Workgroup to Develop Fire Safety Best Practices for Pre-1974 High Rise Apartment Buildings

HB823/Ch. 744(2), 2024

Final Report – June 30, 2025

Approved by the full Workgroup on June 30, 2025

Submitted by:
Acting State Fire Marshal, Jason Mowbray, Workgroup Chair

Workgroup Members

Chief Jason Mowbray, Acting State Fire Marshal, Office of the State Fire Marshal

Senator Sara Love, Member of the Senate of Maryland

Delegate Mary Lehman, Member of the House of Delegates of Maryland

Edward S. "Ted" Tochterman, Jr., Chair of the State Fire Prevention Commission

Chief Bob Phillips, President of The Maryland Fire Chiefs Association

Robbie Blackiston, President's Designee, The Maryland State Firefighters Association*

Chief Joshua Bunting, President's Designee, The Maryland State Firefighters Association

Chief Michael Rudasill, Representative of the Professional Fire Fighters of Maryland

Terin Hopkins, Representative of the National Fire Sprinkler Association

Jeanne Schmager Tebera, PE, CFPS, Representative, The Automatic Fire Alarm Association

Abiodun "Babs" Shonaiya, AIA, Representative, Licensed Architect

Dr. Jamie McAllister, PhD, PE, CFI, CSP, Representative, Fire Protection Engineer

Bradley Patrick, Sr., Representative, Building Owners and Managers Association

Dr. Miriam Hamilton, Representative, Building Owners and Managers Association

Ms. Yasia Daniels, Representative, Building Owners and Managers Association*

Mark Dopkin, Full Time Resident of High-Rise located in Maryland

Workgroup Staff

Mr. Kenneth Bush, Chief Engineer for the Office of the State Fire Marshal

Catherine A. Kelly, Director of the Maryland State Police Government Affairs Unit

Nicole Jordan Jones, Deputy Director of Maryland State Police Government Affairs Unit

*Member resigned and new member was designated.

Table of Contents

Workgroup to Develop Fire Safety Best Practices for Pre-1974 High-Rise Apartment Buildings Charter 4

Executive Summary 6

SECTION I:
RISK ASSESSMENT FOR HIGH-RISE BUILDINGS 8

SECTION II:
BEST PRACTICES FOR ADDRESSING RISK IN HIGH-RISE BUILDINGS 21

SECTION III:
POTENTIAL IMPACTS OF RISK REDUCTION IN HIGH-RISE BUILDINGS 40

Appendix 60

Workgroup to Develop Fire Safety Best Practices for Pre-1974 High-Rise Apartment Buildings Charter

Background
HB823/CH0744 established the Workgroup to Develop Fire Safety Best Practices for Pre-1974 High-Rise Apartment Buildings, hereinafter referred to as the "Workgroup".

Mission and Purpose
The Workgroup is charged with:

- Studying fire safety risks in high–rise apartment buildings that do not have automatic sprinkler systems or other fire safety technology;
- Studying current strategies, practices, and technology to mitigate fire risks, maximize evacuation of occupants, and allow for greater access and more expedient responses by emergency response professionals
- Developing recommendations and best practices for the improvement of fire safety in high–rise apartment buildings that do not have fire sprinkler systems and other fire safety technology.

The Workgroup is directed to consider:

- The availability, feasibility, and degree of fire hazard mitigation of each alternative fire protection
- The cost, design, installation, testing, and maintenance of each fire protection system
- The duration of installation for each alternative fire protection system and the intensity of the disruption of normal occupancy caused by installation.

Objective
The Workgroup is required to report its findings and recommendations to the Governor and the General Assembly on or before December 31, 2024, in accordance with §2-1257 of the State Government Article.

Structure, Membership and Participation
The Workgroup consists of representatives of the following disciplines and organizations:

- State Fire Marshal (Chair)
- One member of the House of Delegates
- One member of the Senate of Maryland
- Chair of the State Fire Prevention Commission or designee
- President of the Maryland Fire Chiefs Association of designee
- President of the Maryland State Firemen's Association or designee
- Representative of the Professional Fire Fighters of Maryland
- Fire Sprinkler Trade Association representative
- Fire Alarm Trade Association representative
- Licensed Architect
- Fire Protection Engineer
- Two Building Owners and Managers Association Representatives
- Full time Resident of a High-Rise Building located in Maryland

Meeting Schedule:
To be determined by the workgroup at the first meeting

Operating procedures
All decisions will be made through a vote. Each voting member will be permitted one vote. Members will need to be present in-person or virtually to participate in a vote. A minimum of 8 of the 14 disciplines or organizations must be present to hold a vote.

The Chair through DSP staff will maintain the permanent record of meetings and materials to include:

- The Workgroup charter, inclusive of any revisions
- The schedule of Workgroup meetings
- Meeting notes and any other documents developed by the Workgroup.

The Chair through DSP staff will post for public notice:

- Date, time and location of meetings
- Agenda of the Workgroup meetings
- Minutes or other required public documents associated with the Workgroup meetings

Executive Summary

The Workgroup to Develop Fire Safety Best Practices for Pre-1974 High Rise Apartment Buildings as established by HB823/CH0744(2) was charged with studying fire safety risks in high–rise apartment buildings that do not have automatic sprinkler systems or other fire safety technology; studying current strategies, practices, and technology to mitigate fire risks, maximize evacuation of occupants, and allow for greater access and more expedient responses by emergency response professionals; and developing recommendations and best practices for the improvement of fire safety in high–rise apartment buildings that do not have fire sprinkler systems and other fire safety technology.

The Workgroup met and worked diligently over the course of 9 months and held 16 public meetings. Workgroup members actively participated in a thoughtful and robust discussion throughout each meeting, resulting in an interim report submitted to the Maryland General Assembly in December 2024 and a comprehensive final report in June 2025. There were differing opinions within the Workgroup regarding the necessity and feasibility of retrofitting sprinklers in pre-1974 buildings. However, this report represents the majority view of the Workgroup on approaches to improving fire safety. All meeting minutes and supporting materials are attached to this report.

Conclusions

The Workgroup recommends a layered approach to improving fire safety in pre-1974 high-rise apartment buildings that lack sprinkler systems. Central to this strategy is the installation of automatic sprinkler systems, which remains the most effective life-safety measure for both fire control and occupant protection. However, recognizing that full retrofitting may not always be immediately feasible, the Workgroup emphasizes the need for interim measures to mitigate risk. These interim measures include ensuring proper compartmentation of egress routes, maintaining and modernizing fire alarm and detection systems, improving building maintenance and code enforcement, and providing comprehensive fire safety education for residents. The importance of routine inspection, testing, and maintenance (ITM) of fire and life safety systems is stressed, as many older buildings currently face deficiencies in this area due to unclear enforcement within existing codes.

The Workgroup also highlights that while alternative suppression technologies (such as water mist or clean agent systems) can supplement safety in specific applications, they are not a substitute for comprehensive sprinkler coverage in residential high-rises. In addition, it is noted that human factors—such as residents' delayed response to alarms, mobility impairments, or misunderstanding evacuation procedures—must be addressed through education and communication in multiple languages, particularly given the diverse populations living in these buildings.

Drawing on national data and high-profile case studies, this report demonstrates that fires in non-sprinklered high-rise buildings often lead to significant injuries and fatalities, especially when egress routes are compromised. Thus, the Workgroup recognizes that compliance with NFPA 101's mandate for full sprinkler protection by 2033, supplemented in the short term with education, improved maintenance, and targeted upgrades would be ideal. Even though the model codes

require the installation of automatic sprinkler protection throughout all existing high rise buildings by 2033, Maryland Public Safety Article §6-206 (a)(2) would not require the installation of such protection pending the classification of each individual building as an inimicable hazard. The Workgroup further acknowledges that state and local fire prevention codes should be clarified to correlate modern ITM requirements for existing buildings.

SECTION I: RISK ASSESSMENT FOR HIGH-RISE BUILDINGS

In section I the Workgroup outlines the scope and findings of Risk Assessment in Pre-1974 High-Rise apartment buildings, focusing on fire risks in non-sprinklered high-rise residential buildings across Maryland. This section provides data-driven analysis on the frequency and impact of high-rise fires, highlights deficiencies in existing fire protection systems, and reviews the limitations of current inspection and maintenance enforcement mechanisms.

Estimated Number of Non-Sprinklered High-Rise[1] Apartment Buildings in Maryland

County/Jurisdiction	Total Residential Highrises (7 or more stories or 75' or more above grade level to highest occupiable floor)	Non-Sprinklered Residential Highrises	Partially Sprinklered Residential Highrises (Common Areas, Basements, Trashchutes, etc.)	Fully-Sprinklered Residential Highrises (** buildings constructed prior to 07/01/74)	Point of Contact	Notes
Allegany County	6			6/**4	Chris Koch, SFMO WRO FPE	
Annapolis						may be included with Anne Arundel Co. stats
Anne Arundel County	5			5	Capt. Donna MCGuire, Anne Arundel Co. FD FMO	
Baltimore City	245	71		174	Jennifer Haslam, Legislative Director for Baltimore City FD	Estimates based on Senator Young, and Mike Rudasill (BCFD) Michael.Rudasil@baltimorecity.gov
Baltimore County	32	4	0	28/**8	Gretchen Yingling, Baltimore County FMO	
Calvert County	1	1			Nicholas Henni, SFMO SRO FPE	
Caroline County	0				Ken Bush, SFMO CFPE	
Carroll County	0				Harry Bradley, SFMO NERO FPE	
Cecil County	0				Harry Bradley, SFMO NERO FPE	
Charles County	0				Nicholas Henni, SFMO SRO FPE	
Dorchester County	1			1	Scott Mason, SFMO LERO FSI	
Frederick County	1			1/**1	BC Chad Kave, Frederick County Fire Marshal's Office	
Gaithersburg						may be included with Montgomery Co. stats
Garrett County						
Harford County	1	1			Harry Bradley, SFMO NERO FPE	
Howard County						
Kent County	0				Ken Bush, SFMO CFPE	
Montgomery County	320	73	UNK		Patsy Warnick, MoCo Fire Marshal/Mngr. of Fire Code Compliance	
Ocean City	41	1*	13*	27/ **9	Josh Bunting, OCFMO (jbunting@oceancitymd.gov)	*Partial and Unsprinklered were approved under NFPA-allowed Life Safety Equivalancy during 2005 sprinkler retrofit.
Prince George's County	43	11	32	0	Aaron White, PG FMO, Jim Reilly PGFD via Terin Hopkins	
Queen Anne's County	0				Jeff Morgan, Queen Anne's Co. Fire Marshal	
Rockville						may be included with Montgomery Co. stats
Somerset County	2			2	Scott Mason, SFMO LERO FSI	
St. Mary's County	0				Nicholas Henni, SFMO SRO FPE	
Talbot County	0				Ken Bush, SFMO CFPE	
University of Maryland	21			21	Alan Sactor, UMD Fire Marshal	
Washington County	6		4	2	Chris Koch, SFMO WRO FPE	
Wicomico County	1			1	Scott Mason, SFMO LERO FSI	
Worcester County	0				Matt Owens, Worcester County FMO	

Maryland High-Rise Fire Data, 2001-2022[2]

This report looked at high-rise fires in Maryland that occurred between 2001-2022 (22 years). The data was submitted by fire departments through the National Incident Reporting System (NIFIRS). The methodology used is explained on the last page of the full report. The report identified 248 fires meeting the selection criteria with an average of 11 fires per year; the data showed an upward trend in fires over the 22-year period. A total of 215 of the 248 fires occurred in apartments, condos, or other residential areas. There were approximately 26 injuries reported or approximately

[1] Data collected by Maryland Office of the State Fire Marshal, June 2025 (High-rises are defined as buildings that are 75 feet to highest occupiable floor.)

[2] Nisja, Jon, NFSA Maryland High-Rise Fire Data, November 2024

one injury for every 9.5 fires. The analysis shows that the presence of operating fire sprinklers reduced the overall risk of injury by 60% and property loss reduction by 55%.

The data set (and reported number of incidents) is conservative, as it only includes fires occurring on the 7th floor or higher. The data set from NFIRS does not allow for identification of a high-rise building. As such, high-rises were identified by determining the floor of fire origin. It was assumed that any fire occurring on the 7th floor or higher was in a high-rise. The data does not capture fires in high-rise buildings on the basement level through the 6-floor. The data set also does not capture fires contained to the unit of origin, alarm activations, hazardous conditions, or false calls.

Fires on lower floors, traditionally, have led to a higher number of fatalities as smoke and heat travels upward. The Twin Parks fire in Bronx, NY (discussed in more detail below) demonstrates the hazards of fires on lower floors. The fire started on the 2nd floor of the un-sprinklered, high-rise. It claimed the lives of 17 people, including 8 children, and injured 44 occupants with 32 individuals sustaining life-threatening injuries.

Inspection, Testing, and Maintenance of Existing Systems

Existing legacy buildings, like the pre-1974, non-sprinklered high-rises that are the focus of the Workgroup, typically have a higher rate of deficiencies and impairments when compared to buildings constructed under newer model codes. In Maryland, the higher incidence of deficiencies is exacerbated due to a lack of inspection, testing, and maintenance (ITM) guidance and enforcement. ITM of fire and life safety systems is necessary to ensure that systems function properly when called upon. Operational uncertainty, and therefore risk, are increased when building fire and life safety systems lack routine ITM. Further, outdated legacy fire projection systems in older buildings have been shown to underperform during emergency situations.

The "Application and Scope" language in the Maryland State Fire Prevention Code (MSFPC) is from NFPA 1 *Fire Code* and exempts existing buildings from additional "new" construction requirements. A structure must only comply with the requirements of the standard under which it was built, e.g., the 1973 codes and standards. The requirements are in place to exempt existing buildings from having to meet requirements for "new" construction that may be implemented in later editions of the reference standards.

The MSFPC further modifies the existing building requirements in NFPA 1, thereby losing the intent within NFPA 1, by making any/all required existing building ITM unenforceable. The current language in MSFPC requires that any current code requirement, including requirements for ITM, must have been in place at the time the building was constructed to be enforceable unless the building is determined to be an inimical hazard. The MSFPC amendments to NFPA 1 make it difficult for an authority having jurisdiction (AHJ) to establish requirements; the AHJ must determine the applicable editions of the codes and standards that were in effect at the time the building was constructed to determine enforceable requirements. A negative outcome of this cumbersome process is a lack of enforcement due to a lack of knowing what to enforce.

NFPA 1 reference to other standards, like NFPA 25, 72 and 101, is not intended to trigger "new" construction requirements for existing buildings but to clarify that "existing requirements" in the reference standards are retroactive. NFPA 1 speaks to the intent of codes and standards that are specifically addressing existing buildings in Section 1.3.2.4 (See Appendix A). This section adds three exceptions to retroactivity of which only two are clear in the MSFPC (A- "new" construction requirements & B- inimical hazard). The MSFPC fails to interpret the specific sections of the reference standards intended to be retroactive:

A. Approved existing facilities, equipment structures and installation.

B. Inimical hazard

C. Where specified by the reference standard, the provisions shall be retroactive

The aforementioned issues need to be clarified in the MSFPC or through additional legislation to ensure proper ITM is being performed in existing buildings and to reduce risk.

Modern-day fires in older structures

Over the last two decades, the National Institute of Standards and Technology (NIST)) and Underwriters Laboratories - Fire Safety Research Institute (UL-FSRI) have studied the fire behavior of legacy and modern furnishings. Modern furnishing fires grow 8-times faster than legacy furnishing fires and reach flashover, e.g., full-room involvement, in less than 5 minutes. These modern furnishing fires produce 200 times more smoke which contains highly toxic asphyxiant gases like carbon monoxide and hydrogen cyanide. The plastics, glues, oils, and synthetics used to create modern-day furnishings are contributing to the smoke toxicity. This fire risk has continued to grow in recent years with the introduction of advanced electronics and the use of lithium-ion batteries contributing to the overall risk.

Human Behavior in Fire

The goal is to evacuate or relocate occupants to a place of safety before they are subjected to untenable conditions produced by a fire. These untenable conditions come in the form of smoke, heat, and toxic gases. The time it takes for an occupant to evacuate to a place of safety is known as the Required Safety Escape Time (RSET). RSET includes the period between ignition of the fire and detection, the period between detection and occupant notification, the period between notification and the occupant's decision to evacuate (pre-movement time), and the period required for occupant evacuation (movement time).

The pre-movement period in a fire is the timeframe between notification of a fire and the occupant's decision to evacuate. During the pre-movement period, cues related to the fire are present. Before an occupant decides to evacuate, they must receive the cue, which is a combination of sensing it, paying attention to it, and comprehending it. An occupant may receive fire cues from the fire environment (e.g., smell of smoke), the building (e.g., activation of an audible/visual fire alarm), or other people in the building (e.g., yelling that there is a fire). After receiving a cue, the

occupant then processes the information to determine if a threat is present and decides to take protective action (threat) or resume his/her normal activity (no threat). The movement period includes the time required to travel through the exit (e.g., corridors and stairs) to a place of safety.

The Available Safe Escape Time (ASET) is the time between the ignition of the fire and an endpoint that hinders the ability of an occupant to safely escape (e.g., smoke, heat, toxic gases). For occupants to safely escape, ASET must exceed RSET. In modern buildings, suppressing the rate of fire growth and ensuring early occupant notification of the fire to have them appreciate prompt evacuation is a primary means of ensuring that ASET exceeds RSET Any increase in the pre-movement or movement time or increase in the rate at which the fire growths can greatly reduce the probability that occupants will not escape before being exposed to untenable levels of smoke, heat, or toxic gases.

Case Studies

In recent years, several multi-fatalities, high-rise building fires in the U.S. have highlighted vulnerabilities associated with the compartmentation method in non-sprinklered buildings. The Cook County Administrative Building in Chicago, IL, the Wedgwood Senior Living Apartments in San Antonio, TX, the Cedar High Apartments in Minneapolis, MN, Twin Parks Apartments in Bronx, NY, Marco Polo in Honolulu, HI, Midtown Towers in Pittsburgh, PA, are among the most notable cases. In all cases, the building was constructed in the 1960s or 1970s when requirements for sprinklers in high-rise residential occupancies were largely absent from jurisdictional codes. Neither of the six structures had sprinklers nor active smoke control systems. The fires originated inside an office space or inside an apartment, but without automatic suppression and through the failure of compartmentation, e.g., fire doors, heat and smoke spread unimpeded into egress pathways. The stairwells in each building served as the main egress routes but were compromised due to failed compartmentation, which in some cases was further exacerbated by firefighting operations. Several occupants that were attempting to evacuate via the stairwells encountered heavy smoke and became incapacitated; some were severely injured while others died due to smoke exposure. In the case of the Marco Polo, three occupants died while sheltering in place in units across the hall from the unit of origin. The following sections explore each case in more depth.

Cook County Administration Building, Chicago, Illinois[3]

The Cook County Administration Building was a 37-story office building located in Chicago, Illinois. The building was constructed between 1962 and 1964. The building had two stair enclosures for egress, one in the northwest and one in the southeast. The building was not protected

[3] Proulx, G. and Reid, I.M.A. (2006), Occupant behavior and evacuation during the Chicago Cook County Administration Building Fire, Journal of Fire Protection Engineering, 16,, pp. 283-309
Illinois University Library (2022), Cook County Administration Building Fire: Introduction. In Significant Illinois Fires: Cook County Administration Building, Fire, https://guides.library.illinois.edu/c.php?g=416856&p=2842528 .
Security Magazine (2004), Lessons from a High-Rise Fire, https://www.securitymagazine.com/articles/76506-lessons-from-a-high-rise-fire-1 .

by a full sprinkler system; only the first-floor lobby, day care center, and second floor of the adjacent building, were sprinklered. The southeast stairwell had a smoke tower which consisted of a natural ventilation shaft with a thermally actuated louver on each floor, but the building was not equipped with an active smoke control system. On October 17th, 2003, a fire started in the 12th floor supply room. The fire was largely contained to the 12th floor office suite, but unsealed ceiling penetrations allowed smoke to spread throughout the building.

