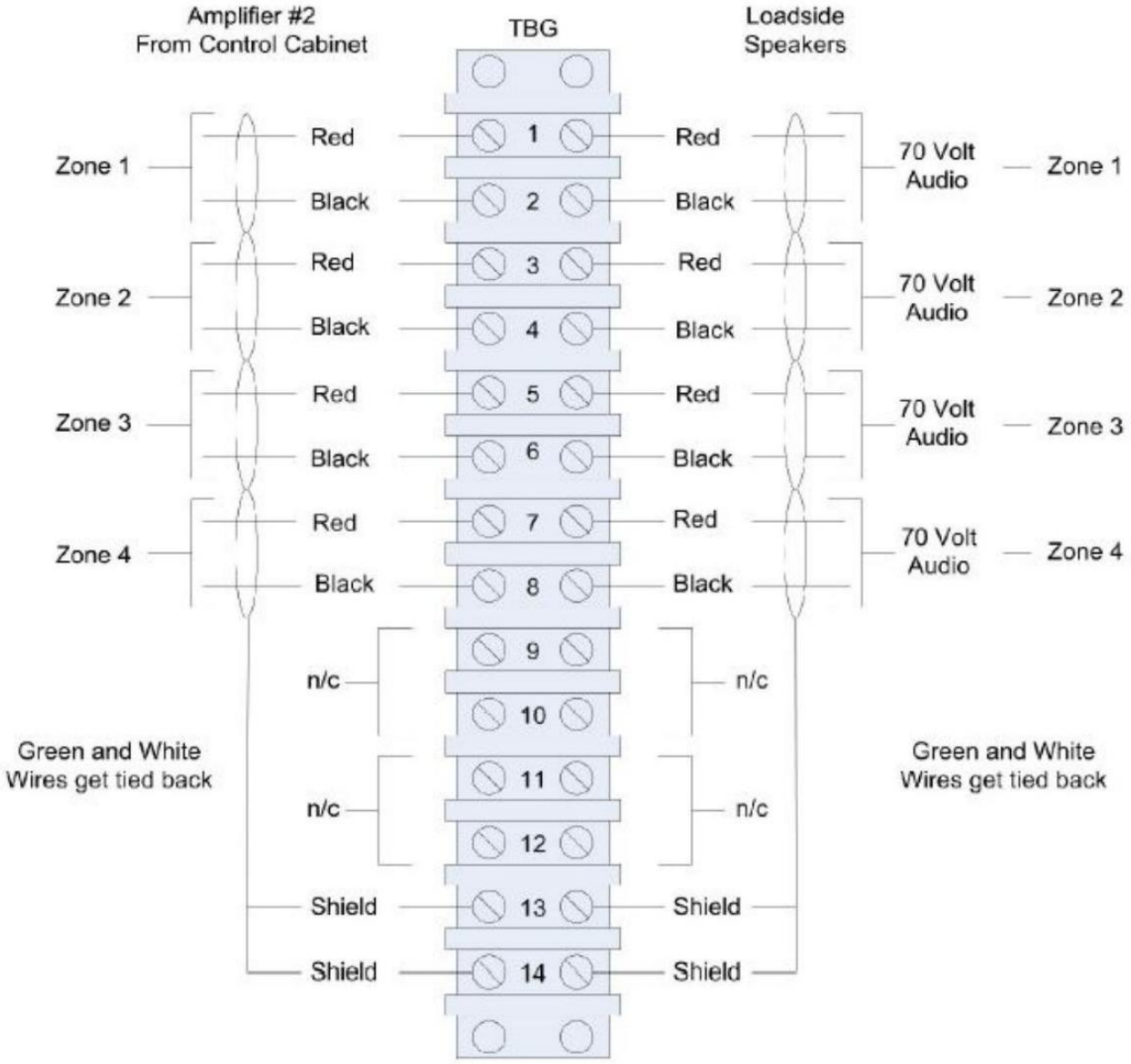

Figure 9: Audio distribution wiring diagram for TBG terminal block showing connections from Amplifier #2 to four 70 Volt speaker zones (Zones 1–4), with red/black conductors per zone, unused terminals (9–12) marked n/c, shields on terminals 13–14, and green/white wires tied back.