The Cook County Administration Building stairwells had vestibules and the standpipe riser was located inside the vestibule. Vestibules were commonly used as a compartmentation method in the 1960s and 1970s whereby a small enclosure (i.e., vestibule) would be placed between the stair tower and the occupied floor to minimize the transfer of smoke between the occupied floor and the stair tower. During fire suppression efforts, firefighters connected to the standpipe connection on the floor below the fire (as is standard practice), ran the hose up the stair tower to the fire floor, and breached the two doors that provided compartmentation between the stair tower, vestibule, and fire floor. This allowed smoke to flow unimpeded into the southeast stairwell. At the same time, occupants were attempting to egress through the same stairwell from higher floors. The evacuees turned back when confronted with the smoke but found the doors leading out of the stairwell were locked; the building was not designed for re-entry and did not have fail-safe locking mechanisms on the stairwell doors. Some evacuees were able to escape through a chocked-open door on the 27th floor. However, thirteen occupants became incapacitated in the southeast stairwell and were not found until the fire was contained. Of the thirteen, only seven occupants were revived.

According to Madrzykowski and Walton[4], the 12th floor smoke tower louver may have failed to open during the fire but through modeling they found that, while a functioning smoke shaft would have had some impact on smoke travel, it would not have been sufficient to remove all the smoke inside the southeast stair due to the open stairwell doors. Madrzykowski and Walton (2004) determined that an automatic sprinkler system would have effectively limited the fire to the storage room, although the suite would still eventually fill with smoke.

After this incident, Chicago passed an ordinance requiring all existing commercial buildings over 80 feet to submit a plan to install automatic sprinklers by 2005. The systems were to be completed by 2017. However, non-transient residential buildings, such as apartments and condos, were exempt from the requirement (Automatic sprinkler 2019).

[4] Madryzkowski, D. and Walton, W.D., Cook County Administration Building Fire, 69 West Washington, Chicago, Illinois, October 17, 2003: Heat Release Rate Experiments and FDS Simulations, National Institute of Standards and Technology, Gaitherburg, MD, July 2004.

Wedgwood Senior Living Apartments, San Antonio, Texas[5]

Constructed in 1962, the Wedgwood Senior Apartments building was an 11-story high-rise with 297 apartments. It served as an independent living facility for adults aged 55 and older and many residents were mobility impaired and/or had chronic diseases. The building was comprised of a central core with three wings extending outward. Each wing contained an enclosed stairwell, and the core contained another enclosed stairwell. Sprinklers were only located in the mechanical, electrical, and auxiliary support spaces in the basement, leaving the above grade living spaces unprotected. Standpipes were in the stairwells of the three wings, but not at the central core. The building was equipped with a fire alarm system which included smoke detectors, speakers, and strobes in the corridors, however, several residents reported not hearing the fire alarm system.

The Castle Hills Fire Department responded to a fire at the Wedgwood Senior Apartments on December 28, 2014. The fire started on the 3rd floor in apartment 302 and by the time the fire department arrived, the 3rd floor corridor was filled with heavy smoke. The apartment door was left open by building staff after they discovered the fire, which breached compartmentation between the apartment and the corridor. Further, the fire department advanced a hose line from the stairwell standpipe connection to apartment 302, which breached compartmentation between the stairwell and the corridor. The fire was primarily contained to the 3rd floor with minor extension into the 4th floor apartment directly above the apartment of origin. Although fire extension was limited, smoke traveled through a common ceiling space above all the apartments and through several open stairwell doors that were propped open by renovation workers; the smoke migrated throughout the stairwells up to the 11th floor and into corridors on most floors of the building. The stairwells had thermally actuated vents at the top of the stair towers, however, they did not activate; there was no active smoke control system in the building.

Five people were pronounced dead at the scene and eighteen residents were transported by EMS due to smoke inhalation. First responders found unconscious victims in stairwells, corridors, and the main lobby. Many residents were trapped on the 6th through 11th floors and firefighters had to pressurize the stairwells from the lobby to assist the residents safely out of the building. Some residents reported that their exit doors jammed when they tried to egress, and first responders had to breach several doors to rescue occupants. Other residents were rescued from their apartments via aerial ladders. In some cases, when attempting to egress and faced with smoke in the corridors, occupants attempted to retreat to their apartments but were locked out.

---

[5] Miramontes, D.A., Foster, D., Mikel, R., Bove, C., and Heightman, A.J. (2015), Fire in Senior Apartments High-Rise Requires Coordinated Multi-Agency Response, Journal of Emergency Medical Services, https://www.jems.com/major-incidents/fire-in-senior-apartments-high-rise-requires-coordinated -multi-agency-response/ .
Texas State Fire Marshal's Office, Wedgwood Apartments Fire Incident Report, Texas Department of Insurance, 2014, https://www.tdi.texas.gov/fire .

Cedar High Apartments, Minneapolis, Minnesota[6]

Cedar High Apartments at 630 Cedar Avenue was a 25-story high-rise apartment building with approximately 192 units. Constructed between 1969 and 1970, the building had two stairways in the single stair enclosure, arranged in a scissor stair configuration, as well as two elevators. While the building was equipped with fire alarm notification and smoke detection devices, there were no sprinklers above the first floor and no smoke control system. Several residents reported not hearing the fire alarm system during the incident.

On November 27, 2019, the Minneapolis Fire Department responded to a fire at 630 Cedar Avenue. The fire started in a 14th floor apartment in the east corner of the building. Five people died from smoke inhalation, and several others were injured. Firefighters found the door to the apartment of origin had been left open (primary compartmentation) and the windows had been breached by the fire. Strong winds blew into the apartment and forced the smoke and heat into the corridor. The door to the apartment was fire-rated and had it not remained open, it is believed that the fire spread would have been limited.

During the fire suppression process, firefighters connected to the standpipe inside the stairwell and breached the door between the stairwell and corridor (secondary compartmentation) with their hose. This allowed the copious smoke filling the corridor from the fully developed apartment fire to enter the stairwell. Smoke also spread through the vertical elevator shaft to the floors above the apartment of origin. While the majority of the victims (four) were trapped on the fire floor due to smoke in the corridor, a fifth victim died inside the stairwell as she attempted to escape through the smoke from an upper floor.

Twin Parks Apartments, Bronx, New York[7]

The Twin Parks Apartments at 333 181st Street was a 19-story apartment building with 118 units located in the Bronx. The building was constructed in 1972, and there were two enclosures for egress. Each enclosure contained two stairs, arranged in a scissor stair configuration. The building was equipped with smoke detection and fire alarm notification devices in the hallways and apartments, but not with sprinklers. Several residents reported not hearing the fire alarm system during the incident.

On January 9th, 2022, a fire started in an electric space heater located in an apartment on the 2nd floor. The fire extended to the nearby bedding and spread throughout the apartment. While the apartment door had a self-closing mechanism, the door did not close when occupants left the apartment, allowing the fire and smoke to spread through the 2nd floor and extend to the 3rd floor. Further, some of the fire doors to the stairwells were propped open or not fully closed (as detailed below), which allowed smoke to enter the stairwells. Moreover, the stairwell door on the fire floor was breached when the fire department connected to the standpipe inside the stairwell and ran their

[6] Minnesota State Fire Marshal Division, Lessons Learned: The November 2019 Minneapolis High-Rise Fire, Minnesota Department of Public Safety, 2020

[7] New York City Fire Department, Fire Incident Reports for 333 East 181 Street, Bureau of Fire Investigation, 2022

hose from the stairwell to the fire floor. As a result of full loss of primary and secondary compartmentation, apartments outside of the area of origin became heavily involved in the fire, and heavy smoke spread throughout the building.

Some residents that were able to shelter in place avoided smoke inhalation, but other units filled with smoke and forced residents to evacuate. Sixty-two residents were present at the time of the fire. Seventeen people died, including eight children, and forty-five residents reported inhaling smoke. All seventeen casualties had attempted to evacuate, which exposed them to the smoke. Occupants who suffered smoke inhalation were found in both stairwells and in corridors and apartments up to the 19th floor. The fire department reported that by the time they arrived, smoke was pushing past the closed doors into the stairwell. During suppression, firefighters entered the 3rd floor through stairwell "B." The hose line kept the stairwell door open, resulting in black-out conditions throughout the stairwell. Firefighters and residents reported that, at some point, both stairwells "A" and "B" had become impassable due to the smoke. Residents also reported that the 15th and 18th floor doors to stairwell "B" were regularly open. It was confirmed that the 15th floor door to stairwell "B" and the 16th floor door to stairwell "A" were open at the time of the fire.

Marco Polo Fire, Honolulu, HI[8]

Constructed in 1971, the Marco Polo Condominium was a 36-story high-rise with 562 units. It served as a multi-family facility with a mixture of owner-occupied units and short- and long-term rental units. Building occupants ranged in age and physical abilities. Several residents were elderly, mobility impaired, had chronic diseases, or had a combination of these conditions. The primary structure consisted of reinforced concrete beams and columns, a concrete floor slab and concrete shear walls. The interior corridor construction was one-hour fire-resistive. A substantial number of the corridor walls, including coincident shaft walls, consisted of gypsum wall board

[8] Honolulu Civil Beat, "Insurance May Not Be Enough For Some Marco Polo Condo Owners", July 21, 2017, https://www.civilbeat.org/2017/07/insurance-may-not-be-enough-for-some-marco-polo-condo-owners/
Honolulu Civil Beat, "What Started The Marco Polo Fire Remains A Mystery", October 16, 2017, https://www.civilbeat.org/2017/10/deadly-marco-polo-high-rise-fire-cause-still-unknown/
Chapman, D., Marco Polo's New Fire Safety System, Building Management Hawaii, November 2021, https://online.flippingbook.com/view/495203721
Chapman, D., Three Years Later, Building Management Hawaii, July 2020, https://issuu.com/tradepublishingco/docs/building_management_hawaii_july_2020
Honolulu Fire Department, Fire Investigation Report No. 2017-0042415 for 2333 Kapiolani Boulevard, Unit 32602
KHON2 News "Frustration Remains for Marco Polo Residents Two Months After Building Ravaged by Fire, September 14, 2017, https://www.khon2.com/local-news/frustration-remains-for-marco-polo-residents-two-months-after-building
Honolulu Civil Beat, "Some Residents Couldn't Hear Alarms In Deadly High-Rise Blaze", July 16, 2017, https://www.civilbeat.org/2017/07/victim-in-honolulu-fire-remembered-as-talented-and-caring/
Honolulu Star Advertiser, "Fire Investigators Find Orgin of Marco Polo Blaze", July 17, 2017, https://www.stardvertiser.com/2017/07/17/breaking-news/fire-investigators-find-orgin-of-marco-polo-fire/
FPE Corner PHCPPros, "The Marco Polo Fire What We Know About The Building and One of the Largest Fires In History", August 24, 2017, https://www.phcppros.com/articles/5746-the-marco-polo-fire-current-aftermath
Anti-Sprinkler Lobbyists Aren't Thinking About Safety", March 20, 2018, https://www.phcppros.com/articles/7169-sprinklers-are-still-illegal-in-hawaii

partitions. Some dwelling unit separation walls were concrete; most were gypsum wallboard partitions consisting of one layer of 5/8 inch gypsum wallboard on either side of metal studs.

The doors between the dwelling units and the interior corridor were 1-3/4-inch solid wood core doors. It is noted that the 1967 UBC did not require self-closing devices on the doors between dwelling units and the corridor, however, it appears these doors were provided with closing devices. Corridors on each floor had access to one of three enclosed exit stairs. The center stair was designed as a smoke-proof enclosure, with an open-air vestibule between the corridor and the stairs. The 1967 UBC only required one exit to be a smoke-proof enclosure. Stair enclosures were provided with doors with a 90-minute fire protection rating. It was reported in the media that there were several units that modified the door to the corridor by installing jalousie louvers. There were other reports that some units installed "security" screen doors in front of the main door and propped the main door open for ventilation. Whether or not this condition contributed to the rapid-fire extension on the upper floors has not been confirmed. Unconfirmed fire department reports indicate that wind was a factor in this fire.

Except for the trash chutes, the building was not equipped with automatic sprinklers. The trash chute access rooms and chutes were provided with sprinklers connected to the domestic plumbing system. As an existing high-rise condominium, the Marco Polo was not required by the Honolulu building or fire codes to have complete automatic sprinkler protection. The building had a manual dry standpipe system, with standpipe risers and hose connections located in the west and east stairwells. The center stair did not have a dry standpipe riser, nor was it required by the 1967 UBC, which required buildings four stories or more in height to be equipped with not less than one dry standpipe and an additional standpipe for each additional 10,000 square feet or fraction thereof. The two dry standpipes were not interconnected, as was also permitted by the 1967 UBC. A Class II (occupant use) standpipe system was provided with fire hose cabinets located throughout the corridors. It was reported (unconfirmed) that firefighters attempting to use the fire hose cabinets experienced boiling hot water being discharged from the nozzles.

The original building fire alarm system consisted of manual fire alarm stations and alarm bells in the corridors. Elevator lobbies were equipped with smoke detectors. There was no emergency voice communication system, nor was one required by the building code for existing high-rise condominiums. Dwelling unit smoke alarms are required for existing condominiums and are permitted to be battery-operated. Several occupants of the building reported they were unable to hear the fire alarm system.

The Honolulu Fire Department responded to a fire at the Marco Polo on July 14, 2017. The fire started on the 26th floor in the living room of unit 2602. This unit is located on the northwest side of the building, very close to the west exit stair. The exact fire cause has not been determined, but HFD investigators have ruled out arson and cooking as causes. From Unit 2602, the fire extended into the corridor and eventually to upper floors through interior penetrations. It has been reported that the fire breached gypsum wallboard corridor partitions in several locations. Photographs and video of the fire show large amounts of smoke issuing from the top of various shaft openings on the roof. The fire also extended into units directly above from the exterior after having broken glass windows and balcony doors. Photographs also show that the fire "leapfrogged" to at least three units above the unit of fire origin.

Three people were pronounced dead at the scene, and five people, including one firefighter, were seriously injured. The three fatalities in this fire were a woman, age 71, found in Unit 2615, and a man, age 54, and woman, age 87, both found in Unit 2613. These two apartments were located directly across the corridor from Unit 2602. On August 4, 2017, a fourth victim died in the hospital from injuries sustained in the fire. The fourth fatality was an 81-year-old woman who was rescued from her unit on the 32nd floor suffering from severe smoke inhalation.
The fire damaged more than 200 of the buildings 562 dwelling units, forty of which were "completely destroyed. The estimated direct fire loss was $107 million.

Midtown Towers, Pittsburgh, PA[9]
The Midtown Towers at 643 Liberty Avenue was an 18-story apartment building with 95 units located in Pittsburgh's Central Business District. Built in 1907 as the Keenan Building, this building was the first skyscraper on Liberty Avenue. The building changed hands repeatedly over the years but remained an office tower until 1971, when it was converted into federally subsidized housing and renamed Midtown Towers.

On May 15, 2017, around 3 am, a fire started on the 6th floor in the bedroom of unit 606. The fire resulted in one death and four injuries. Two civilians and two firefighters were injured. Several firefighters were trapped at one point while fighting the blaze. More than 100 residents were evacuated. The cause of the fire was later determined to be smoking. Smoking materials were found near the bed of the 75-year-old victim who died in the fire because of heat exposure and smoke inhalation.

The building was not equipped with a fire sprinkler system because it was not required to be. Authorities say, however, that the building's fire alarm did function, alerting emergency personnel to the blaze. According to the fire incident report, when first responders arrived, the fire alarm panel indicated smoke detector activation on floors 8 through 12. Several tenants reported, however, that the building's fire alarm was not loud enough or startling enough.
First responders used the stairwell for access to locate the fire floor. Upon ascending the stairwell, EN03 encountered several residents evacuating down the stairwell. The residents advised EN03 of possible residents down in stairwells and hallways on the sixth floor. Upon reaching the fifth floor, smoke conditions became prevalent in the stairwell. EN03 donned facepieces and continued to the sixth floor. Upon entering the sixth floor, EN03 encountered heavy smoke conditions, with smoke banking down close to the floor level. EN03 located the fire in unit 606 and forced entry

[9] Pittsburgh Post-Gazette, "It was a very difficult fire to fight: 1 dead, 3 firefighters injured in 7-alarm downtown blaze", May 15, 2017, https://www.post-gazette.com/
Pittsburgh Post-Gazette, "Lack of sprinklers in Pittsburgh's high-rises has been an issue for years", May 15, 2017, https://www.post-gazett.com
Pittsburgh Post-Gazette, "Woman killed in fatal fire at Midtown Towers was like a mother to everyone", May 20, 2017, https://www.post-gazette.com/
KDKA News, "KDKA Investigates: Fire Officials Making Push To Have All Buildings Retrofitted With Sprinkler Systems", November 15, 2017, https://www.cbsnews.com/pittsburgh/news/kdka-investigates-sprinkler-system-retrofit/
Pittsburgh Post-Gazette, "Three years after a fatal fire, a restored Midtown Towers gets ready to welcome residents", August 31, 2020, https://www.post-gazette.com/
Pittsburgh Bureau of Fire – Fire Incident Report No. 17-1038648, May 15, 2017.

using a set of irons. Upon entry into the unit, EN03 encountered visible flames and high heat conditions.

The fire moved through void spaces in the building, making it particularly difficult to fight. Occupants recalled thick choking black smoke in the corridors, having difficulty breathing, and being led out of the building by firefighters. According to the fire incident report, the fire had run through a pipe chase that extended the entire height of the building. After initially getting the fire under control, firefighters discovered that the blaze was still burning within the building's walls, jumping between the 7th and 10th floors in a pipe chase. Furnishings with synthetic materials also increased the intensity of the fire.

Crews on the scene also reported debris falling out of a window and catching at least one dumpster behind the building on fire. Firefighters conducted a full evacuation of the building.
The incident required 31 fire suppression apparatus and 101 fire personnel. The first unit arrived on the scene at 03:06:30 and the last unit cleared at 11:41:39. As part of the overhaul operations, EN03 checked the building for fire extension. They opened pipe chases throughout the upper floors of the building and flowed water into the chases to prevent any further fire spread.

Because of the extensive smoke and water damage from the fire, the building interior had to be gutted entirely and rebuilt. The process took three years. The building now has a full sprinkler system, a new fire alarm system, a new elevator, air conditioning, a generator, and a fire pump. Overall, the renovations cost $16 million. Residents were able to move back into the restored building in September 2020.

Seven years later, on October 15, 2024, firefighters were called to the Midtown Towers around 6:45 p.m. and found heavy smoke pouring from a 13th-floor apartment. Unlike the fire in 2017, the sprinkler system suppressed this fire allowing firefighters to quickly extinguish it. The fire remained confined to that single suite, preventing further damage. Except for the residents of the fire-damaged apartment and another below it affected by water damage, the building's residents were allowed to return to their homes that evening.

Summary Table- Key Highlights from Incidents
The table below provides a consolidated view of pertinent data from each incident for comparison purposes. The table details the date the buildings were constructed, the number of stories, number of injuries and deaths, floor of fire origin, fire alarm and sprinkler system details, smoke control, and other factors affecting fire and smoke spread and life safety. The consolidated data demonstrates a common theme: a lack of fire sprinklers and compartmentation allowed for early compromise of egress pathways, trapping occupants, and resulting in numerous deaths and injuries. In most cases, these factors were further compounded by a lack of effective emergency notification systems.

	Cook County	Wedgewood	Cedar High	Twin Parks	Marco Polo	Midtown Towers
Built	1964	1962	1970	1972	1971	1907 (converted to residential in 1971)
# of stories	37 stories	11 stories	25 stories	19 stories	36 stories	18 stories
# injuries	13 injuries	18 injuries	Unknown	44 injuries	5 injuries	4 injuries
# deaths	6 deaths	5 deaths	5 deaths	17 deaths	4 deaths	1 death
Origin Floor	12th floor	3rd floor	14th floor	2nd floor	26th floor	6th floor
Fire alarm system	Equipped with detection and notification appliances	Equipped with detection and notification appliances in common areas; single station alarms in apartments	Equipped with detection and notification appliances in common areas; single station alarms in apartments	Equipped with detection and notification appliances in common areas; single station alarms in apartments	Manual fire alarm boxes at exits and bells in corridors: Elevator lobby smoke detectors; Dwelling unit smoke alarms; Supplemental occupant notification by handheld bullhorn	Smoke alarms present; further details not available
Sprinkler system	No sprinklers	No sprinklers outside of basement	No sprinklers above first floor	No sprinklers	No sprinklers except for trash rooms and chutes	No sprinklers
Smoke control	Vents in stairwells	Vents at top of stairwells	No smoke control	No smoke control	Vents in stairwells	Unknown

Factors affecting fire/smoke spread and life safety	Smoke entered stairwell from fire floor during firefighting operations; occupants egressed through firefighting stairwell; security features in stairwell trapped occupants in stairwell	Fire apartment door left open; some stairwell doors were propped open; common ceiling above apartments allowed for smoke spread	Fire apartment door left open; occupants egressed through firefighting stairwell	Fire apartment door left open; some fire doors in stairwell were propped open or did not fully close.	Fire apartment door left open; breached gypsum wallboard partitions; spread through interior penetrations; fire leapfrogged through broken window to at least three units above the unit of fire origin.	Officials indicated that the intense fire moved through void spaces in the building.

SECTION II: BEST PRACTICES FOR ADDRESSING RISK IN HIGH-RISE BUILDINGS

In this section the Workgroup presents best practices for mitigating fire risk in high-rise buildings. It emphasizes the importance of a layered safety strategy, highlights the effectiveness of automatic sprinkler systems, and provides guidance from NFPA 101 and ICC codes to support retrofit efforts in existing buildings.

According to a report published by Ahrens (2016), fires in high-rise buildings in the U.S., between the years 2009 and 2013, caused an annual average of 40 civilian deaths, 520 civilian injuries, and $153 million in direct property damage. Five occupancies made up the majority (73%) of these high-rise fires: apartments (62%), hotels (4%), dormitories (2%), offices (2%), and facilities for the care of the sick (2%). Within these high-rises, fires in apartment occupancies caused the most civilian deaths (64%), injuries (75%), and damage (25%) within a single occupancy group. Between the years 2009-2013, only 42% of high-rise apartments involved in a fire were sprinklered[10]. In Maryland specifically, a report by the National Fire Sprinkler Association (NFSA) identified 248 fires that occurred on the seventh story or above in high-rise buildings between 2000 and 2022, with an upward trend in fires over the 22-year period[11]. Approximately 87% of these fires occurred in apartments, condominiums, or other residential areas and there were approximately 26 injuries reported, or approximately one injury for every 9.5 fires. The analysis shows that the presence of operating fire sprinklers reduced the overall risk of injury by 60% and property loss reduction by 55%[12]. Due to the limitations of the NFSA study, the data collected only captured fires originating on the seventh floor or higher. It should be noted that fires occurring on lower floors in high-rises typically have higher instances of injury or death, due to vertical smoke and heat spread and the increased number of occupants above the fire floor. While these events are low frequency fires, they are very high-risk events. As can be seen through these national and state statistics, fire protection in high-rise buildings isn't just a regulatory requirement; it's a critical component of occupant safety and property preservation.

With the unique challenges posed by existing high-rise structures, such as limited retrofitting access, high occupant density, and complex evacuation routes, the selection of fire protection systems becomes even more important. Fire and life safety building codes, including the IBC and NFPA 101, require a multi-layered approach to ensure occupants are afforded the best opportunity to survive in a fire emergency. This strategy relies upon multiple means of fire prevention and protection to create a robust, redundant safety system with no single point of failure. Some of the fire safety schemes utilized in this layered approach, as outlined in the International Building Code (IBC) and NFPA 101 *Life Safety Code*, include means of egress, compartmentation, interior finishes (floor, ceiling, and wall), fire suppression, fire and smoke detection, fire alarm notification, smoke control, and operational features (i.e. written occupant emergency plans, occupant training and education, and inspection, testing, and maintenance programs). When

[10] Ahrens, M., High-Rise Fires, National Fire Protection Association, Quincy, MA, November 2016.

[11] Nisja, J. (n.d.). High-Rise Building Fires by the Numbers: Trends in the United States 2000-2022 [Review of High-Rise Building Fires by Numbers: Trends in the United States 2000-2022]. National Fire Sprinkler Association.

[12] Nisja, J. (n.d.). High-Rise Building Fires by the Numbers: Trends in the United States 2000-2022 [Review of High-Rise Building Fires by Numbers: Trends in the United States 2000-2022]. National Fire Sprinkler Association. (T.Hopkins, personal communication, May 5, 2025).

implemented, each of these methods becomes a critical element in the overall safety of building occupants.

Fire Suppression

1. Automatic Sprinkler Systems

Fire suppression is a foundational component of the layered approach. Among the various systems available, automatic sprinkler systems are consistently proven to be the most effective, model code-compliant option for retrofitting existing high-rise buildings. Model fire and life safety codes and standards recognize the effectiveness of sprinkler systems and thus incorporate requirements for their installation in nearly all building types of a significant size.

In high-rise buildings, automatic sprinkler systems represent the most cost-effective and technically sound method for providing comprehensive fire protection. Due to the inherent challenges in high-rise firefighting, including delayed manual suppression efforts, limited viable exterior access to upper floors, and complex occupant evacuation, early control of fires at the source is critical. Sprinklers, designed to activate automatically at a predefined thermal threshold, deliver immediate and localized water application significantly limiting fire growth and heat release rates. Data from the NFPA indicates that the presence of sprinklers in residential occupancies reduces the civilian fire death rate by 88% and direct property damage by 59% compared to residential structures without automatic fire suppression[13]. Furthermore, modern sprinkler systems are engineered for high reliability, with activation reported in 92% of fires where conditions warranted, and successful fire control achieved in 99% of those activations. In the high-rise environment, where manual hose streams may take 10–15 minutes or longer to reach and effectively engage a fire, the automatic operation of sprinklers ensures critical fire control during the most important early minutes by controlling fire growth and preventing the occurrence of flashover. This greatly enhances life safety, structural integrity, and firefighter operational safety. Sprinkler protection remains the foundation of a resilient, performance-based fire safety strategy for existing high-rise building retrofit.

The Maryland Fire Prevention Code (2020) adopts the 2018 edition of NFPA 101 (Life Safety Code) by reference with select local amendments. NFPA 101 (2018), Chapter 31 governs existing apartment buildings, including high-rises and other occupancies. According to this chapter, high-rise buildings must be equipped with fire protection systems that provide sufficient fire suppression, control fire spread and facilitate safe occupant evacuation. Specifically, NFPA 101 Paragraph 11.8.3.1requires that all new and existing high-rise buildings be equipped with automatic sprinklers since sprinklers have proven to be the most reliable and effective means of controlling fire growth and ensuring occupant safety. For existing high-rise apartment buildings, NFPA 101 has required automatic sprinkler protection throughout the building, or an approved engineered life safety system (ELSS), since 1991. In 2021, More recent editions of NFPA 101 recognized that “it is not always feasible for existing buildings to immediately comply with a retrofit requirement” and therefore incorporated a 12-year period for compliance (until 2033). The 2024 edition of NFPA 101 maintains the 2033 deadline for existing high-rise apartment buildings to be provided with automatic sprinkler protection. The justification for the sprinkler requirement

[13] McGree, T., U.S. Experience with Sprinklers, National Fire Protection Association, Quincy, MA, April 2024.

was developed by the 11 members of the NFPA High Rise Building Safety Advisory Committee (HRB-SAC). The text of the substantiation is copied below.

> *"The goal as stated in 4.1 of NFPA 101 is to provide an environment for the occupants that is reasonably safe from fire by the following means: (1) Protection of occupants not intimate with the initial fire development (2) Improvement of the survivability of occupants intimate with the initial fire development. Sprinklers in residential occupancies have proven time and again to greatly improve both of these things.* ***With the continued loss of life in unsprinklered high-rise apartment buildings it is time that the Code requires some form of automatic sprinkler protection in all existing high-rise apartment buildings.*** *While there were other factors at play, the Grenfell Tower fire took 71 lives and the Marco Polo condo fire claimed the lives of 4 people. It is hard to know exactly what role sprinklers would have played, but there is little doubt that, at a minimum, sprinklers, in both cases, would have slowed the fire's growth. The committee acknowledges that it is not always feasible for existing buildings to immediately comply with a retrofit requirement and therefore has allowed a 12-year period for compliance. In addition, the committee acknowledges that it can be difficult to retrofit dwelling units that are currently occupied. Therefore, an option has been provided that takes this into account"*

As alluded to in their above substantiation, the HRB-SAC proposed that if automatic sprinkler protection throughout the building could not feasibly be implemented, a partial sprinkler system and an ELSS could be considered an acceptable alternative. The partial sprinkler system would be required to include sprinklers in corridors, sprinklers in non-residential areas, and one sprinkler inside each dwelling unit, above the door opening from the corridor. This proposed approach is similar to requirements within the 1984 Los Angeles Dorothy-Mae Ordnance[14], named for the 1982 high-rise fire that killed 24 people. The ordinance requires a partial sprinkler system in pre-1943 buildings with three or more stories. Sprinklers are required to be placed in corridors along with one sprinkler inside each dwelling unit, above the door opening from the corridor. It was recognized, however, that the design of these systems was developed specifically to meet the building construction of pre-1943 Los Angeles buildings and there is no data to support the general use of such systems. In considering the partial sprinkler system option proposed by the HRB-SAC, 23 of the 24 members of the NFPA 101 Safety to Life-Residential Occupancies Committee (SAF-RES) who voted on the issue rejected the proposal. The SAF-RES provided the following statement to justify the rejection:

> *"The concept of permitting an engineered life safety system as an alternative to a fully sprinklered high-rise apartment building was merely copied from the Existing Business Occupancy Chapter (Section 39.4.2.1) several Code cycles ago to offset the resistance to the installation of sprinklers within the individual dwelling units by building owners and tenant associations. The premise appears to have been since the engineered life safety system was acceptable for an existing high-rise office, it must also be acceptable for an existing high-rise apartment building. Unfortunately, this is not true. Other than both occupancies occurring in a high-*

[14] https://lafd.org/fire-prevention/fire-development-services/dorothy-mae-ordinance

rise building, the way the occupants occupy them are radically dissimilar. While occupants of an office building are awake, alert, and participate in evacuation/ relocation drills, residential occupants are asleep, ill, intoxicated, aged, infirm, or suffering from a wide range of long-term health and/or mobility impairments. NFPA's Home Structure Fire report, dated September 2017 reports that 24-percent of residential fatalities result from fires within living rooms, family rooms, and dens and 23-percent of residential fatalities result from fires in the bedroom. Also note that cooking fires within the residence account for 47-percent of the fires. ***Given that residential fires occur most frequently within the dwelling unit, omission of sprinklers within dwelling units of an apartment building is unacceptable.*** *The ELSS option was removed for existing high-rise buildings. Existing high rises have two options- provide sprinklers or perform a performance-based design.*

Within NFPA 101 (2018), Chapter 31, the following four options are permitted for existing apartment buildings during the time period leading up to 2033:

- **Option 1-** buildings without fire suppression or detection systems
- **Option 2-** buildings provided with a complete approved automatic fire detection and notification system in accordance with 31.3.4.4
- **Option 3-** buildings provided with approved automatic sprinkler protection in selected areas, as described in 31.3.5.9
- **Option 4-** buildings protected throughout by an approved automatic sprinkler system

Option 4 is considered to be the safest configuration, and this is reflected within the NFPA 101 requirements accordingly. Options 1, 2, and 3 are intended to provide interim measures until Option 4 (complete sprinkler protection) can be achieved by 2033. When Options 1, 2, or 3 are utilized, more robust compartmentation, easier access to means of egress, and more advanced fire alarm and smoke control systems are required to account for lack of fire control via suppression.

Option 3 as defined by NFPA 101 Chapter 31, utilizes a similar approach to that proposed by the HRB-SAC for a partial sprinkler system. Option 3 requires that automatic sprinklers be provided throughout corridors and one sprinkler be provided inside each dwelling unit, above the door opening from the corridor. The rejection by the SAF-RES committee on the option to utilize a partial sprinkler system in conjunction with an ELSS confirms that Option 3, as well as Options 1 and 2, are intended to be temporary conditions in place until Option 4 (complete sprinkler protection) can be achieved.

The option to use an ELSS as part of an alternative to complete sprinkler protection, which was allowed by NFPA 101 through the 2018 edition, was removed in 2021 in response to a public input comment that indicated "the option of an ELSS system… is not working in the field" due to lack of specificity and lack of quality assurance. In lieu of requiring an ELSS, the 2021 and 2024 editions of NFPA 101 direct the designer to complete a performance-based design in accordance with Chapter 5, which is considered more rigorous than the previous ELSS requirements. While the allowance for an ELSS has been removed from the national model codes as an alternative to automatic sprinkler protection, pre-approved and installed systems are allowed to remain without additional installation of automatic sprinklers.

It is important to note here that NFPA includes a clear reminder in every edition of standard stating, "…any previous edition of this document no longer represents the current NFPA Standard on the subject matter addressed." The organization emphasizes that users should adopt the most up-to-date edition to take full advantage of advancements in safety, evolving industry practices, and the most recent technical understanding. Using outdated editions may result in code violations, reduced safety, and missed opportunities to apply proven improvements. NFPA further clarifies that at any given time, the official NFPA code consists solely of the current published editions of its documents, underscoring the importance of adhering to the 2024 editions of 2024 NFPA 1 Fire Code (published November 17, 2023) and 2024 NFPA 101 Life Safety Code (published August 25, 2023), as the current definitive and authoritative standard (as of this writing).

To summarize, the NFPA 101 committees recognize that automatic sprinkler protection of existing high-rise buildings is the most valuable life safety measure that can be implemented, and thus specifically requires the installation of sprinklers before 2033. However, the committees also recognize that this may not be feasible in some cases. In such cases, a rigorous performance-based design for the specific building must be implemented to ensure that an adequate level of protection can be met while a building is without an automatic suppression system. Some of the components that have been considered (or suggested) for incorporation into such a design are discussed in the sections below.

2. Other Fire Suppression Systems

In high-rise fire safety, no single solution fits every scenario but when evaluating systems for whole-building coverage, retrofit feasibility, cost-effectiveness, and life safety, automatic fire sprinklers consistently outperform the alternatives. A breakdown of how automatic fire sprinklers compare to other common fire suppression systems is provided below.

a. Water Mist Systems

While water mist systems offer some innovative benefits, they fall short when it comes to practicality in existing high-rises:

Pros:

- Use significantly less water than traditional sprinklers.
- Minimize water damage, which is beneficial for spaces with sensitive equipment.
- Can be effective in enclosed and small-scale environments.

Cons:

- High installation costs due to specialized high-pressure piping and associated restraints, nozzles, water and nitrogen tanks, and high-pressure pumps.
- Reduced effectiveness in ventilated or open spaces, which are common in high-rise designs.
- Complex maintenance requirements and specialized parts are not widely available.
- Limited regulatory clarity for full-building residential applications.

Why Sprinklers Are More Suitable for High-Rise Apartments: Automatic sprinklers deliver more consistent and reliable fire suppression across all areas of a high-rise, regardless of room size,

ventilation, or ceiling height. They're governed by well-understood building codes, and installation can be streamlined using modern, cost-efficient materials.

b. Clean Agent / Gas Suppression Systems (e.g., FM-200, Novec 1230)

Clean agent and gaseous suppression systems, such as FM-200 and Novec 1230, are not well-suited for high-rise retrofit applications when compared to automatic sprinkler systems. These systems are governed by NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems, which requires a tightly enclosed, controlled environment to maintain the agent concentration necessary for effective fire suppression. Retrofitting a high-rise to meet these requirements would necessitate extensive compartment sealing, pressure-relief venting, and ongoing integrity testing (per Annex C of NFPA 2001), which is often impractical, cost-prohibitive, and operationally disruptive in older or occupied buildings. Additionally, clean agent systems are designed for protection of specific hazards or small room volumes, not the large, interconnected floor plates and open spaces typical of high-rise design. In contrast, automatic sprinkler systems, compliant with NFPA 13 Standard for the Installation of Sprinklers, provide wide-area, scalable fire control and life safety benefits by directly cooling, suppressing, and containing fires, enhancing survivability for occupants and improving tactical conditions for first responders. Sprinklers offer proven, practical, and economically feasible fire protection across the entire building footprint, making them the superior choice for high-rise retrofits.

Pros:

- Leave no residue, ideal for data centers, server rooms, and sensitive electronics.
- Rapid discharge can extinguish a fire before it spreads.

Cons:

- Only effective in fully enclosed, sealed environments.
- Do not cool the space, they suppress flames, but heat and smoke remain.
- Has a finite supply of extinguishing agents, limited by the size of the storage tank(s). In most applications, an interlocked pre-action sprinkler system is required as a backup in case the clean agent is depleted prior to suppressing the fire.
- Post-discharge, the room must often be vented and equipment reset, causing downtime.
- Expensive to refill and maintain.
- Requires automatic smoke detectors throughout the protected space to activate the releasing panel and to provide occupants time to leave the space.
- Ineffective in common areas, open-plan units, or corridors.
- Intended for use in data centers that don't contain household furnishings made of materials with high heat release rates.
- Some agents, such as FM-200 and Novec 1230 are being phased out due to environmental concerns.

Why Sprinklers Are More Suitable for High-Rise Apartments: Sprinklers actively cool the space, suppress flames, and reduce smoke; all critical for safe evacuation. They don't require enclosure sealing or expensive recharging and can protect entire floors, not just isolated rooms.

c. Kitchen Hood Suppression Systems and Hood Suppression Canisters

In residential occupancies, cooking is the leading cause of all building fires and injuries[15]. Kitchen hood suppression systems are specifically designed to protect localized cooking equipment and commercial kitchen hazards. When they operate as intended, these systems can be very effective in suppressing cooking fires and preventing spread outside of the cooking area. However, they offer no protection for general building areas, corridors, other areas of residential units (i.e., bedrooms living rooms), or structural components, making them wholly inadequate as a primary fire protection solution for a high-rise retrofit.

Additionally, fire suppression hood canisters, often sold for residential kitchens or small-scale use, are not certified by recognized agencies such as UL or FM Global. Lacking formal performance testing, these devices are not recognized by national building or fire codes. They may offer limited extinguishment over a stove or cooktop but do not deliver reliable, regulated, or inspected fire protection. Unlisted canisters cannot replace automatic sprinkler systems in high-rise buildings and do not satisfy the fire suppression requirements of NFPA 101 (Life Safety Code) or NFPA 1 (Fire Code).