- TBG is for second speaker system
- Scanner speaker
- Zone 1: Engine room speaker
- Zone 2: Inside speakers
- Zone 3: Inside speakers

- Zone 4: Outside speakers only

Drawing Information

Project: Montgomery County DTS
Description: MCFRS DEMARC Terminal TBG Secondary Audio System Speaker
Drawing Number: 8

Engineer: B. Sheriff
Drawn By: Ted Weitzel
Revised: 08/21/08
Revision: 1

Filename: Montgomery County Drawing & VSD
Scale: None
Size: A

Version 2022.1

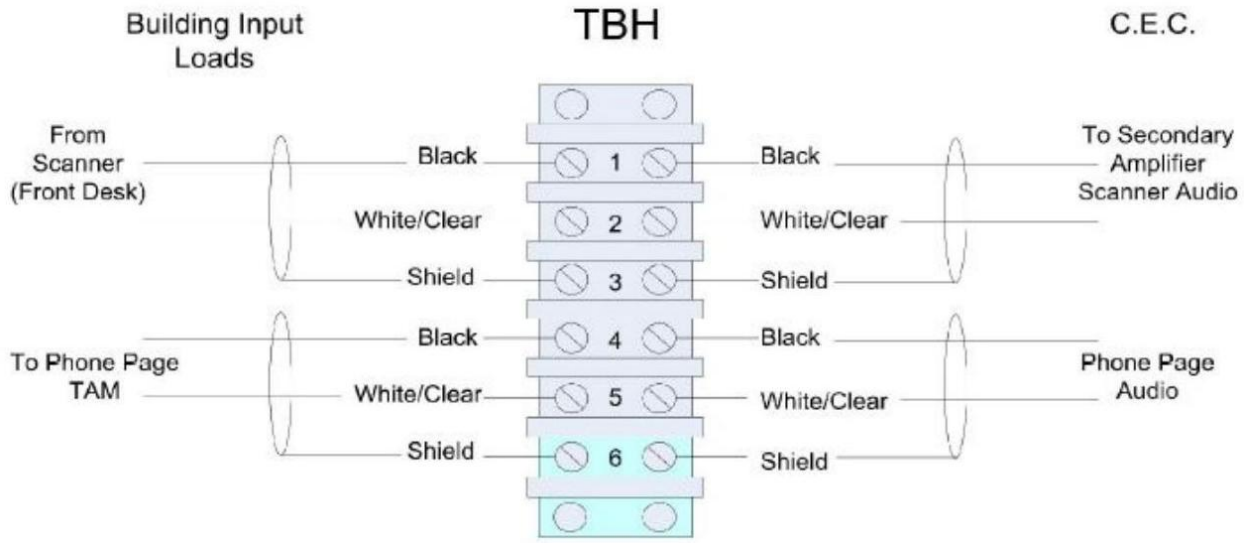

Figure 10: TBH terminal block wiring diagram showing building input loads and audio routing. The diagram depicts a six-position TBH (Terminal Block Housing) with numbered terminals 1 through 6. On the left side, wiring from the scanner (front desk) connects to terminals 1–3 using black, white/clear, and shield conductors. Below that, wiring to the Phone Page TAM connects to terminals 4–6 with matching black, white/clear, and shield conductors. On the right side, corresponding outputs route from terminals 1–3 to the secondary amplifier for scanner audio, and from terminals 4–6 to phone page audio. Each conductor type (black, white/clear, shield) is aligned horizontally across the terminal block, indicating straight-through signal continuity.

Field	Value
Description	MCFRS DEMARC Terminal TBH; Secondary Audio System; Scanner/Phone Page Inputs; Drawing 9
Engineer	B. Sheriff
Drawn By	Ted Weitzel
Revised	08/18/06
Revision	1
Filename	Montgomery County Drawing 9.VSD
Scale	None
Size	A

Version 2022.1

Table 1: MCFRS DEMARC Cabinet Terminal Block Layout (Drawing 10)

Legend: The symbol “ ” represents a terminal connection point. Numbered entries (for example, “ 1 ”) indicate terminal position numbers within each terminal block (TBA, TBB, TBC, TBE, etc.). Blank cells indicate no terminal assignment shown.