Commercial kitchen hood suppression systems are governed by NFPA 96 and NFPA 17A. These systems target grease fires within the immediate cooking area and require close proximity to the hazard to be effective. These systems are required in all new commercial kitchen installations per NFPA 96, as referenced by the MSFC, the IBC and International Mechanical Code (IMC).

In contrast, automatic sprinkler systems provide comprehensive, scalable coverage throughout the building, offering life safety, property protection, and early fire control across all occupancies and spaces—not just isolated hazard zones. As a result, fire sprinklers remain the only practical, code-compliant, and proven solution for broad fire protection in high-rise retrofits.

Pros:
- Highly effective for commercial kitchen fires involving grease or cooking oils.
- Activate quickly and suppress high-risk flames at their source.

Cons:
- Extremely limited in coverage—protects only kitchen appliances and cooking surfaces.
- Has a finite supply of extinguishing agents limited by the size of the storage tank/canister. Note that automatic sprinkler systems are required to be installed in commercial kitchens to serve as a backup if the chemical supply is depleted.
- Not applicable for general area fire protection in living rooms, bedrooms, and other areas where fires are also known to start.

Why Sprinklers Are More Suitable for High-Rise Apartments: Automatic sprinklers offer whole-building protection, including kitchens, living areas, lobbies, stairwells, laundry rooms, storage rooms, and mechanical rooms. A hood system might control a stovetop fire, but it won't protect occupants from a fire that starts in the adjacent hallway, sleeping area, or neighboring unit.

[15] Federal Emergency Management Agency (FEMA), (2021), Cooking Fires in Residential Buildings (2017-2019), Topical Fire Report Series, 21(5).

d. Fire Extinguishers

While fire extinguishers are a critical first line of defense for incipient fires, they are not a substitute for automatic fire sprinkler systems when it comes to protecting high-rise buildings. Fire extinguishers depend entirely on human intervention: someone must be present, trained, and willing to act quickly under high-stress conditions. In a high-rise environment, where evacuation times are extended and fire spread can be rapid, relying solely on extinguishers is insufficient for comprehensive life safety and property protection. Sprinklers, by contrast, activate automatically and without human action, providing immediate suppression even when a space is unoccupied—an essential feature for nighttime fires or during off-hours when staffing is low. Sprinkler systems ensure continuous, scalable fire protection throughout the entire building, making them indispensable for effective high-rise fire defense.

Pros:
- Low upfront cost.
- Readily available in emergencies.
- Essential tools for trained occupants for incipient fire control.

Cons:
- Rely entirely on human response—ineffective if no one is present or trained.
- Can't suppress rapidly spreading fires.
- Limited reach and duration; has a finite supply of extinguishing agent due to the size of the tank; not suitable for large-scale protection.
- Difficult to use by elderly occupants and occupants with limited dexterity

Why Sprinklers Are More Suitable for High-Rise Apartments: Sprinklers activate automatically and immediately, even if no one is home. This makes them especially effective for nighttime or unoccupied fires, and they can suppress the fire early before flashover occurs.

Summary Comparison Table

System	Covers Entire Building?	Suppresses Fire Automatically?	Effective in Open Areas?	Retrofit-Friendly?	Cooling/Smoke Reduction?
Sprinklers	☑ Yes	☑ Yes	☑ Yes	☑ Yes (can have challenges due to the need to route pipe through concealed spaces or through materials containing asbestos)	☑ Yes
Water Mist	✗ No	☑ Yes (limited areas)	✗ No	✗ Difficult	✗ Limited
Clean Agent	✗ No	☑ Yes (sealed rooms only)	✗ No	✗ Difficult	✗ No

System	Covers Entire Building?	Suppresses Fire Automatically?	Effective in Open Areas?	Retrofit-Friendly?	Cooling/Smoke Reduction?
Hood Systems	❌ No	☑ Yes (kitchens only)	❌ No	☑ Easy (in kitchens)	❌ No
Fire Extinguishers	❌ No	❌ No	❌ No	☑ Easy	❌ No

3. Fire/ Smoke Detection and Alarm Systems

Detection and occupant notification are also foundational components of the layered approach. Early fire detection is critically important in existing high-rises, where longer evacuation times, limited access for firefighting crews, and the high risks associated with delayed response make it even more crucial. Smoke detectors, fire alarm systems, and other automatic early warning technologies play an essential role in detecting a fire and notifying occupants, which in turn initiates emergency response actions. Additionally, voice evacuation systems are vital for providing clear, real-time instructions to occupants, guiding them safely out of the building. Despite the importance of early detection and communication, these systems alone do not stop fire growth. Without active fire suppression, a rapidly detected fire can escalate into a major incident before firefighters are able to intervene and occupants are able to safely escape. Smoke alarms and detectors are necessary for providing the initial alert, but they only notify occupants; they do not control or extinguish the fire. Therefore, integrating automatic early detection with automatic fire suppression is critical to forming a complete fire safety strategy. This combination not only provides timely notification but also actively suppresses the fire at its source, maximizing life safety, property protection, and operational resilience.

Per NFPA 101 Chapter 31, all existing high-rise apartment buildings are required to be provided with a manual fire alarm system. This is true for buildings that are protected with or without automatic sprinkler systems or automatic fire detection systems; the manual fire alarm system requirements apply to Options 1 through 4 as defined in NFPA 101 Chapter 31. This system must be capable of being activated manually via a fire alarm pull station and, if applicable, automatically upon operation of the sprinkler system. Occupant notification is required to be provided via audible signals that can be effectively heard above the average ambient sound level under normal conditions in both common areas and apartment units. Since the early 1990s, NFPA 72 has prescribed specific audibility levels of 15 dBA above the average ambient noise in all areas. For sleeping areas, additional minimum audibility levels are required. Originally, the minimum sound level in sleeping areas was 70 dBA and since 2002, the minimum sound level (measured at pillow level) is required to be 75 dBA. This audibility level is required to be met by both the building fire alarm system notification devices (i.e. horns or loudspeakers in corridors and dwelling units) and by audible alarm devices in a dwelling unit (i.e. smoke alarms). Inside apartments, smoke alarm requirements vary by the protection scheme option utilized for the building, as outlined below:

- **Option 1 (no sprinkler and no automatic fire detection system – only manual fire alarm system activation)-** In every sleeping area, outside every sleeping area in the immediate vicinity of the bedrooms, and on all levels of the unit

- **Option 2 (no sprinkler and complete manual and automatic fire detection system)-** Heat detectors are required in each room of the apartment. Smoke alarms within the apartment units are not required.
- **Option 3 (sprinkler protection in selected areas)-** In every sleeping area, outside every sleeping area in the immediate vicinity of the bedrooms, and on all levels of the unit
- **Option 4 (full sprinkler protection throughout the building)-** Outside every sleeping area in the immediate vicinity of the bedrooms and on all levels of the unit

Smoke alarms inside the apartment are intended to notify the occupants within that apartment only; they do not activate the building fire alarm system notification devices. This approach is used to ensure that building wide evacuation does not result from nuisance alarms, e.g., from burned food, etc. If an actual fire exists, notification to the rest of the building is intended to be provided in a timely manner via operation of an automatic sprinkler within the apartment or occupant activation of a manual pull station. When Option 2 is utilized, the heat detectors inside the apartment do activate the building fire alarm system.

In Option 1 and Option 2, when complete automatic sprinkler protection is not provided for an existing apartment building, additional smoke alarms or heat detectors are required to be provided within all bedrooms. The intent of this requirement for additional devices is to provide earlier detection and warning of fire or smoke conditions and to provide occupants with a greater amount of time to safely escape.

In the case of Option 1, where there is no automatic initiation of the building wide fire alarm system, notification to other occupants relies solely on human behavior, so an occupant is expected to activate a manual pull station. Ideally, this is done by the occupant who first discovers the fire in the apartment of origin. However, this is not always the case, which can lead to significant delays in notification to all building occupants. Relying on human behavior is a single point of failure in the safety system that can lead to significant delays in emergency forces notification, occupant notification, and evacuation. Without a sprinkler system to control the growth of the fire, conditions within the building may become untenable with heat, smoke, and toxic gases before occupants are even aware of the need to evacuate. As such, in order to reduce the required time to egress, NFPA 101 Chapter 31 restricts the distances an occupant must travel to an exit if Option 1 is utilized (See Section e). Even with these restrictions, per the overall strategy of NFPA 101 Chapter 31, the allowance of this condition is only temporary while building owners work towards providing complete automatic sprinkler protection; it is not an acceptable permanent condition.

In Option 2 a more extensive fire detection system is utilized. In addition to heat detectors installed in each room of an apartment, smoke detectors are required throughout all common areas and workspaces. These heat and smoke detectors automatically activate the occupant notification devices throughout the building. By reducing the reliance on occupant actions, this approach increases the probability that a fire will be detected in its early stages and occupant notification will be initiated shortly after detection. However, while these additional features increase the time available to occupants to evacuate safely, they do not prevent the spread of fire and smoke. Not all occupants leave immediately after a fire alarm system is activated and some occupants, such as the handicapped, elderly, or young, may not be capable of leaving without assistance. Moreover, in buildings that experience false alarms, occupants may question if the emergency is real. When the time required to exit the building is significant, as is the case in high-rise buildings, there is a

risk that conditions will become untenable with heat, smoke, toxic gases, and no visibility as the fire grows and occupants are egressing from floors above the fire. Therefore, Option 2 is not considered an acceptable, permanent condition.

When Options 1, 2, or 3 are being utilized as temporary measures, features beyond automatic sprinkler protection and fire detection and notification are required to increase the level of safety. These additional features are discussed in the proceeding sections.

a. Fire Compartmentation

Compartmentation, a component of the layered approach, controls the spread of fire and smoke (depending on the design). Compartmentation may consist of fire barriers, fire partitions, fire walls, smoke barriers, smoke partitions, fire doors, and firestopping. These features are designed to resist the passage of heat and smoke so that occupants on the non-fire side are provided with additional time for safe egress. They also provide protection for the building itself to reduce impacts that may compromise structural integrity. Exits, such as enclosed stairwells, are typically required by building and fire codes to be enclosed with fire barriers so that occupants can travel down the stairs with a safe separation from hazardous conditions. Compartmentation is the primary method used to limit the spread of fire and smoke in non-sprinklered buildings and when these systems are installed and maintained as required, they are highly effective. However, in general, the exit compartmentation method assumes that all occupants will receive early notification of a fire and promptly leave the building before fire department suppression activities begin, i.e., before compartmentation is breached by hose lines running from standpipes in the stairwells through fire doors onto the fire floor and into the fire apartment. All compartmentation is also highly dependent upon systems being properly inspected, tested, and maintained (i.e., ensuring fire doors automatically close). As such, modern day fire and life safety approaches are layered and include both compartmentation, active smoke control, and suppression to eliminate the potential for single points of failure.

In existing high-rise apartment buildings that are not protected throughout with automatic sprinklers (Options 1, 2, & 3), stairwells are required to be enclosed with 2-hour rated fire barriers with door openings protected by 1 1⁄2-hour rated fire doors. In existing high-rise apartment buildings that are protected throughout with automatic sprinklers (Option 4), the fire resistance rating of the stairwell enclosure is permitted to be reduced to 1-hour with door openings protected by 1-hour rated fire doors. In all buildings, doors to stairwells are required to be self-closing and self-latching.

In all existing high-rise apartment buildings, exit access corridor walls are required to have a minimum fire resistance rating of ½-hour. In buildings that utilize Option 1 or 2, doors that open into exit access corridors are required to be at least 20-minute rated fire doors. In buildings that utilize Options 3 or 4, doors that open into exit access corridors are not required to be rated fire doors but are required to resist the passage of smoke. All doors that open into exit access corridors are required to be self-closing and self-latching in all existing high-rise apartment buildings.

In existing high-rise apartment buildings, apartment units are not required to be separated by fire barriers. This is due to the recognition that retrofitting all apartment walls to meet a minimum fire resistance rating is not reasonably feasible. However, all new high-rise buildings, which must have

sprinkler protection, are required to have 30-minute fire resistance rated walls between apartment units. In new low-rise apartment buildings not protected with a sprinkler system, the unit separations are required to have a 1-hour fire resistance rating.

Without an automatic sprinkler system to suppress a fire, compartmentation becomes the only method to limit the spread of fire and smoke; for this reason, NFPA 101 increases the requirements for enclosures of exits, exit access corridors, and apartment units. This exemplifies the idea that more robust compartmentation is needed when sprinkler protection is not present, as the heat and smoke must be contained solely by these methods, even as the fire continues to grow. However, in the absence of fire suppression, these systems will eventually become overwhelmed. Additionally, it is important to understand that compartmentation methods that include fire doors, or other openings, can easily become compromised. In recent years, several multi-fatality, high-rise building fires in the U.S. have highlighted vulnerabilities associated with compartmentation in non-sprinklered buildings (see Section I). In these incidents, apartment doors that failed to close and stairwell doors that were breached for standard firefighting procedures (i.e. hose line from the stairwell to the fire floor) allowed smoke to spread, uncontrolled, exposing occupants and causing fatal consequences. As such, in high-rise apartment buildings, compartmentation cannot be the only method of fire and smoke control, as this would be a single point of failure. Compartmentation must be used in conjunction with other active means of protection, i.e., the layered approach, to ensure occupants are afforded adequate protection during egress. Additionally, it is important to ensure proper inspection, testing, and maintenance programs are implemented for fire compartmentation systems, whether sprinkler system protection is provided or not; this aids in improving the reliability of these systems.

b. Smoke Control

For the design of active smoke control systems, NFPA 101 and the IBC reference NFPA 92: *Standard for Smoke Control Systems*. NFPA 92 establishes two types of smoke control systems, smoke containment systems and smoke management systems. Generally, smoke containment systems look to restrict the movement of smoke from one area to another (i.e., prevent smoke from entering a stairwell), while smoke management systems are intended to mitigate the impacts of smoke within an area (i.e., exhausting smoke from an atrium). In the case of high-rise apartment buildings, smoke containment systems are the most applicable.

There are five design approaches that NFPA 92 offers for smoke containment – stairwell pressurization, zoned smoke control, elevator hoistway pressurization, vestibule pressurization, and smoke refuge area pressurization. These design approaches are discussed within the proceeding sections.

c. Stairwells

In fatal fire incidents, compartmentation failures have led to exposure of evacuating occupants to toxic gases in egress pathways, particularly stairwells. This warrants a special focus on protecting the integrity of stairwells which serve as the only egress routes from the upper floors of a high-rise building. NFPA 101 and the IBC address this concern through requirements for smokeproof enclosures for exit stairs in high-rises. In addition to automatic sprinkler protection throughout the building, the IBC requires stairwells in all new high-rise buildings, including apartments, to be smokeproof enclosures. For existing high-rise apartment buildings not protected with automatic

sprinklers throughout, NFPA 101 Chapter 31 requires that all exit stairs be smokeproof enclosures. This NFPA 101 requirement is retroactive and is required to be implemented immediately if Options 1, 2, or 3 are utilized while working to install complete sprinkler protection. If an existing apartment building is protected throughout with an automatic sprinkler system, then NFPA 101 does not require exit stairs to be smokeproof enclosures. While this is a decrease in the level of protection required for new buildings, NFPA 101 recognizes that the protection provided by an automatic sprinkler system is the most critical and thus deems this condition acceptable.

NFPA 101 and the IBC prescribe several methods to achieve smokeproof enclosure of stairwells. These include using natural ventilation, mechanical ventilation incorporating a vestibule or by pressurizing the stair enclosure. Of these, stairwell pressurization is the most common and the most easily implemented in existing buildings.

d. Stairwell Pressurization

Typically, the design pressure for stairwell pressurization is achieved by installing fans that inject fresh air into the stairwell. In basic systems (non-compensated) fans are typically sized assuming that all doors in the stairwell will be closed and are designed to deliver a constant pressure for that condition only. However, as seen in previous fire incidents, a breach of stairwell doors can be expected once the fire department arrives, and while occupants are still exiting. In a non-compensated system, the fans cannot provide a greater pressure to account for open doors as the maximum pressure differential provided by the stairwell pressurization system is limited by the maximum allowable force to open doors into the stairwell. In other words, increasing the interior stairwell pressure to account for an open door on the fire floor may cause occupants to not be able to open a stairwell door and enter the enclosure on other floors. A compensated stairwell pressurization system can help to protect against open door conditions. These systems can utilize either a modulating supply airflow or means for overpressure relief to adjust the pressure inside the stairwell such that it remains consistent as doors are opened and closed. While these types of systems provide enhanced smoke protection for the stairwell, they still have limits to their capabilities. If the fire continues to grow due to the lack of automatic fire suppression, pressures on the fire floor are likely to overwhelm the system, particularly when the stairwell door is opened on the fire floor during firefighting operations. This results in smoke entering the stairwell unimpeded, essentially rendering the stairwell pressurization system useless. As such, the coupling of a smoke containment system with an automatic fire suppression system is critical in the overall life safety strategy for a high-rise building, e.g., a layered approach.

e. Natural Ventilation

This approach requires exterior vestibules between the interior of the building and the stair enclosure. It is not typically implemented in high-rise buildings.

f. Vestibules

If stairwell pressurization is not utilized, then stairwell vestibules with mechanical ventilation are required in all new high-rise buildings per NFPA 101 and the IBC. Vestibules create a buffer between the interior of the fire floor and establish a multi-layer defense where the smoke must overcome both the protection at the vestibule and at the stairwell. The vestibules are provided with independent supply and exhaust ducts with the exhaust riser discharging to the exterior of the building. This allows smoke to collect and be removed prior to entering the stairwell. Additionally,

the stairwell is required to be provided with a dampered relief opening and supplied mechanically with sufficient air to maintain a minimum positive pressure relative to the vestibule when doors are closed. This helps prevent smoke from migrating from the vestibule into the stairwell but is not considered a stairwell pressurization system. In existing buildings, adding stairwell vestibules with mechanical ventilation is often difficult, if not infeasible, due to space limitations.

Pressurized vestibules are those in which supply air is provided to create a positive pressure differential in the vestibule relative to the interior of the fire floor. While pressurized vestibules cannot be used as a standalone approach, they can be utilized to increase the effectiveness of stairwell pressurization systems; however, they are not commonly implemented.

As is the case with stair pressurization systems, smokeproof enclosures created using vestibules are vulnerable to being compromised during fire department operations. Standard operating procedures for fire departments are to connect standpipe hose lines on the floor below a fire and then bring the hose line up the stairs and through the doors to the fire floor. As such, even if the standpipe hose connections are in a stairwell vestibule, it is still expected that both the stairwell entry door and the vestibule entry door will be opened and remain open during firefighter operations. This quickly eliminates the buffer provided by the vestibule. If the fire continues to grow due to the lack of an automatic fire suppression system, conditions can overcome the capabilities of the vestibule exhaust and, if provided, the stairwell pressurization system.

4. Elevator Hoistways

In addition to smoke protection requirements for stairwells, the IBC requires openings in elevator hoistways in all new high-rise buildings to be protected to prevent the migration of smoke from floor to floor through the hoistway. This can be achieved through provision of enclosed elevator lobbies, additional smoke and draft control door assemblies at the hoistway door opening, or positive pressurization of the hoistway. As is the case with stairwells, a fire that continues to grow will soon overcome the capabilities of an elevator hoistway pressurization system. As such, elevator lobbies or additional smoke and draft control doors at the hoistway openings may provide better protection in the case of buildings not protected throughout by an automatic sprinkler system. There are no retroactive requirements in the IFC or NFPA 101 for elevator hoistway smoke control. Without an automatic sprinkler system to control the growth of the fire, smoke can infiltrate upper floors in existing high-rise buildings through the elevator hoistways, as has occurred in multi-fatality fires (see Section I).

a. Smoke Compartments

Establishment of multiple smoke compartments or smoke zones on each floor level can aid in restricting migration of smoke from the fire area to other areas of the building. This allows for an increased amount of time for occupants who are remote to the fire to be alerted of the emergency and begin egress activities. It can also serve as an additional layer of protection between the fire area and at least one exit, such as a stair. Smoke compartments are established via smoke barriers or partitions which are constructed as a continuous membrane (i.e. wall) to resist the movement of smoke. Openings in the smoke barrier wall are protected by listed smoke or fire doors.

Per NFPA 101 Chapter 31, all exit access corridors, in existing high-rise apartment buildings that are not protected throughout with automatic sprinklers (Options 1, 2, & 3), are required to be

divided into at least two smoke compartments of equal size via smoke partitions; this requirement does not apply if exits are less than 50 feet apart. The length of a single smoke compartment cannot exceed 200 feet. These requirements are retroactive and therefore, if buildings are to remain without sprinkler protection for a prolonged period, they must be implemented. Because of the additional protection afforded by a complete automatic sprinkler system, smoke compartments are not required in existing high-rise apartment buildings that utilize Option 4.

b. Means of Egress

In fire safe building design, the objective is to evacuate or relocate occupants to a place of safety, e.g., outside, before they are subjected to untenable conditions caused by smoke, heat, and toxic gases produced during a fire. The number of means of egress available to the occupants and the arrangement of these means are critical in determining the amount of time occupants may be exposed to hazardous conditions and the amount of time occupants need to escape. The longer an occupant must travel through an unprotected area, the more susceptible they are to succumb to the effects of the fire, particularly smoke. As such, life safety codes establish requirements to limit the distances occupants must travel prior to reaching an exit. An exit can be a door to the exterior or a protected exit enclosure, such as a fire resistance rated stairwell. Once the occupant is inside the exit enclosure, they are considered protected, and codes do not prescriptively limit the amount of time for occupants to travel down the stairs. This emphasizes the points made previously on the importance of effective smoke control for protection of stairwell enclosures which is dependent on suppressed fire growth.

Automatic sprinkler systems are effective in quickly limiting the spread of fire and thus, smoke. As such, fire and life safety codes recognize that occupants remote from the fire in buildings fully protected with automatic sprinkler systems will be afforded a greater amount of time for safe egress. This permits greater exit access travel distances to be used. Per NFPA 101, Chapter 31, in existing apartment buildings without sprinkler protection or complete smoke/fire detection (Option 1), the maximum allowable travel distance from an apartment door to the nearest exit (i.e. stairwell door) is 100 feet. In buildings provided with additional means of protection such as partial sprinkler coverage or complete smoke/fire detection (Options 2 and 3), this maximum allowed travel distance is increased to 150 feet. In this case, the partial sprinkler system and automatic smoke/fire detection is expected to provide earlier warning of a fire and limited suppression if sprinklers are provided, thus increasing the amount of time available for escape. In existing apartment buildings protected throughout by an automatic sprinkler system (Option 4), the maximum travel distance is allowed to be increased to 200 feet. Due to the increased levels of protection, travel distances from any point within an apartment to a corridor door are also allowed to be increased when the building is protected throughout with automatic sprinklers or complete automatic smoke/fire detection (Options 2 and 4); for buildings using Option 1 or 3, this is 75 feet, and for buildings using Option 2 or 4, it increases to 125 feet. At least two exit stairs are required in all high-rise apartment buildings and occupants on each floor must be provided with ready access to both. In buildings protected throughout with an automatic sprinkler system (Option 4), once an occupant leaves an apartment, they must travel a maximum distance of 50 feet before they are presented with an option to travel towards either exit. This is defined as the common path of travel. In buildings not protected throughout with an automatic sprinkler system (Options 1, 2, and 3), the common path of travel is limited to 35 feet. To summarize, existing apartment buildings protected throughout with automatic sprinkler systems are permitted to be larger and have larger apartment units than

those without complete automatic sprinkler protection. The size of existing apartment buildings and the location of the exits therein cannot feasibly be altered. Therefore, the individual building must be examined and the methods of detection and suppression designed around these constraints.

5. Operating Features

In the hierarchy of controls for reducing risk of injury, engineering controls, such as those discussed previously in this section, take precedence over administrative or operational controls such as education, training, and rules or policies. Engineering controls are more effective because they rely less on human action. This is especially true in apartment buildings where consistent and repeated education, training, and cooperation of occupants is difficult, significant turnover of occupants is ongoing, and visitors who are unfamiliar with the building are present. Additionally, relying on residents to respond according to plan during a fire is a risk in and of itself. The materials in modern furnishings produce toxic deadly smoke and gases, with flashover generally occurring in less than 2 minutes. This rapidly degrading environment causes extreme distress to the exposed occupants. Due to this distress, and despite repeated training and drills which cannot realistically simulate an emergency, these occupants become wholly unreliable to complete tasks required for extinguishment (i.e., fire extinguishers), containment (i.e., closing doors), or notification (i.e., activating fire alarm). However, implementing operational features into the overall fire and life safety plan of an apartment building can still play an important role by adding another layer of protection/mitigation.

NFPA 101, Chapter 31 provides limited requirements for operating features of existing high-rise apartment buildings. These requirements include the following:

1. Establishment of emergency actions plans, reviewed and approved by the authority having jurisdiction (AHJ), that outline the following:
    1. Occupant and staff response to emergencies
    2. Evacuation, relocation, and shelter-in-place procedures appropriate to the building, its occupancy, emergencies, and hazards
    3. Appropriateness of the use of elevators
    4. Design and conduct of fire drills
    5. Type and coverage of building fire protection systems
    6. Specific details, locations, and operational features of security features that could impact or be integrated with life safety systems
    7. Design and conduct of life safety, security, lockdown, and other drills not associated with fire
    8. Operational features that are to be integrated with a voice evacuation system, a mass notification system, or both, to meet design and operational requirements of other installation standards
    9. Other items required by the AHJ
2. Provision of emergency instructions to occupants of each apartment to indicate location of alarms, egress paths, and appropriate actions to be taken if a fire occurs in their apartment or another apartment in the building.
3. Annual inspection of doors to exit enclosures, such as stairs, and doors with electrical locks or other special locking arrangements.

4. Prohibition of highly flammable furnishings or decorations outside of dwelling units.
5. Integrated testing of fire and life safety systems per NFPA 4: *Standard for Integrated Fire Protection and Life Safety System Testing* at least every 10 years.

These operational features can significantly influence how occupants and employees respond to an emergency and therefore it is critical to ensure that they are implemented, whether a building has sprinkler protection or not.

Regarding fire drills, NFPA 101 Chapter 31 does not specify frequency or methods; it is left to the building owner to establish this in the approved emergency action plan. For high-rise office buildings, NFPA 101 Chapter 39 goes one step further and requires "periodic" fire drills, as well as fire extinguisher training for occupants. To take a similar approach for high-rise apartment buildings, an AHJ may consider establishing the required frequency (i.e. annual) and methods of fire drills, as well as requiring fire extinguisher training for occupants. Additionally, providing fire prevention training to occupants on topics such as safe cooking practices and electrical safety, can help to reduce the risk of a fire occurring in the first place. Training and education coupled with the previously mentioned layers of the safety system can provide a comprehensive approach to reduce risk and save lives in existing high-rise apartment buildings.

a. Inspection, Testing and Maintenance

Engineering controls such as automatic sprinkler systems, fire alarm systems, smoke control systems, and fire doors remain effective if they are properly maintained in their original, approved condition. Therefore, periodic inspections and testing must be conducted to ensure their operability and identify issues before they arise. The NFPA standards provide comprehensive inspection, testing, and maintenance (ITM) requirements specific to each type of fire and life safety system. By reference, existing apartment buildings are required to comply with these requirements for all systems utilized in the building. However, history has shown that this is not always the case (see Section I). Automatic sprinkler systems, fire alarm systems, and fire extinguishers are prominent features of a building that are commonly included in regular ITM programs, although the necessary frequency and scopes of this ITM may not always be compliant. For example, automatic sprinkler systems require monthly, quarterly, semi-annual, and annual inspections and tests; however, many buildings will only conduct annual inspections and tests. This leaves some system components vulnerable to failure during the extended time between inspections/tests. Less prominent fire and life safety features such as smoke control systems, emergency lights and exit signs, fire and smoke doors, and fire and smoke dampers are even more susceptible to neglect. Many buildings do not have established periodic ITM programs that are compliant with the requirements of the applicable fire and life safety codes for these systems. Building owners and operators must be made aware of these requirements in order to implement the appropriate ITM programs and competently oversee the service companies that are contracted to perform these critical tasks.

b. Jurisdictional Oversight and Enforcement

The fire and life safety code requirements for apartment buildings, whether prescriptive or performance-based, are established through adoption of the appropriate codes and standards by an AHJ. For new buildings, the initial design and installation of these systems is often overseen through the issuance of building and construction permits and/or use and occupancy permits. These

processes are crucial in ensuring the appropriate systems are selected and installed in a compliant manner. The process for oversight of retroactive requirements for existing buildings, however, is not as well established in many jurisdictions. The same is true for ongoing operational requirements, such as fire and life safety system ITM and education of occupants on emergency procedures. Due to the expenses and challenges associated with maintaining compliance with these operational requirements, without adequate oversight and enforcement, building owners or operators may cut corners. This can be detrimental to the fire and life safety features of a building and can lead to fatal consequences. The multi-fatality fires referenced in Section I demonstrate a common causal factor was lack of system inspection, testing, and maintenance. To prevent this, jurisdictions need to consider implementation of well-developed education programs, periodic inspections of existing buildings, and enforcement procedures when compliance issues are identified or reported.

Chapter 1 of the IFC outlines the authorities and responsibilities of the fire code official and department of fire prevention. Responsibilities of the department include the implementation, administration, and enforcement of the code provisions and authorities include, but are not limited to, requiring and issuing permits, requiring and conducting inspections, and initiating prosecution of violations. The process used to establish and conduct these authorities and responsibilities must be well developed by the jurisdiction. They should ensure that the fire and life safety objectives are not just idealistically met but that actual, widespread, and ongoing compliance is achieved through oversight and enforcement. To do this, requirements for operational permits or periodic permits, such as annual or triennial, can be considered for existing high-rise buildings, particularly those not protected throughout with an automatic sprinkler system. Oversight and enforcement help to ensure the required fire and life safety features, either existing or retroactively installed, will function during an emergency.

6. Summary

The fire protection industry has reached a consensus that in high-rise buildings an automatic sprinkler system is needed to achieve adequate levels of fire and life safety. Building owners, fire prevention authorities, and government officials should share a common goal to adopt the nationwide consensus approach. Current fire and life safety codes reflect this mentality through complete automatic sprinklers system requirements that are retroactive, with NFPA 101 requiring compliance by 2033. In the interim, NFPA 101 requires alternative fire protection methods (Options 1, 2, and 3) to be implemented to provide an acceptable level of life safety. These methods include, at a minimum, the following fire protection and life safety features:

1. Smoke alarms or heat detectors in every sleeping area.
2. Stairwells enclosed with at least 2-hour fire resistance rated construction with at least 90-minute fire resistance rated, self-closing, and self-latching doors.
3. At least 20-minute fire resistance rated corridor doors, unless partial sprinkler protection is provided.
4. Smokeproof exit enclosures via natural ventilation, mechanical ventilation incorporating a vestibule, or pressurizing the stair enclosure.
5. At least two smoke compartments on each floor.
6. Decreased maximum exit access travel distances.

These requirements are in addition to the following requirements applicable to all existing high-rise apartment buildings, even those protected throughout with automatic sprinklers.

1. A manual fire alarm system.
2. Smoke alarms outside every sleeping area and on all levels of an apartment unit.
3. Stairwells enclosed with at least 1-hour fire resistance rated construction with at least 60-minute fire resistance rated, self-closing, and self-latching doors.
4. Corridor walls with at least ½-hour fire resistance rated construction.
5. Self-closing and self-latching corridor doors that resist the passage of smoke.
6. Maximum exit access travel distances.
7. Provision of emergency instructions to occupants.
8. Periodic inspection, testing, and maintenance of all fire protection and life safety systems.

In lieu of working towards providing automatic sprinkler protection throughout existing high-rise apartment buildings, the currently adopted 2018 edition of NFPA 101 permits a performance-based design to be completed. This design may incorporate any combination of automatic or manual suppression, automatic fire or smoke detection, fire alarm notification, fire and smoke compartmentation, active smoke control, and operating features. The design must however, provide "systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety" over those prescribed by the code. Therefore, the design for the permanent condition of an existing high-rise apartment building that will not have complete automatic sprinkler protection must provide systems and methods that are beyond what is required for the prescribed interim measures in NFPA 101 (Options 1, 2, and 3).

Whatever approach is taken to provide interim or permanent fire and life safety for existing buildings, jurisdictional oversight and enforcement is a critical factor. Building owners and operators must be educated and held accountable for bringing buildings into compliance in a reasonable time frame. Once compliance is achieved, it needs to be ensured that the design features required to meet performance objectives are maintained for the life of the building. Jurisdictional oversight becomes even more important when a performance-based design which includes features that require special knowledge or attention is utilized.

SECTION III: POTENTIAL IMPACTS OF RISK REDUCTION IN HIGH-RISE BUILDINGS

In this section the Workgroup evaluates the potential impacts of retrofitting older, non-sprinklered high-rise buildings in Maryland. This report therefore examines the potential impacts on property owners of Non sprinklered- high-rise- residential apartment buildings and condominiums built before 1974 in the State of Maryland, when reducing risk per the currently adopted 2018 NFPA 101 Life Safety Code and NFPA 1 Fire Code. The report outlines the regulatory background, risk reduction challenges with associated estimated costs in present-day (2025) dollars; case study cost analyses of retrofit projects, the cost impact of asbestos abatement if present in buildings, occupant displacement and a comparison between a basic sprinkler retrofit and a comprehensive fire protection upgrade.

1. Introduction

Maryland currently enforces the 2018 edition of the NFPA 101 Life Safety Code as the baseline fire protection standard. This code mandates multiple layers of protection, including robust means of egress, basic fire detection and alarm systems, and where required, automatic sprinkler systems. Maryland amended the 2018 NFPA and deleted the sprinkler requirement for existing buildings, therefore automatic sprinklers were NOT required in existing high-rise buildings built before 1974 in the State of Maryland, however local Authorities Having Jurisdiction (AHJs) have the authority to enforce stricter standards. In contrast, high-rise- residential apartment buildings and condominiums constructed before 1974 were built to comply with the BOCA Building Code (the precursor to the International Building Code or IBC) that did not require sprinkler systems. As a result, many of these older structures now face significant challenges in achieving full risk reduction with modern fire safety requirements.

2. Background

2.1 Industry best practices are outlined in National Codes such as the NFPA 101 Life Safety Code

2.2 Currently Enforced Standards: NFPA 101 (2018 Edition)

Scope and Philosophy: The 2018 NFPA 101 Life Safety Code is the primary document guiding fire protection measures in Maryland at the time of this writing. It requires multiple, redundant safeguards so that life safety does not hinge on a single measure. For example, adequate means of egress, timely fire detection, and where applicable automatic sprinkler systems are all integral components.

Passive and Active Protections: Modern design mandates integration of both passive fire resistive construction (compartmentation, fire-rated doors, smoke barriers) and active suppression measures (sprinklers, alarms), providing a comprehensive safety net for occupants.

2.3 Pre-1974 High-rise- Buildings

Designed Under Legacy Codes: Buildings constructed prior to 1974 were designed under legacy precursor codes to the IBC that emphasized passive fire protection. These structures typically used fire-resistive- materials and manual fire suppression and alarm systems such as standpipe systems (piping, valves and hose connections) and manual fire alarm pull stations for life safety.

Risk Reduction Gap: Transitioning these buildings into compliance with the 2018 NFPA 101 often involves retrofitting new sprinkler systems, replacing obsolete fire detection and alarm systems, updating exit pathways, and resolving structural and material deficiencies that were once acceptable under legacy codes.

2.4 HB823 requires the Working Group to examine the cost, design, installation, testing, and maintenance of each fire protection system.

2.5 HB823 requires the Working Group to examine the duration of installation for each alternative fire protection system and the intensity of the disruption of normal occupancy caused by installation.

3. Methodology

The cost, design, installation, testing, and maintenance of each fire protection system as well as the duration of installation for each component of fire protection systems, and the intensity of the disruption of normal occupancy caused by installation varies from building to building. It depends on the present condition of the subject property when compared to what is required per the current code in effect, and the proposed improvements. This report will examine the impacts dictated by HB823 on properties in the following current conditions:

3.1 Properties where current condition is up to date with current code – No sprinklers, updated fire detection and notification systems.

Basic Sprinkler Retrofit (Minimal Upgrades):

Scenario: The building's existing life safety features and systems are otherwise relatively compliant; only an automatic sprinkler system is missing. Assumes no hazardous materials.

Cost Estimate: • Approximately $2.00-$4.00 per sq. ft[16].

Implications: • Limited disruption; no major structural, detection, or auxiliary system upgrades are needed. • Represents the least invasive retrofit, ideal for structures that comply with current fire codes and standards except for fire suppression. This condition would likely need a fire pump upgrade.

3.2 Properties where current condition is NOT up to date with current code - No sprinklers, outdated fire detection and notification systems. Assumes no hazardous materials.

Comprehensive Retrofit (Full System Overhaul):

Scenario: The building requires remediation of code deficiencies for fire detection and alarm and means of egress, as well as the installation of suppression equipment, often compounded by structural limitations and potential asbestos abatement.

Cost Estimate: • As demonstrated in the case studies, total costs escalate to the range of $9–$12+ per sq. ft. depending upon the combination of deficiencies addressed, with $12.00/sf being on the

[16] https://www.libertyfiresolutions.com/blog/how-much-does-a-fire-sprinkler-system-cost/

high end for asbestos issues[17]. (Comparatively, abatement costs are typically less impactful than displacement costs/square foot.)

Implications: • Involves a phased, multi-disciplinary approach with extensive planning, engineering design, and significant capital investment. • Disruption is more pronounced, often necessitating temporary occupant relocation and temporary operational changes.

3.3 Properties where current condition is NOT up to date with current code and minimal asbestos abatement required - No sprinklers, outdated fire detection and notification systems, occupant displacement NOT required.

Comprehensive Retrofit (Full System Overhaul):
Scenario: The building requires updates to fire detection, means of egress, and additional suppression equipment, often compounded by structural limitations and potential asbestos abatement.

Cost Estimate: • As demonstrated in the case studies, total costs escalate to the range of $9–$12+ per sq. ft. depending upon the combination of challenges addressed. (Markup for abatement)

Implications: • Involves a phased, multi-disciplinary approach with extensive planning, engineering redesign, and significant capital investment. • Disruption is more pronounced, often necessitating temporary operational changes.

3.4 Properties where current condition is NOT up to date with current code and asbestos abatement required - No sprinklers, outdated fire detection and notification systems, occupant displacement required.

Comprehensive Retrofit (Full System Overhaul):
Scenario: The building requires updates to fire detection, means of egress, and additional suppression equipment, often compounded by structural limitations and potential asbestos abatement.