TBA

TBB

TBC

TBE

1

1

1

1

2

2

2

2

3

3

3

3

4

4

4

4

5

5

5

5

6

6

6

6

7

7

7

7

8

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8

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9

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12

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14

15

15

TBF

16
16

17
17
1
18
TBG
18
2

3

4
1
19

2
20
TBH
3
21

4
22
1
5
23
2
6
24
3
7
25

4

8

26

5

9

27

6

10

28

11

29

Montgomery County DTS

12

30

DESCRIPTIONMCFRSDEMARC CabinetTerminal Block LayoutDrawing 10

13

31

Engineer: B. Sheriff
Drawn By: Ted Weitzel
Revised: 08/18/06
Revision: 1

Filename: Montgomery County Drawing 10.vsd
Scale: None
Size: A

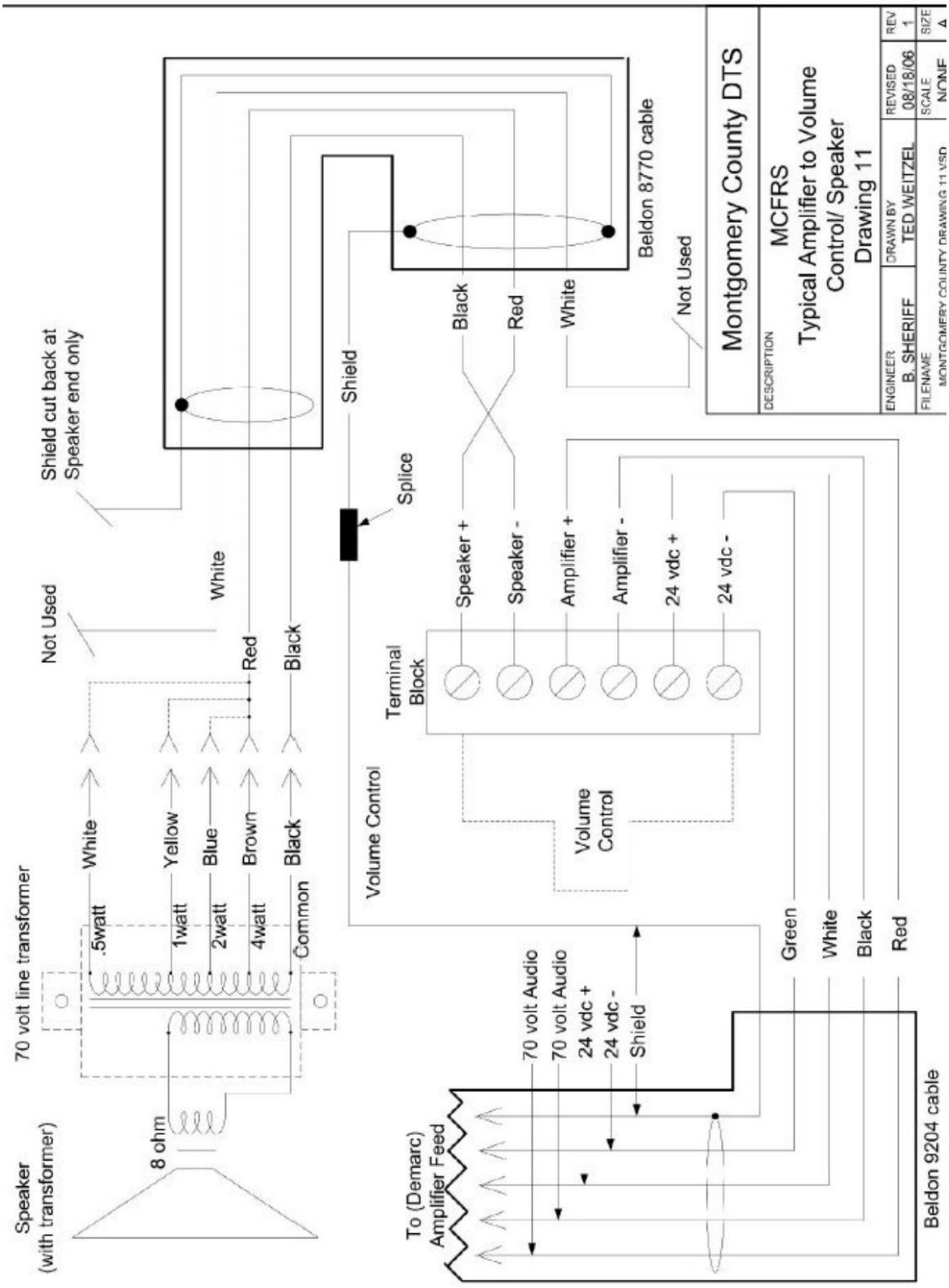

Figure 11: MCFRS Typical Amplifier to Volume Control/Speaker – Drawing 11. The schematic illustrates a 70-volt audio system where audio outputs (70 Volt Audio +/–), 24 VDC +/–, and shield conductors run from a Demarc Amplifier Feed through Belden 9204 cable to a terminal block and volume control. The diagram shows speaker +/– and amplifier +/– terminals, 24 VDC connections, splice points, shield termination (shield cut

back at speaker end only), and color-coded wiring (black, red, white, green). A 70-volt line transformer with multiple wattage taps (.5W, 1W, 2W, 4W, common) connects to an 8-ohm speaker. A typical Belden 8770 cable is also referenced for the amplifier-to-volume-control connection.

Field	Value
Jurisdiction	Montgomery County DTS
Description	MCFRS Typical Amplifier to Volume Control/Speaker – Drawing 11
Engineer	B. Sheriff
Drawn By	Ted Weitzel
Revised	08/18/06
Revision	1
Filename	Montgomery County Drawing 11.vsd
Scale	None
Size	A