Cost Estimate: • As demonstrated in the case studies, total costs escalate to the range of $12–$16+ per sq. ft. depending upon the combination of challenges addressed[18].

Implications: • Involves a phased, multi-disciplinary approach with extensive planning, engineering redesign, and significant capital investment. • Disruption is more pronounced, often necessitating occupant relocation and temporary operational changes.

Examination is conducted by analyzing case studies cost estimates of each situation based on proposals and studies submitted by contractors. In order for the information to be applicable and useful to owners and occupants of buildings of various sizes and conditions impacts will be expressed in dollars per square foot. Costs per unit will be extracted where the number of units in the building and the sizes of each unit type is available. Costs per unit information is useful to

[17] https://www.naahq.org/sites/default/files/2022-06/sprinkler_retrofit_mandates_fact_sheet.pdf

[18] Redacted-Willoughby-Condo-Fire-Protection-Upgrade-Project-Rough-Order-of- Magnitude-Estimate-Cost.pdf

property owners in order to apportion costs to units of varying sizes, which is particularly important to condominium owners because each unit owner is personally responsible for a portion of the retrofit cost according to the size of their unit.

4. Unit Costs of Fire Protection System Components in Generic Buildings

4.1. Risk Reduction Challenges and Incremental Cost Impacts Specific to Buildings Constructed Under Legacy Codes

Retrofitting older buildings to reduce fire hazard risks involves addressing several key challenges. The estimates below represent costs in dollars per square foot that contribute to the overall retrofit budget. Note that overlapping solutions often yield some cost efficiencies; therefore, these costs are listed in incremental order and are not strictly additive.

Table 4.1 Probable Costs Associated with Sprinkler Retrofit Challenges[19]

Component	Estimate ($/ft²)	Description
Aging Infrastructure	$2.60–$5.20	Upgrading outdated fire protection components (wiring, piping, structural materials) to meet modern standards.
Retrofitting Limitations	$3.90–$6.50	Addressing complex integration issues routing concealed sprinkler piping and sensors through limited spaces may require minor structural modifications.
Regulatory & Legal Hurdles	$1.30–$2.60	Revising engineering designs, meeting new permitting guidelines, and preparing compliance documentation to satisfy current codes.
Disruption to Occupants	$1.30–$5.00	Additional costs related to minimizing occupant disruption during phased work (e.g., temporary relocations, rescheduling work during off-hours).

4.2 Additional Challenges Specific to Buildings Constructed Under Legacy Codes

[19] https://homeguide.com/costs/fire-sprinkler-system-cost?utm_source=chatgpt.com

Table 4.2 – Probable Costs Associated with Additional Sprinkler Retrofit Challenges[20]

Challenge	Estimate ($/ft²)	Description
Historical Preservation Restrictions	$3.90–$7.80	Custom design strategies (e.g., concealed installations) required to preserve historic character while meeting modern fire codes.
Structural & Spatial Limitations	$2.60–$6.50	Creative engineering needed to navigate limited space; may require structural enhancements for new system installations.
Aging Mechanical, Electrical, and Plumbing (M/E/P) Systems	$5.20–$10.40	Extensive upgrades of outdated M/E/P systems to support modern fire safety equipment and digital integration.
Integration with Modern Technology	$1.30–$3.90	Costs for adding digital management systems, networked sensors, and modern control panels to legacy infrastructures.
Water Supply Constraints	$2.60–$5.20	Upgrading water supply systems (including pumps and piping) to provide adequate pressure and flow for sprinkler systems.
Frequent Code Updates & Regulatory Transitions	$0.65–$1.30	Ongoing engineering and permit adjustments as local codes evolve, particularly for grandfathered properties.

4.3. Impact of Asbestos Abatement on Retrofit Projects

The presence of asbestos in some legacy buildings requires strict abatement protocols which can elevate retrofit costs. Costs will depend on the category of asbestos (friable or non-friable), quantities of asbestos, whether the asbestos is located in the areas where work will be performed, and whether it will be disturbed by the work.

[20] https://homeguide.com/costs/fire-sprinkler-system-cost?utm_source=chatgpt.com

Table 4.3 – Probable Costs Associated with Work in Buildings Where Asbestos is Present

Asbestos Type		**Present-Day Escalated Estimate ($/ft²)**
Friable Asbestos		$8.00–$20.00
Non-Friable Asbestos		$5.00–$8.50

Note: The necessity to displace occupants during friable asbestos abatement creates additional scheduling complexities and indirect financial burdens on property owners, such as home moving and property storage expenses. The cost per square foot expressed in the table is per square foot of floor space, not to be confused with most asbestos abatement estimates measured in cost per square foot of asbestos containing material removed. On the contrary, it is important to note that abatement of asbestos containing materials, especially popcorn ceilings, will be a betterment to the property. For real estate transaction purposes, full abatement will result in the seller having one less defect to disclose on the *Maryland Residential Property Disclosure Statement* required by Section 10-702 of the Real Property Article, *Annotated Code of Maryland.*

Based on the above unit costs sprinkler retrofit projects could range from $3.00 - $16.00 per square foot for cases not involving asbestos abatement. Note that larger buildings tend to have cost per square foot larger than those of smaller buildings.

5. Case Studies of Residential High-Rise Retrofit Projects

The National Fire Sprinkler Association (NFSA) prepared a Contractor Bid and Retrofit Package 2025 to demonstrate what a proper Request for Proposal (RFP) should be, when requesting pricing from sprinkler contractors for a retrofit project. It contains all the necessary information a building owner should provide to receive accurate and complete pricing proposals from contractors without the inclusion of scopes of work not related to the installation sprinklers. Of course, if a building requires other aspects of its composition to be upgraded, refurbished or repaired to fully comply with local codes the costs of those items shall be in addition to the costs captured in this sprinkler retrofit pricing package.

The NFSA prepared this template bid package to ensure all information necessary is provided because most estimates provided to building owners are either incomplete or contain work not

related to the provision of sprinkler systems. In this review of the pricing information obtained nationwide the Baltimore Area pricing is used to demonstrate how the information may be utilized by the manager of an apartment building or a condominium association to portion cost.

Summary of the Retrofit Package: Baltimore Area
5.1 Properties where current condition is up to date with current code – No sprinklers, updated fire detection and notification systems. No hazardous materials.

The document describes a comprehensive retrofit project for a 12-story residential high-rise (with one basement level) that was originally built to older 1975 BOCA/1976 UBC codes. The retrofit aims to upgrade the building's life-safety systems to current standards by:

Installing a modern wet-pipe fire sprinkler system: The design complies with the 2024 model codes and the 2022 edition of NFPA 13. Sprinklers will be installed throughout dwelling units, public areas, and mechanical spaces on all relevant floors, using new CPVC and Schedule 40 steel piping as appropriate. The retrofit integrates with existing systems (for example, the 6-inch standpipe system with a pre-existing 750-gpm fire pump).

Upgrading the fire alarm and smoke detection system: The upgraded system is designed to meet NFPA 72 requirements. It includes provisions for tamper/flow switches, a new fire alarm panel (if needed), and adaptations to allow supervision of the sprinkler system by the alarm.

Scope and Construction Methodology: The work is structured in phases so that only one floor is offline at any given time, minimizing occupant disruption. Other elements include site security during off-hours-, asbestos remediation, and aesthetic restoration of affected areas once the mechanical work is complete.

Regulatory and Code Referenced Details: Extensive appendices provide side-by-side code comparisons (2024 IFC, 1975 BOCA, 1976 UBC), sample floor plans, and detailed bid items. The project includes both the "base retrofit" needed for a fundamental upgrade and a detailed opinion of probable cost to support scalability (for example, on a per story basis).

Below is a cost breakdown using the Baltimore opinion of probable cost. In this example, we assume the Baltimore retrofit range is about $889,750 to $1,216,863. For our calculations we use the midpoint of approximately $1,053,307 as the total retrofit cost for the entire building.

Building Geometry Recap:
The building has a 10,000-sf footprint per floor over 13 floors (1 basement, Floor 1, plus Floors 2–12).
The residential portion is on Floors 2–12 (11 floors total).
On each residential floor: Total area = 10,000 sf
Dwelling (usable residential) area = 8,400 sf
Common space on that floor (corridors, lobbies, etc.) = 1,600 sf
Total residential floors area = 11 × 10,000 = 110,000 sf
Total residential dwelling area = 11 × 8,400 = 92,400 sf
Total common area in residential floors = 11 × 1,600 = 17,600 sf

Additionally, non-residential common areas on the Basement and Floor 1 add 20,000 sf
Total common area (residential floors + non-residential) = 17,600 + 20,000 = 37,600 sf
Unit Mix:
Each residential floor contains 8 units: 4 one-bedroom- units of about 900 sf and 4 two-bedroom- units of about 1,200 sf.
Total number of residential units = 11 floors × 8 = **88 units**

Step 1. Determine the Overall Cost per Square Foot
We start by "spreading" the total retrofit cost over the entire building area of 130,000 sf:
Cost per sf = $1,053,307 ÷ 130,000 sf ≈ **$8.10/sf**

For owners of apartment buildings (rentals) this is sufficient information for the project, however for condominium owners and building managers who wish to apportion retrofit costs relative to apartment size the following detailed breakdown is necessary:

Step 2. Break Out the Costs
2.1 Residential Dwelling Area Cost:
2.1.1 Total dwelling area = 92,400 sf
2.1.2 Dwelling cost = 92,400 sf × $8.10/sf ≈ **$748,440**
2.2 Common Area Cost:
2.2.1 Total common area = 37,600 sf
2.2.2 Common area cost = 37,600 sf × $8.10/sf ≈ **$304,560**

Step 3. Apportion the Common Area Cost to Residential Units
Since all residential units share the common areas, we divide the total common area cost equally among the 88 units:
Common share per unit = $304,560 ÷ 88 ≈ **$3,460**

Step 4. Compute Unit-Specific Costs Based on Dwelling Area
For each unit the "base" cost is determined by its actual living space multiplied by the cost per square foot:
For a 900-sf (one bedroom-) unit:
Dwelling cost = 900 sf × $8.10/sf = **$7,290**
Adding the common share gives: Total unit cost ≈ $7,290 + $3,460 = **$10,750**
For a 1,200-sf (two bedroom-) unit:
Dwelling cost = 1,200 sf × $8.10/sf = **$9,720**
Adding the common share gives: Total unit cost ≈ $9,720 + $3,460 = **$13,180**

Table 5.1 - Summary

Unit Type	Dwelling Area (sf)	Dwelling Cost (@ $8.10/sf)	Common Share per Unit	Total Cost per Unit
One-bedroom (approx.)	900	$7,290	$3,460	$10,750

Two-bedroom (approx.)	1,200	$9,720	$3,460	$13,180

Summary
Using the Baltimore opinion of probable cost:
The overall retrofit cost is about $1,053,307 for 130,000 sf or roughly $8.10/sf.
When apportioned to residential units:
A 900-sf unit would bear a cost of approximately $10,750.
A 1,200-sf unit would bear about $13,180.
These estimates reflect both the unit's own usable space plus an equal share of the building's common areas (which include corridors, lobbies, and the non-residential areas on the basement and Floor 1).

Of course, these are approximations. In practice, project-specific factors such as differences in unit mix distribution, actual measured common areas, and site-specific retrofit conditions (like union versus open shop labor rates or additional abatement needs) may adjust the final numbers.

5.2 Properties where current condition is NOT up to date with current code - No sprinklers, outdated fire detection and notification systems

Horizon House, Baltimore, MD
Summary of the Retrofit Package – Horizon House
The Horizon House retrofit project is a comprehensive fire protection upgrade for a high-rise residential building located at 1101 N. Calvert Street, Baltimore, MD. Originally constructed in 1965, the 219-unit multifamily high-rise will be brought into compliance with modern fire protection standards via a new fire pump and wet/dry pipe sprinkler systems.

Key Retrofit Elements
Sprinkler and Fire Suppression System- Retrofit design valued at $1,450,000. The scope includes: Design and installation of a fire pump and a combination wet/dry pipe sprinkler system. Work beginning at the flange after the backflow preventer. Reuse of existing standpipe system for zone controls. Replacement of the existing standpipe booster pump. New fire pump room (constructed by others) to be located in the garage. All fire sprinkler piping to be CPVC; black pipe to be Sch 40 threaded and Sch 10 grooved. Permits, as-builts, and one-year warranty included. Shop drawings sealed by a NICET III technician.

Project Constraints and Conditions- All work to be completed during standard business hours (M–F, 7:00 AM to 3:30 PM). Pipe concealment, furniture relocation, and garage room construction to be handled by others. Electrical, backflow prevention, freeze protection, seismic bracing, painting, and fire alarm systems are explicitly excluded.

Building Geometry Recap
Total Building Area: 172,147 sf - Total Units: 219 - Estimated Common Area (20%): 172,147 × 20% ≈ 34,429 sf - Estimated Dwelling Area: 172,147 – 34,429 ≈ 137,718 sf.

Table 5.2A - **Unit Mix and Sizes**

Unit Type	**Size (sf)**	**Count (Est.)**
Studio	545	40
1 Bedroom	729–890	100
1 Bedroom + Den	729	10
2 Bedroom (1 bath)	990	30
2 Bedroom (1.5 bath)	990	20
2 Bedroom (2 bath)	1,275	19

Step 1. Determine the Overall Cost per Square Foot
Cost per sf = $1,450,000 ÷ 172,147 sf ≈ $8.42/sf

Step 2. Break Out the Costs
2.1 Residential Dwelling Area Cost: 137,718 sf × $8.42/sf ≈ $1,159,548

2.2 Common Area Cost: 34,429 sf × $8.42/sf ≈ $290,452

Step 3. Apportion the Common Area Cost to Units
Common share per unit = $290,452 ÷ 219 ≈ $1,326

Step 4. Compute Unit-Specific Costs

Table 5.2B – Unit Specific Costs

Unit Type	**Size (sf)**	**Dwelling Cost (@ $8.42/sf)**	**Common Share**	**Total Cost per Unit**
Studio	545	$4,590	$1,326	$5,916
1 Bedroom (avg.)	800	$6,736	$1,326	$8,062

1 Bedroom + Den	729	$6,140	$1,326	$7,466
2 Bedroom (1/1.5 ba)	990	$8,342	$1,326	$9,668
2 Bedroom (2 bath)	1,275	$10,736	$1,326	$12,062

Summary
Based on the CSA proposal of $1,450,000, the estimated retrofit cost per square foot is $8.42/sf. Cost allocations per unit range from approximately $5,916 for a studio to $12,062 for a large 2-bedroom, 2-bath apartment. These values account for both the private unit area and each unit's proportional share of the common areas. As with all estimates, actual costs may vary due to field conditions, precise unit mix, construction logistics, and exclusions (electrical, fire alarms, etc.).

Park Ritchie, Takoma Park, MD
Summary of the Retrofit Package – Park Ritchie
The Park Ritchie retrofit project targets life-safety upgrades for a high-rise multifamily building at 7600 Maple Avenue, Takoma Park, MD. Built in 1968, the 189-unit structure spans approximately 214,490 square feet. The proposed retrofit, valued at $1,360,000, includes the installation of modern fire suppression systems compliant with NFPA standards.

Key Retrofit Elements
Design and installation of a new fire pump and wet/dry pipe sprinkler system. Highlights of the scope include: Design to meet NFPA 13 and 20 standards.- Installation starting from the backflow preventer outlet.- CPVC piping throughout; black pipe specified for threads/grooves.- Reuse of existing standpipe system and replacement of booster pump.- New fire pump room in garage (to be constructed by others).- All permits, as-builts, NICET III-sealed drawings, and testing included.- One-year warranty on all CSA-installed materials and labor.- Work to be performed during standard working hours only (M–F, 7 AM – 3:30 PM).

Building Geometry Recap
Total Building Area: 214,490 sf - Total Units: 189 - Estimated Common Area (20%): 214,490 × 20% ≈ 42,898 sf - Estimated Dwelling Area: 214,490 – 42,898 ≈ 171,592 sf.

Table 5.2C - Unit Mix and Sizes

Unit Type	Size (sf)	Bathrooms
One-Bedroom	750–850	1

Two-Bedroom	1,000–1,200	1.5–2
Two-Bedroom + Den	1,200	2
Three-Bedroom	1,400	2

Step 1. Determine the Overall Cost per Square Foot
Cost per sf = $1,360,000 ÷ 214,490 sf ≈ $6.34/sf

Step 2. Break Out the Costs
2.1 Residential Dwelling Area Cost: 171,592 sf × $6.34/sf ≈ $1,088,899

2.2 Common Area Cost: 42,898 sf × $6.34/sf ≈ $271,101

Step 3. Apportion the Common Area Cost to Units
Common share per unit = $271,101 ÷ 189 ≈ $1,434

Step 4. Compute Unit-Specific Costs

Table 5.2D – Unit Specific Costs

Unit Type	Size (sf)	Dwelling Cost (@ $6.34/sf)	Common Share	Total Cost per Unit
One-Bedroom	800	$5,072	$1,434	$6,506
Two-Bedroom	1,100	$6,974	$1,434	$8,408
2BR + Den	1,200	$7,608	$1,434	$9,042
Three-Bedroom	1,400	$8,876	$1,434	$10,310

Summary
With a total estimated cost of $1,360,000, the average retrofit cost is approximately $6.34/sf. Unit-specific costs range from roughly $6,506 for a one-bedroom apartment to $10,310 for a three-bedroom unit. These projections account for both private unit area and each unit's proportional share of common spaces. Real-world costs may vary due to construction-specific conditions, final unit mix distribution, and site-specific logistics.

5.3 Properties where current condition is NOT up to date with current code and minimal asbestos abatement required - No sprinklers, outdated fire detection and notification systems, occupant displacement NOT required.

The presence of asbestos and complications in Horizon House and Park Ritchie in the next two estimates is hypothetical, created only to illustrate the impact of asbestos on the overall cost of the project. The actual estimate received did not indicate asbestos abatement activities.

Table 5.3A - Horizon House (hypothetical asbestos and complications present)

Unit Type	**Dwelling Area (sf)**	**Dwelling Cost (@ $12/sf)**	**Common Share per Unit**	**Total Cost per Unit**
Studio	545	$6,540	$2,055	$8,595
1 Bedroom (avg.)	800	$9,600	$2,055	$11,655
1 Bedroom + Den	729	$8,748	$2,055	$10,803
2 Bedroom (1/1.5 ba)	990	$11,880	$2,055	$13,935
2 Bedroom (2 bath)	1275	$15,300	$2,055	$17,355

Using the revised retrofit cost of $12 per square foot, total unit-specific costs increase proportionally. These updated figures reflect both each unit's usable square footage and a proportional share of common area costs with a total building cost of **$2,065,764**.

Table 5.3B - Park Ritchie (hypothetical asbestos and complications present)

Unit Type	**Dwelling Area (sf)**	**Dwelling Cost (@ $12/sf)**	**Common Share per Unit**	**Total Cost per Unit**
One-Bedroom	800	$9,600	$2,720	$12,320
Two-Bedroom	1100	$13,200	$2,720	$15,920
2BR + Den	1200	$14,400	$2,720	$17,120

Three-Bedroom	1400	$16,800	$2,720	$19,520

Using the revised retrofit cost of $12 per square foot, total unit-specific costs increase proportionally. These updated figures reflect both each unit's usable square footage and a proportional share of common area costs with a total building cost of $2,572,680.

5.4 Properties where current condition is NOT up to date with current code and asbestos abatement required - No sprinklers, outdated fire detection and notification systems, occupant displacement required

The Willoughby Condominium Estimate

The Willoughby Condominium is an example of the worst case scenario in terms of impact of fire protection retrofit projects on building owners and occupants. In addition to the fire protection retrofit costs, the nature of the asbestos present requires significant occupant displacement resulting in additional costs related to moving and property storage.