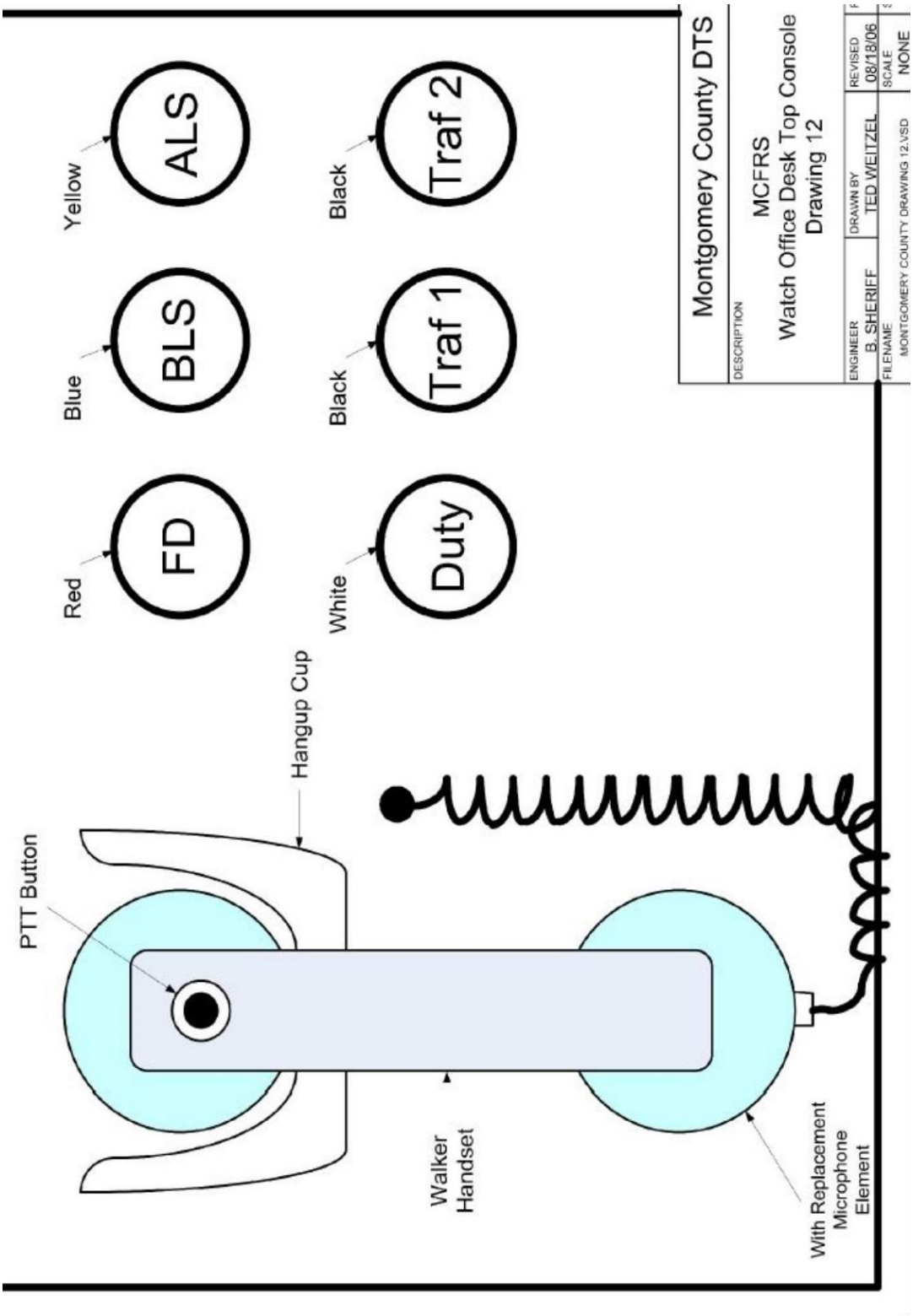

Figure 12: Watch Office Top Console – Drawing 12. The diagram illustrates the layout of a dispatch control console. Circular labeled buttons appear in two vertical columns: left column "ALS" (Yellow), "BLS" (Blue), and "FD" (Red); right column "Traf 2" (Black), "Traf 1" (Black), and "Duty" (White). Below the buttons is a walker-style handset resting in a hang-up cup, with a clearly labeled PTT (Push-To-Talk) button on the handset body. A coiled

cord extends from the handset to the console base, which includes a replacement microphone element. The right margin of the drawing contains a title block referencing Montgomery County DTS, MCFRS, Watch Office Top Console, Drawing 12, and Version 2022.1.