The dwelling units at The Willoughby, located at 4515 Willard Avenue, Chevy Chase, Maryland, consist of a mix of efficiencies, one-bedroom, two-bedroom, and three- bedroom apartments. The building contains a total of 815 units spread across 25 stories. Below is a breakdown of the unit types and their features:

Table 5.4A - Composition of Dwelling Units

Unit Type	Number of Units	Bed rooms	Average Size (Sq. Ft.)	Total Area/ Unit Type	Cost / Unit to Sprinkler @ $9/sf.	Cost / Unit to Sprinkler @ $16/sf.
Efficiency	140	0	327	45780	$2,943.00	$5,232.00
One-Bedroom	350	1	881	308350	$7,929.00	$14,096.00
Two-Bedroom	275	2	1300	357500	$11,700.00	$20,800.00
Three-Bedroom	50	3	1645	82250	$14,805.00	$26,320.00
Total	**815**			**793880**		

Additional Details

- The building was originally constructed in 1968 and converted to condominiums in 1982.
- It includes luxury amenities such as a rooftop pool, gym, library, party room, and laundry facilities.
- Smoking and pets are prohibited within the building.
- Parking spaces available: 701, with garage parking offered for rent.

High Level Analysis of the Provided Cost Estimate

- Existing building is partially sprinklered (common areas and garage). This system is being replaced. It is not clear whether this is being done because the system is no longer serviceable or an engineering necessity.
- Most of the Fire Alarm scope is required by Maryland's current adopted version of the Life Safety Code (2018)
- The cost of sprinkling the luxury amenities such as a rooftop pool, gym, library, party room, and laundry facilities are included in the estimate.
- Dwelling units are not sprinklered and account for only 793,880 SF of the 1,362,763 SF covered in the estimate.
- The preceding table attempts to distill the cost of protecting the dwelling units with sprinklers, If all other parts of the building were in compliance with the 2018 NFPA 101. Only Concept 2 is considered because it is less than Concept 1.

I. **Cost Summary (Concept 2)**

Based on the Executive Cost Summary, here's a breakdown of the costs associated with Concept 2 for different project start dates:

Table 5.4B: Fire Alarm and Fire Suppression Systems Costs (Concept 2)

Executive Cost Summary from Estimate					
		Concept 2			
Project start date 3/1/2026	**Start date**	**Project Cost**	**Sprinkler Retrofit Cost (w/o deferred maint.)**	**Cost/SF (1,362,763 SF)**	**Cost/SF (1,362,763 SF)**
Fire alarm system	3/1/2026	$9,200,648			
Fire Suppression System	3/1/2027	$17,124,352			
Fire alarm system + Fire Suppression System	3/1/2026	$21,712,956	**$12,512,308**	**$9**	**$16**
Project start date 3/1/2028	Start date	Project Cost			
Fire alarm system	3/1/2028	$9,515,296			

Fire Suppression System	3/1/2029	$18,359,546			
Fire alarm system + Fire Suppression System	3/1/2028	$22,455,505	**$12,940,209**	**$9**	**$16**

II. **Fire Alarm System Analysis & Comparison to 2018 NFPA 101 (Maryland)**

This section analyzes the fire alarm upgrades proposed in Concept 2 and compares them against the 2018 NFPA 101 Life Safety Code requirements for high-rise residential buildings in Maryland.

A. Proposed Fire Alarm Upgrades (Concept 2 - Based on Document Info):

- Garage: Replace fire alarm system; cables in galvanized rigid steel conduits.
- Back of House (BOH), Public & Administration Areas, Mechanical & Electrical Rooms: Replace fire alarm system; cables in EMT conduits.
- Tenant Areas: Replace fire alarm system; wired alarms replaced in existing locations, wireless alarms and sounders in new locations. No raceways are installed inside tenant spaces.
- Corridors: Replace fire alarm system. Surface metal raceway (Wiremold) is considered if the fire alarm system is replaced before the fire sprinkler system. Fire alarm cables will be run with fire sprinklers if the two systems are replaced concurrently.
- Interface: Allowance included for interface between the fire alarm control and existing building energy management system (BEMS).

A. Relevant 2018 NFPA 101 Requirements (Maryland):

- General Requirement: High-rise buildings generally require a supervised automatic fire alarm system in accordance with Section 9.6.
- Smoke Detection: Smoke detectors are typically required in common areas, corridors, and dwelling units (specific placement depends on the building's existing system and any exceptions being utilized).
- Notification: The fire alarm system must provide occupant notification throughout the building.
- Supervision: The fire alarm system must be supervised to ensure proper operation and prompt response to alarms.
- Emergency Voice/Alarm Communication System (EVACS): High-rise buildings often require an EVACS to provide clear and directed evacuation instructions.
- Smoke Control: While not directly part of the fire alarm system, smoke control is crucial. This often involves pressurization of stairwells, and proper fire-stopping in corridors.
- NFPA 72: The installation and maintenance of the fire alarm system must comply with NFPA 72, National Fire Alarm and Signaling Code.

B. Compliance Gaps & Observations:

1. Residential Unit Coverage: The proposal mentions replacing alarms in tenant areas, but it's unclear what type of alarm is being replaced and if the proposed system meets current code requirements for smoke detection within the dwelling units. Maryland may require interconnected smoke alarms in all units.

2. Wireless System Adequacy: The use of wireless alarms and sounders in tenant areas raises a question of reliability and signal strength, particularly in a high-rise concrete building. The proposal needs to demonstrate that the chosen wireless system is fully compliant with NFPA 72 and suitable for the building's construction.

3. EVACS: The proposal doesn't explicitly mention an Emergency Voice/Alarm Communication System (EVACS). Given that this is a high-rise, it's likely required. The absence of EVACS could be a significant compliance gap.

4. Smoke Control Measures: While the proposal mentions replacing stairwell and elevator shaft pressurization fans (under HVAC), it doesn't explicitly integrate these systems with the fire alarm system for coordinated smoke control. Activation of these fans upon alarm is often a code requirement.

5. Fire-Rated Doors and Corridors: It is not evident that the fire rated doors and corridors meet code, and more information is needed to make that determination.

C. Areas Exceeding Code (Potential):

Conduit in Specific Areas: Using galvanized rigid steel conduit in the garage and EMT conduit in other areas might be more robust than strictly required by code, depending on the specific wiring methods allowed. However, this could be a design choice for enhanced durability.

III. **Smoke-Control Comparison**

Table 5.4C: Smoke-Control Comparison

	Proposed Upgrade	**NFPA 101 Requirements (Maryland)**
Pressurized stairwells	Replace stairwell and elevator shaft pressurization fans.(quantity assumed to be seven) New fan controls and tied-into existing	Must maintain a positive pressure to prevent smoke infiltration during a fire.
Fire Rated Doors	Not explicitly mentioned, requires further investigation of existing conditions and proposed replacements if any.	Must meet specific fire-resistance ratings (e.g., 1-hour, 1.5-hour) based on location and function. Should be self-closing and equipped with positive latching.

Corridors	Surface metal raceway similar to wiremold is considered if the fire alarm system is replaced by itself prior to the fire sprinkler system. Fire alarm cables will be run with the fire sprinklers if the two systems are being replaced concurrently.	Must have appropriate fire-resistance ratings. Penetrations for wiring or other utilities must be properly fire-stopped. Corridor walls should extend to the deck above (or have equivalent fire-stopping).
Interface with Fire Alarm	Included an allowance for interface between fire alarm control and existing building energy management system.	Integration of smoke control systems (fans, dampers) with the fire alarm system for coordinated operation during a fire is essential. The fire alarm system should be able to initiate and control smoke control functions automatically.

IV.**Next Steps & Recommendations:**

1. Detailed Scope of Work: Obtain a detailed scope of work for both fire alarm and fire suppression upgrades. This should include specific equipment specifications, wiring diagrams, and clearly defined performance criteria.

2. Code Compliance Review: Engage a qualified fire protection engineer to conduct a thorough code compliance review of the proposed upgrades against the 2018 NFPA 101 Life Safety Code as adopted by Maryland, along with local amendments.

3. EVACS Evaluation: Determine if an EVACS is required (it likely is) and ensure that the fire alarm upgrade includes it.

4. Wireless System Validation: If wireless alarms are used, demand proof of NFPA 72 compliance and suitability for the building's construction.

5. Smoke Control Integration: Verify that the smoke control system (pressurization fans, dampers, etc.) is fully integrated with the fire alarm system for coordinated operation.

6. Long-Term Costs: Consider the life-cycle costs of both concepts (including maintenance, testing, and potential future upgrades) before making a final decision.

Table 5.4D - Detailed Occupant Displacement Impacts

Fire Sprinkler Retrofit Including Displacement Costs for Asbestos Abatement				
Item	Cost for 10'x10' bedroom of 1 BR apt	Cost for 10'x15' bedroom of 2 BR apt	1 Month/3 days	1 Month/3 days

Storage Rental Fee[21]	$206/month and $6.87/day	$377/month and $12.57/day	$206/$20.61	$377/$37.70
Hotel stays[22]	28 nights avg. $131 per night		$3668/$393	$3668/$393
Packing costs[23]	Full packing		$1,000.00	$1,600.00
Moving costs x 2	$100 per hour for 2 movers and truck	1 BR @ 3-5 hours per local move 2 BR @ 6-7 hours per local move	$900	$1300
Insurance & Items Requiring Special Handling	Full value protection: 1% of total value; released value protection: $.6 per lb.	1 BR: 1800-3500 lbs. 2 BR: 2700-5000 lbs. or insure with homeowner's policy	$1590 (incl. deductible & difficult access, elevator & long carry)	$3120 (incl. deductible & difficult access, elevator & long carry)

Table 5.4E - Summary

All Inclusive per Unit Costs (Fire Protection + Displacement)			
Units with Asbestos	**1 BR Apt Costs**	**2 Br Apt Costs**	**3 Br Apt Costs**
Fire Protection and Alarm (2029)	$7,929-$14,096	$11,700-$20,800	$14,805-$26,320
Storage, Moving, Hotel, and Insurance	$3,906.00	$6,451.00	$8,064.00
Total Cost	**$11,835-$18,002 per unit**	**$18,151-$27,251 per unit**	**$22,869-$34,384 per unit**

This analysis is based on the limited information provided in the document. A comprehensive assessment requires a more detailed review of the proposal and the building's existing fire protection systems.

Sources
Redacted-Willoughby-Condo-Fire-Protection-Upgrade-Project-Rough-Order-of- Magnitude-Estimate-Cost.pdf 2018 NFPA Life Safety Code as adopted by Maryland

[21] Security Public Storage, temperature controlled rental facility in Bethesda,https://www.securitypublicstorage.com/locations/bethesda

[22] "Rockville Average Hotel Costs," https://www.budgetyourtrip.com/hotels/united-states-of-america/rockville-4367175

[23] How Much Does It Cost to Hire Movers for a 1 BR Apartment?" ANGI, https://www.angi.com/articles/cost-to-move-1-bedroom-apartment.htm

5.5 Conclusion

Retrofitting pre-1974 high-rise residential buildings and condominiums in Maryland to comply with the 2018 NFPA 101 Life Safety Code is a complex, time-consuming, and expensive yet important undertaking. The process confronts multiple challenges—from outdated infrastructure and retrofitting limitations to historical preservation issues and the possible need for asbestos abatement. Present-day cost estimates indicate that comprehensive remediation of existing building and fire code deficiencies along with sprinkler retrofits may range from approximately $9 to over $12 per square foot, while a basic sprinkler system retrofit typically costs around $2-$4 per square foot. Furthermore, the presence of hazardous materials like friable asbestos in popcorn ceilings not only adds direct costs but could also entail temporary occupant displacement, further complicating project logistics.

In summary, modernizing fire protection systems in high-rise buildings designed under legacy codes requires significant planning, careful execution, and collaboration among property owners, engineers, regulatory agencies, and contractors. These retrofits, whether basic or comprehensive, result in a substantial yet critically important investment to safeguard lives and property in today's risk reduction landscape. When owners understand their choices and the incentives for fire protection systems, a retrofit project can be completed smoothly and economically. Most importantly, the resulting system will deliver unmatched fire safety and environmental safety (in cases that require asbestos abatement) for decades.

Appendix

A. Attendance

B. Meeting Minutes

C. Extracted content from NFPA 1 and MSFPC

NFPA 1 -Fire Code

1.3.2.4 Retroactivity of Referenced Standards to Existing Conditions.

Unless otherwise specified by 1.3.2.4.1 through 1.3.2.4.3, the current provisions of the referenced standards shall not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of this Code.

1.3.2.4.1 Where specified by a reference standard for existing occupancies, conditions, or systems, the provisions of the referenced standards shall be retroactive.

1.3.2.4.2 Facilities, equipment, structures, and installations, installed in accordance with a reference standard, shall be maintained in accordance with the edition of the standard in effect at the time of installation.

1.3.2.4.3 In those cases where the AHJ determines that the existing situation constitutes an imminent danger, the AHJ shall be permitted to apply retroactively any portions of the current referenced standards deemed appropriate.

COMAR §29.06.01.03 Application and Scope

This chapter applies to both new and existing buildings and conditions. In various sections there are specific provisions for existing buildings that may differ from those for new buildings. Unless otherwise noted, this chapter does not apply to facilities, equipment, structures, or installations that were existing or approved for construction or installation before the effective date of this chapter, except in those cases in which it is determined by the authority having jurisdiction (AHJ) that the existing situation constitutes a hazard so inimical to the public welfare and safety as to require correction. The requirements for existing buildings and conditions may be modified if their application clearly would be impractical in the judgment of the AHJ, but only if it is clearly evident that a reasonable degree of safety is provided. The State Fire Marshal or the legally appointed designee has the authority to make a determination of the applicability of this chapter to any building or condition in it, subject to the right of appeal to the State Fire Prevention Commission as prescribed in COMAR 29.06.02.

D. Repealed.

E. The provisions of this chapter do not apply in Baltimore City except to those buildings and conditions specifically prescribed in Public Safety Article, Title 6, Subtitle 4, Annotated Code of Maryland.

F. The provisions of this chapter do not apply to buildings used solely as dwelling houses for not more than two families as prescribed in Public Safety Article, Title 6, Subtitle 3, Annotated Code of Maryland.

G. Research Foundation Total Cost of Fire (2017) and Statewide High-Rise Building Survey (2024). https://www.nfpa.org/education-and-research/research/fire-protection-research-foundation/projects-and-reports/total-cost-of-fire-in-the-united-states

H. NFSA High-Rise Retrofit Study

I. The Willoughby Fire Protection Upgrade Project

J. Castle Sprinkler & Alarm Inc. - Ritchie Park

K. Castle Sprinkler & Alarm Inc. - Horizon Apartments

ATTENDANCE ROSTER

Workgroup to Develop Fire Safety Best Practices for Pre-1974 High-Rise Apartment Buildings (HB823)																		
Name	Organization	10/2/24 attendance	10/23/24 attendance	11/6/24 atttendance	12/5/2024 Attendance	12/11/14 Attendance	1/13/25 Attendance	1/27/225 Attendance	2/10/25 Attendance	2/24/25 Attendance	3/10/2025 Attendance	3/24/25 Attendance	4/10/25 Attendance	4/21/25 Attendance	5/8/2025 Attendance	5/19/2025 Attendance	6/2/2025 Attendance
Senator Sara Love	Member of the Senate of Maryland	NO	YES	YES	**NO**	YES	YES	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Delegate Mary Lehman	Member of the House of Delegates	NO	NO	NO	**NO**	NO	NO	No	No	NO	NO	No	No	No	No	No	NO
Acting Fire Marshal Jason Mowbray	State Fire Marshal or designee	YES	YES	YES	**YES**	YES	YES	Yes	Yes	NO	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Edward S. "Ted" Tochterman, Jr.	Chair of the State Fire Prevention Commission or designee	YES	NO	YES	**YES**	YES	YES	Yes	Yes	NO	Yes	Yes	No	Yes	Yes	Yes	Yes
Bob Phillips	President Maryland Fire Chiefs Association or designee	NO	YES	YES	**YES**	YES	YES	Yes	Yes	Yes	NO	Yes	Yes	No	Yes	Yes	Yes
*Robbie Blackiston (resigned in December)	President Maryland State Firemen's Association or designee	YES	YES	NO	**NO***	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Chief Joshua Bunting (designated January 2025)	President Maryland State Firemen's Association or designee	n/a	n/a	n/a	**n/a**	n/a	YES	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
Chief Michael Rudasill	Representative of the Professional Fire Fighters of MD	YES	YES	YES	**YES**		YES	Yes	Yes	NO	yes	yes	Yes	Yes	Yes	Yes	Yes
Terin Hopkins	Fire Sprinkler Trade Association representaive	YES	YES	YES	**YES**	YES	YES	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No
Jeanne Schmager Tebera, PE, CFPS, Member Automatic Fire Alarm Association	Fire Alarm Trade Association representative	YES	YES	YES	**YES**	YES	YES	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Abiodun "Babs" Shonaiya	Licensed Architect	YES	YES	YES	**YES**	YES	YES	Yes	Yes	Yes		No	Yes	Yes	Yes	No	Yes
Dr. Jamie McAllister	Fire Protection Engineer	YES (V)	YES	YES	**YES**	YES	NO	Yes	No	Yes	Yes	No	Yes	yes	Yes	Yes	No
Bradley Patrick, Sr.	Building Owners and Managers Association Representative	YES	YES	YES	**YES**	YES	YES	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Miriam Hamilton (Appointed January 2025)	Building Owners and Managers Association Representative	n/a	n/a	n/a	**n/a**	n/a	YES	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
*Ms. Yasia Daniels (resigned in December)	Building Owners and Managers Association Representative	YES	NO	YES	**NO***	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Mark Dopkin	Full Time Resident of High-Rise located in Maryland	n/a	YES	YES	**YES**	YES	YES	NO	NO	NO	Yes	No	Yes	Yes	Yes	Yes	Yes
Catherine A. Kelly	Workgroup Staff	YES	YES	YES	**YES**	YES	YES	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Nicole Jordan Jones	Workgroup Staff						YES	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Kenneth Bush								Yes	Yes	Yes	Yes Ye	Yes	No	Yes	No	Yes	Yes

Workgroup to Develop Fire Safety Best Practices for Pre-1974 High Rise Apartment Buildings

October 2, 2024

Meeting location: Maryland Fire and Rescue Institute, University of Maryland, 4500 Campus Drive, Classroom 3, College Park, Maryland. Virtual option: meet.google.com/uem/ajqi-jxn or phone +1 -301-969-5253, PIN: 778 740 499#

The meeting was called to order by the Chair, Acting Fire Marshal Jason Mowbray at 10:09 am.

Present in person were workgroup members: Acting Fire Marshal Jason Mowbray, Edwards S. "Ted" Tochterman, Jr., Robbie Blackiston, Chief Michael Rudasill, Terin Hopkins, Jeanne Schmager Tebera, Abiodun "Babs" Shonaiya, Bradley Patrick, Sr. and Yasia Daniels. Attending virtually, member Dr. Jamie McAllister. Absent workgroup members: Senator Sara Love, Delegate Mary Lehman and Bob Phillips. Members of the public in attendance: Ashley Powell, and Hugo Canto. Staff in attendance: Tom Elder DLS, Penny Doty MSP, Ken Bush MSP and Tom Williams MSP. Workgroup staff: Catherine Kelly MSP.