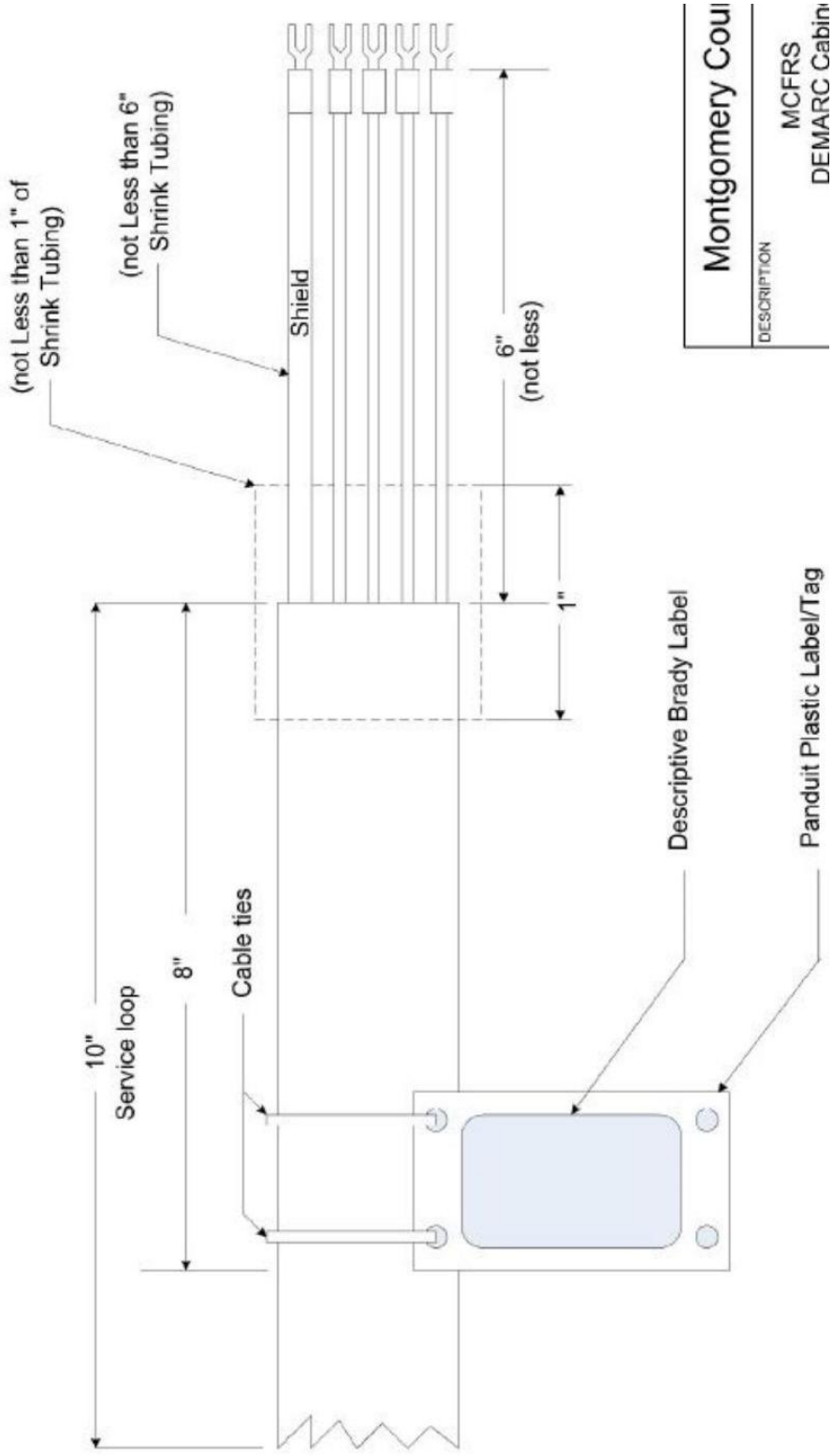

Figure 13: MCFRS DEMARC Cabinet Cable End Detail. Technical drawing showing multiple vertical conductors terminating at forked lugs at the top, bundled within a labeled shield section. Callouts indicate shrink tubing (not less than 1 inch and not less than 6 inches in

specified areas), a minimum 6-inch vertical dimension, a 1-inch spacing near the cabinet entry, an 8-inch cable-tie spacing, and a 10-inch service loop. The lower portion shows cables routed into a cabinet-mounted plate with a descriptive Brady label and conduit plastic label/tag, secured by fasteners at the corners.

Description: MCFRS DEMARC Cabinet Cable End Detail – Drawing 13
Engineer: B. Sheriff
Drawn By: Ted Weitzel
Revised: 08/16/06
Revision: 1
Filename: Montgomery County Drawing 13.vsd
Scale: None
Size: A

Document Version: 2022.1

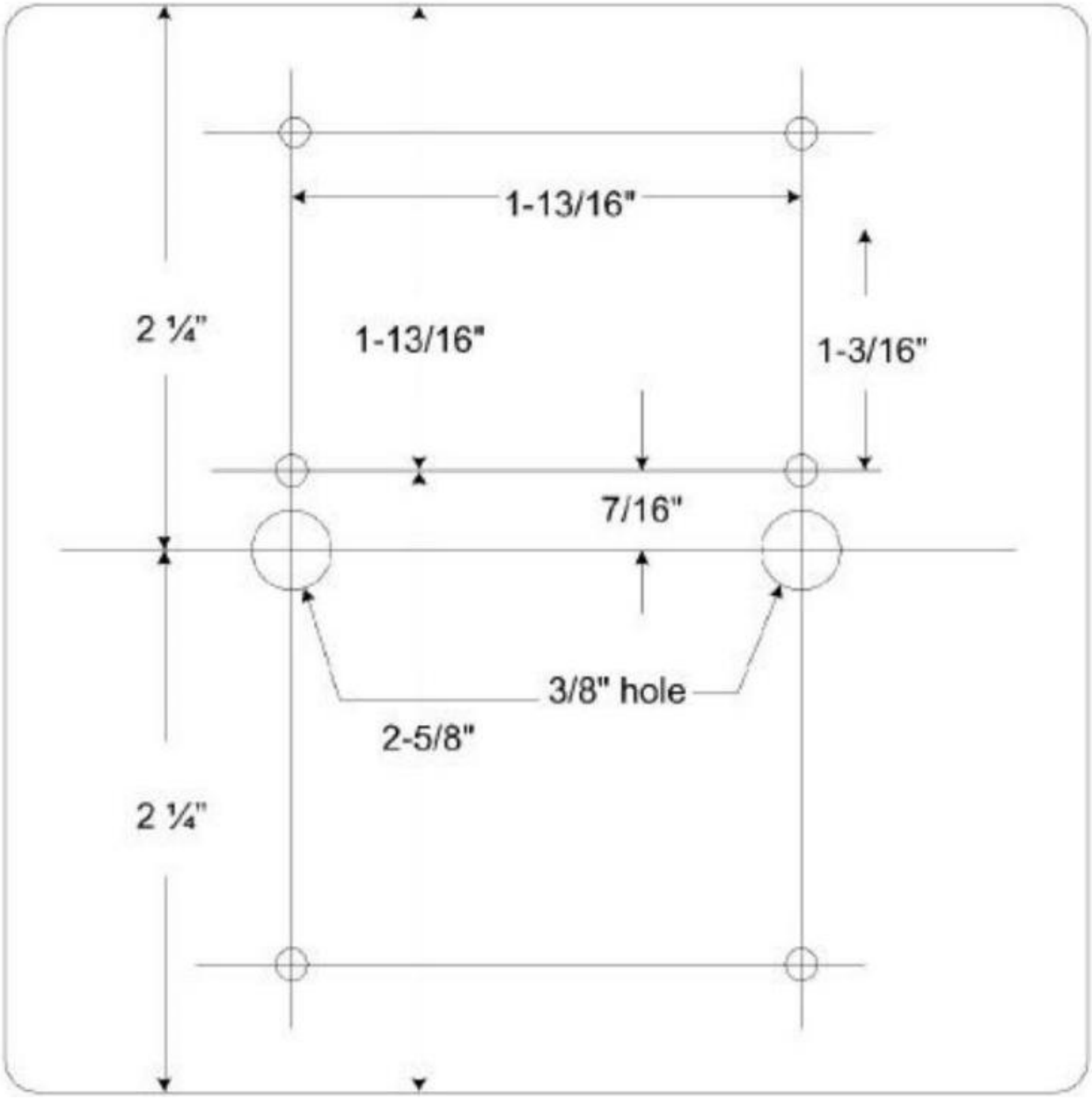

Figure 14: Dual volume control plate layout for MCFRS showing a blank two-gang stainless steel wall plate with four corner mounting holes, two central 3/8 inch circular control openings spaced 2-5/8 inches apart horizontally, 7/16 inch vertical offset from centerline, 1-13/16 inch spacing between upper mounting holes, 1-3/16 inch vertical spacing on right side, and overall vertical dimensions of 2-1/4 inches from center to top and bottom edges.

Label Size: 3” x 3/8”
Minimum Type Size: Not less than 1/4”

Table 1: Drawing and Specification Information

Field	Value
Jurisdiction	Montgomery County DTS
Description	MCFRS Dual Volume Control Plate, Drawing 14
Engineer	B. Sheriff

Field	Value
Drawn By	Ted Weitzel
Revised	08/21/06
Revision	1
Filename	Montgomery County Drawing 14
Scale	None
Size	A

Version 2022.1

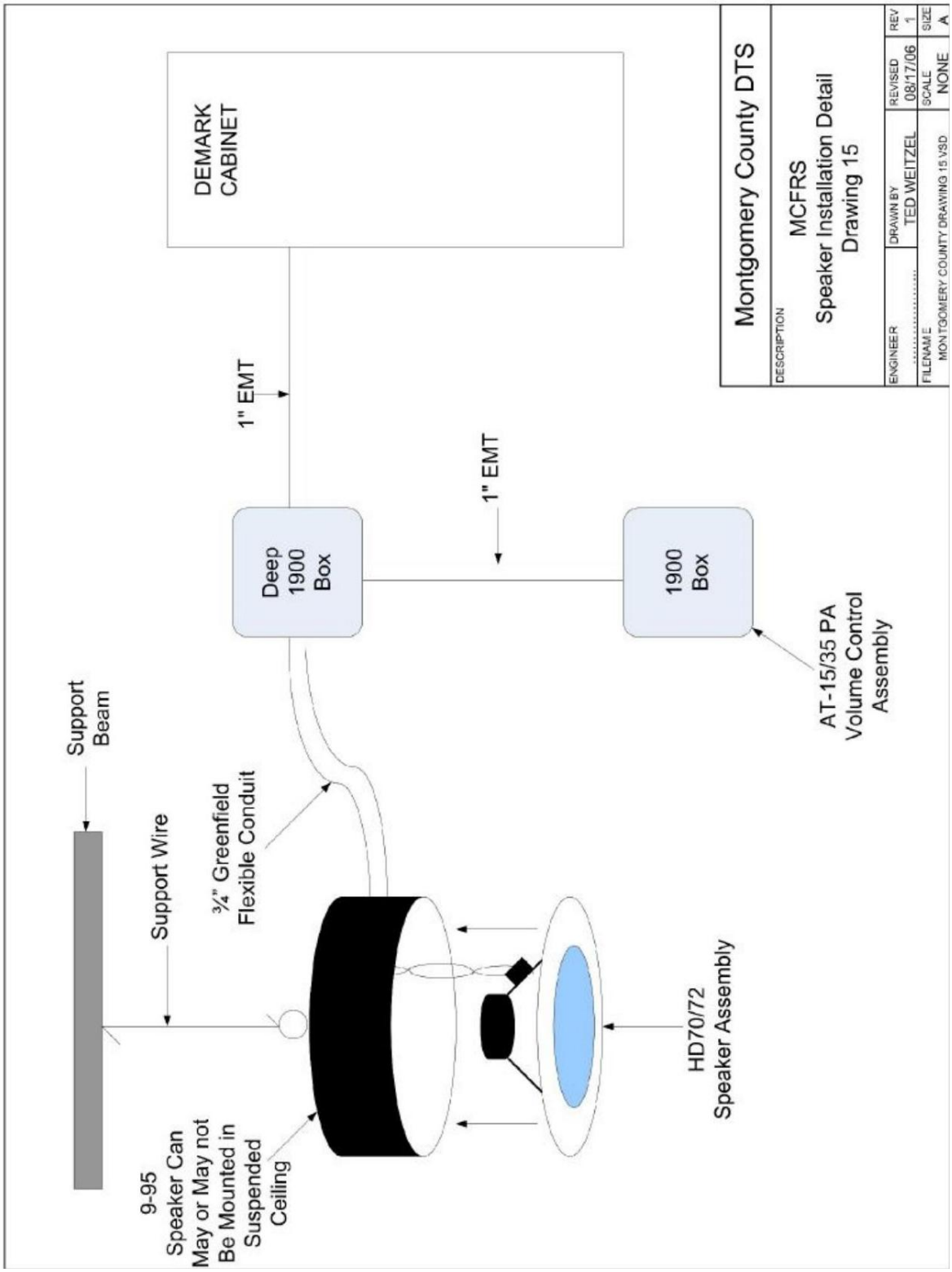

Figure 15: Speaker installation detail (MCFRS) showing wiring layout and mounting components. The diagram illustrates a Demark Cabinet connected via 1-inch EMT conduit to a Deep 1900 Box and a standard 1900 Box. A 9-95 speaker can is shown suspended from a support beam using support wire, with ¾-inch Greenfield flexible conduit routed to the speaker

assembly (HD7072). The system connects to an AT-15/35 PA Volume Control Assembly. Arrows indicate conduit paths and component relationships.

Montgomery County Maryland Building Design Standards

2022 Edition

Revision 2022.1

Department of General Services

Montgomery County, Maryland

Division of Building Design and Construction

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