Roll call was completed by workgroup staff. Staff confirmed there was a majority present. After which the charter of the workgroup was reviewed which included the background, mission and purpose, objective, structure, and operating procedures.

Dr. McAllister asked how the term "other fire safety technology" is defined. Ken Bush responded at the Chair's request that both active and passive systems define the reference in question.

Ms. Tebera asked about the reporting requirement timeline and asked if the report is truly due December 31, 2024. It was confirmed that the report is in fact due on that date. Which opened discussion regarding the will of the group to the best approach to reach the objectives outlined in the law. It was determined by the group that subcommittees should be created to address the fire safety risks and the current strategies and technologies that mitigate fire risks. Ms. Tebera also asked if there was an existing list of this class of buildings. Terin Hopkins shared that a group he is associated with has an informal list that contains a good portion of the buildings in Maryland included in this class. Mr. Hopkins agreed to shared the information with the workgroup members.

Two subcommittees were created. Subcommittee (i) will focus on studying the fire safety risks in high-rise building that do not have automatic sprinkler systems or other fire safety technology. Members who volunteered to serve are: Dr. McAllister, Edward S. Tochterman, Jr., Jeanne Schmager Tebera and Terin Hopkins. Dr. McAllister agreed to lead the group.

Dr. McAllister asked if the focus of the workgroup is the whole class of high-rise buildings constructed prior to 1974 rather than individual buildings in the class. It was confirmed her assumption was correct.

Subcommittee (ii) will focus on studying current strategies, practices, and technology to mitigate fire risks, maximize evacuation of occupants, and allow for greater access and more expedient responses by emergency response professionals. Members who volunteered to serve are: Abiodun "Babs" Shonaiya, Robbie Blackiston, Terin Hopkins, Bradley Patrick, Chief Mike Rudasill, Dr. McAllister and Yasia Daniels. Yasia Daniels agreed to lead the group.

Meeting schedules were discussed and the following meeting dates and times were agreed upon:

Subcommittee (i) will meet on October 9, 2024 from 0900 to 1100, and on October 17, 2024 from 0900 to 1000.

Subcommittee (ii) will meet on October 10, 2024 from 0900 to 1100, and on October 16 from 1100 to 1300.

The full workgroup will meet on October 23, 2024 from 0900 to 1100 and on November 6 from 0900 to 1100.

All meetings of both subcommittees and the full workgroup will be held virtually, as agreed upon by the members.

Chair Mowbray asked the leads of the subcommittees for any guidance to the members of their groups. Each provided that they will assess the tasks and discuss roles and assignments at the upcoming meetings.

At this time each workgroup member introduced themselves and provided their background and interests in the subject at hand. Workgroup staff reiterated the scheduled meeting dates and times and confirmed all meetings will be virtual.

Chair Mowbray asked if there was and additional business the group members wished to address, hearing none the meeting was adjourned at 11:32am.

These minutes are respectfully submitted by Catherine A. Kelly.

Workgroup to Develop Fire Safety Best Practices for Pre-1974 High Rise Apartment Buildings

October 23, 2024

Workgroup to Develop Fire Safety Best Practices for Pre-1974 High Rise Apartment Buildings
Wednesday, October 23 · 9:00 – 11:00am
Google Meet joining info
Video call link: https://meet.google.com/zin-xbyx-sah
Or dial: (US) +1 470-705-3469 PIN: 660 037 346#

The meeting was called to order by the Chair, Acting Fire Marshal Jason Mowbray at 09:05 am.

Present virtually were workgroup members: Acting Fire Marshal Jason Mowbray, Senator Sara Love, Robbie Blackiston, Chief Michael Rudasill, Bob Phillips, Terin Hopkins, Jeanne Schmager Tebera, Abiodun "Babs" Shonaiya, Bradley Patrick, Sr., Dr. Jamie McAllister and Mark Dopkin. Absent workgroup members: Edwards S. "Ted" Tochterman, Jr., Yasia Daniels, and Delegate Mary Lehman and. Members of the public in attendance: Chief Josh Bunting, Brian Anleu, David Mandell, Ashley Clark, Bill Castelli and John Fiastro. Staff in attendance: Ken Bush MSP. Workgroup staff: Catherine Kelly MSP.

Roll call was completed by workgroup staff. Staff confirmed there was a majority present.

The minutes from the October 2, 2024 meeting of the work group were approved by unanimous vote.

Chair Mowbray asked the lead of Subcommittee (i), Dr. McAllister, to present the groups findings. During the review of the raw information that included the objectives and goals of current fire safety risks in high-rise apartment buildings that do not have automatic sprinkler systems or other fire safety technology; the estimated number of pre-1974 high-rise apartment buildings in the State of Maryland that are not fully sprinklered (119); a review of several case studies, most out of state; and a summary of next steps of the subcommittee.

Following Dr. McAllister's presentation of information, a question regarding the focus of the workgroup was asked relative to ownership of the units in the pre-1974 high-rise buildings. The question will be posed to the Environment and Transportation Committee staff who worked on the bill and the response will be shared with workgroup members upon receipt.

Chair Mowbray asked for Subcommittee (ii) to present their findings. In the absence of the lead, Abiodun "Babs" Shonaiya presented current mitigation strategies, practices and technologies to maximize evacuation of occupants and allow for greater access and expedient responses by first responders. The review included current practices that are included in national model codes, current practices in HUD regulations, and a review of the approach used in Ocean City, Maryland.

Following the presentation of information, discussion regarding Baltimore City and the code they have adopted was had.

Chair Mowbray, directed the Subcommittee leads to finalize the information presented and each lead to prepare a document for the Work Groups review in preparation for the next meeting of the group on November 6, 2024. Dr. McAllister noted that the information provided by Subcommittee (i) may change in format but the content will not effectively change.

The Work Group members agreed to be prepared to fully discuss the findings of the subcommittees and to begin discussions on potential recommendations to proffer in the final report to the General Assembly.

Next meetings were discussed. The Chair asked that the duration of the November 6, 2024 meeting be changed to three hours. December meetings were scheduled; the second meeting scheduled in case the work is not competed at the first meeting in December.

Meetings in December were scheduled for:

December 5, 2024 from 0900 to 1200

December 11, 2024 from 0900 t0 1200 (if needed)

Chair Mowbray asked if there was any new business or if any workgroup members had any further comments; hearing none the meeting was adjourned at 1045.

These meeting minutes are respectfully submitted by Catherine A. Kelly.

Workgroup to Develop Fire Safety Best Practices for Pre-1974 High Rise Apartment Buildings

November 6, 2024 Meeting Minutes

Video call link: https://meet.google.com/egb-scah-vhh
Or dial: (US) +1 413-276-7139 PIN: 670 242 544#

The meeting was called to order by the Chair, Acting Fire Marshal Jason Mowbray at 0902 am.

Present in person were workgroup members: Acting Fire Marshal Jason Mowbray, Edward S. "Ted" Tochterman, Jr., Chief Michael Rudasill, Terin Hopkins, Jeanne Schmager Tebera, Abiodun "Babs" Shonaiya, Bradley Patrick, Sr., Bob Phillips, Yasia Daniels, Senator Sara Love, Mark Dopkin and Jamie McAllister. Absent workgroup members: Delegate Mary Lehman, and Robbie Blackiston. Members of the public in attendance: Ashley Clark, Matt Pipkin, Joshua Bunting and Brian Anleu. Staff in attendance: Tom Elder DLS, and Ken Bush MSP. Workgroup staff: Catherine Kelly MSP.

Roll call was completed by workgroup staff. Staff confirmed there was a majority present.

Minutes from the October 23, 2024 meeting of the workgroup were reviewed and approved unanimously by the workgroup members.

Dr. McAllister, Subcommittee (i) lead, shared that the final report was not yet finalized. Subcommittee member Terin Hopkins presented the Maryland High-Rise Fire Data report information from the National Fire Sprinkler Association that looked at high-rise fires in the state of Maryland for the period of 2001-2022 using data submitted by fire departments to the National Fire Incident Reporting System. Mr. Hopkins noted that the report only includes fires in buildings that were reported on the 7th story or above as the 7th floor is often assumed to be the height at which a building meets the definition of a high-rise.

Discussion ensued about the occurrences of fires and the correlation of the number of fires and the number of non-sprinklered buildings in those counties.

Dr. McAllister went on to ask the work group members about how to format the subcommittee report taking in to account the information collected and how to best make it readable. It was decided that full reports and reference documents will be incorporated by reference and attached as appendices to the report.

Mr. Dopkins opened dialogue about partial sprinkler and other mitigation systems and how they being considered. Workgroup members discussed the lack of data available to report on the efficacy of partial systems.

Ms. Daniels, Subcommittee (ii) lead, reported that the report is not yet finalized. The Chair asked if the subcommittees felt they could have their work products prepared by November 22, 2024 for dissemination to the workgroup members. The date was agreed to.

The subcommittees scheduled internal meetings to finalize their reports.

Workgroup members discussed other issues like tap fees and funding for improvements that were tabled to be discussed once the subcommittees present their reports and the workgroup moves into the formulation of recommendations stage of their work.

Chair Mowbray asked if there was and additional business the group members wished to address, hearing none the meeting was adjourned at 10:01am.

Staff reminded the group of the next scheduled meetings: December 5, 2024 at 0900 and December 11, 2024 at 0900, both are virtual only.

These minutes are respectfully submitted by Catherine A. Kelly.

Workgroup to Develop Fire Safety Best Practices for Pre-1974 High Rise Apartment Buildings
December 5, 2024
Meeting Minutes
Video call link: https://meet.google.com/aes-raou-cut
Or dial: (US) +1 636-324-2339 PIN: 294 438 018# VIRTUAL ONLY

The meeting was called to order by the Chair, Acting Fire Marshal Jason Mowbray at 0904 am.

Present were workgroup members: Acting Fire Marshal Jason Mowbray, Edward S. "Ted" Tochterman, Jr., Chief Michael Rudasill, Terin Hopkins, Jeanne Schmager Tebera, Abiodun "Babs" Shonaiya, Bradley Patrick, Sr., Bob Phillips, Mark Dopkin and Jamie McAllister. Absent workgroup members: Senator Sara Love, Delegate Mary Lehman, Yasia Daniels and Robbie Blackiston. Members of the public in attendance: Joshua Bunting, Katie Nash, W. Caste, Hugo Cantu, Guy "J" Guzzone, Josie Friedli, Bob (no last name) and Brian Anleu. Staff in attendance: Tom Elder DLS, and Ken Bush MSP. Workgroup staff: Catherine Kelly MSP.

Roll call was completed by workgroup staff. Staff confirmed there was a quorum present.

Chair Mowbray shared that work group member Robbie Blackiston, the President of the Maryland State Firefighters Association's designee, has resigned. Chair Mowbray also shared that Yasia Daniels, appointed by the Governor as a Building Owners and Managers Association Representative also resigned. Chair Mowbray acknowledged the work both members performed.

Minutes from the November 6, 2024 meeting of the workgroup were reviewed and approved unanimously.

Dr. McAllister, Subcommittee (i) lead, presented the committee's draft report including the objectives and goals of the subcommittee, the estimated number of non-sprinklered high-rise apartment buildings, the data from the National Incident Reporting System reporting the high-rise fires in Maryland (2001-2022), information relative to inspection, testing and maintenance of existing systems and cases studies.

Abiodun "Babs" Shonaiya, the newly designated Subcommittee (ii) lead, presented the committee's draft report including the objectives and goals, review of current strategies in the national model codes, NFPA 101 (2024), NFPA 1 (2024), HUD regulations and Ocean City Maryland's standards.

At the conclusion of the presentations discussion regarding the presentations began. First Dr. McAllister noted that the draft reported require more refining prior to final adoption. Mr. Shonaiya stated that both reports need to be refined. That determination was followed by points raised by work group members including the complexities of engineering solutions for these buildings, local jurisdictional requirements and how they vary, the financial impact of current and potential future proposed solutions.

Chair Mowbray recognized the uniqueness of the buildings focused on by the work group and how difficult given that consideration it is to come up with a across the board per square foot cost or per unit cost for fire protection systems. He then invited the members to start discussions on the next phase of the work group focus.

Incentives, what other jurisdictions require and offer for incentives for retrofits, the lack of uniformity among local jurisdictions were the topic of discussion among the group. At 10:42 am a break was taken.

The meeting resumed at 10:50am. The Chair asked for the group to refine what recommendations are the will of the group. The consensus after considering some named alternatives was that more information relative to costs, incentives, what happens when the prescriptive requirements can not be met need to be researched more and discussed before recommendations can be crafted and reported from the group.

The Chair opened discussion on the path forward and what the will of the work group is. At the conclusion of the discussion Dr. McAllister made the following motion: The Work Group will formulate an interim report including the subcommittee reports to be submitted by December 31, 2024 which will include a request to extend the timeline of the work group to complete its work and submit its final report on or before June 20, 2025. Bob Phillips seconded the motion. Chair Mowbray called for a vote; the motion passed with 9 in the affirmative and 1, Mr. Tochterman in the negative.

Chair Mowbray reiterated that the next meeting the work group will review the refined versions of the Subcommittee (i) and Subcommittee (ii) and the draft interim report to be submitted. Subcommittee leads confirmed they can make the deadline. The next meeting of the work group is scheduled for December 11, 2024 at 09:00 am.

A request to share any further discussion was made by the Chair. Hearing none; a motion to adjourn was considered and was unanimously passed. The meeting adjourned at 11:38am.

These minutes are respectfully submitted by Catherine A. Kelly.

Workgroup to Develop Fire Safety Best Practices for Pre-1974 High Rise Apartment Buildings
December 11, 2024
Meeting Minutes
Video call link: https://meet.google.com/gpu-tphu-wip
Or dial: (US) +1 424-371-6012 PIN: 201 720 738#

The meeting was called to order by the Chair, Acting Fire Marshal Jason Mowbray at 0903 am.

Present were workgroup members: Acting Fire Marshal Jason Mowbray, Senator Sara Love, Edward S. "Ted" Tochterman, Jr., Terin Hopkins, Jeanne Schmager Tebera, Abiodun "Babs" Shonaiya, Bradley Patrick, Sr., Bob Phillips, Mark Dopkin and Jamie McAllister. Absent workgroup members: Delegate Mary Lehman, and Chief Michael Rudasill. Members of the public in attendance: Joshua Bunting, W. Caste, Hugo Cantu, Barin Nag, Greg von Lehmen, Ashley Clark, and Brian Anleu. Staff in attendance: Ingeborg Ritchie MSP. Workgroup staff: Catherine Kelly MSP.

Roll call was completed by workgroup staff. Staff confirmed there was a quorum present.

Minutes from the December 5, 2024 meeting of the workgroup were reviewed and approved unanimously.

Dr. McAllister, Subcommittee (i) lead, presented the updates made to the committee's report highlighting some additional information and formatting changes. Abiodun "Babs" Shonaiya, Subcommittee (ii) lead, presented the updates made to the committee's report highlighting additional information and formatting changes.

Motions were made and seconded to adopt both subcommittee reports in the form presented. Each motion passed unanimously.

Chair Mowbray then asked if work group members had reviewed a letter shared by Senator Love from two of her constituents. Sen. Love presented the concerns delineated in the letter. Discussion followed. Chair Mowbray referred to a letter sent to the work group from a collective including: Apartment and Office Building Association of Metropolitan Washington, Maryland Multi-Housing Association, Inc., The Elizabeth Condominium, Grosvenor Park III Condominium, Mica Condominium, Promenade Towers Mutual Housing Corp and Willoughby Condominium. As Mr. Brian Anleu of AOBA was in attendance, Chair Mowbray recognized him and asked that he share comments. Mr. Anleu noted that the letter mirrored the concerns raised by Sen. Love's constituents and thanked the group for the opportunity to address them.

Discussion followed the presentation of the letters. Much of the discussion center around alternative systems. At which time a reference was made to a report, the "Jensen Hughes Report". Mr. Hopkins asked that the report be shared with the Work Group members. Mr. Anleu agreed to provide to Work Group staff for dissemination to the members. The Chair noted that many of the concerns raised will be incorporated in the review process of the next phase of the Work Groups efforts.

Senator Love made a motion to adopt that draft interim report for submission, the motion was seconded and the Chair called for discussion. After full discussion the vote was called and the motion was adopted unanimously.

Chair Mowbray asked the Work Group members how they would like to proceed with next phase of the work. It was decided the full group would meet to address the remainder of the charge created by law. Meetings will be every other Monday beginning on January 13, 2025, held virtually and will be scheduled at 10:30am for 1 hour duration. The goals set at this meeting for the first meeting in 2025 were for Work Group members to review all provided resources and consider input from those documents.

A request to hear any new business was made by the Chair, hearing none a motion to adjourn was entertained and passed unanimously. The meeting was adjourned at 11:12am.

These minutes are respectfully submitted by Catherine A. Kelly.

Workgroup to Develop Fire Safety Best Practices for Pre-1974 High-Rise Apartment Buildings (HB823)

Name	Organization
Senator Sara Love	Member of the Senate of Maryland
Delegate Mary Lehman	Member of the House of Delegates
Acting Fire Marshal Jason Mowbray	State Fire Marshal or designee
Edward S. "Ted" Tochterman, Jr.	Chair of the State Fire Prevention Commission
Bob Phillips	President Maryland Fire Chiefs Association or designee
Designated member resigned 11/22/24	President Maryland State Firemen's Association or designee
Chief Michael Rudasill	Representative of the Professional Fire Fighters of MD
Terin Hopkins, National Fire Sprinkler Association	Fire Sprinkler Trade Association representative
Jeanne Schmager Tebera, PE, CFPS, Member Automatic Fire Alarm Association	Fire Alarm Trade Association representative
Abiodun "Babs" Shonaiya	Licensed Architect
Dr. Jamie McAllister	Fire Protection Engineer
Bradley Patrick, Sr.	Building Owners and Managers Association Representative
Appointed member resigned 12/4/24	Building Owners and Managers Association Representative
Mark D. Dopkin	Full Time Resident of High-Rise located in Maryland
Catherine A. Kelly	Workgroup Staff

Workgroup to Develop Fire Safety Best Practices for Pre-1974 High Rise Apartment Buildings
Monday, January 13, 2025
Meeting Minutes
Video call link: https://meet.google.com/vfm-kuse-fwu
Or dial: (US) +1 585-376-1774 PIN: 912 020 846#

The meeting was called to order by the Chair, Acting Fire Marshal Jason Mowbray at 10:33 a.m.

Present were working group members: Acting Fire Marshal Jason Mowbray, Senator Sara Love, Edward S. "Ted" Tochterman, Jr., Bob Phillips, Josh Bunting, Chief Michael Rudasill, Terin Hopkins, Jeanne Schmager Tebera, Abiodun "Babs" Shonaiya, Bradley Patrick, Sr., Miriam Hamilton, and Mark D. Dopkin.

Staff in attendance: Ken Bush, MSP/OFSM.

Workgroup staff: Catherine Kelly, MSP, and Nicole Jordan Jones, MSP.

Members of the public in attendance: Matt Pipkin, Ashley Clark, Brian Anleu, Dennis Dawson, Hugo Cantu, Steve Silverman, Joseph Woods, Malcom Moody, Steven Hinch, and Franc (DHCD Baltimore City)

Absent working group members: Delegate Mary Lehman, and Dr. Jamie McAllister

Roll call was compiled by workgroup staff. Staff confirmed there was a quorum present.

Minutes from the December 11, 2024 meeting of the workgroup were reviewed and approved with one member abstaining.

Chair, Acting Fire Marshal Jason Mowbray introduced two new members to the group. Miriam Hamilton, Board Vice President of Promenade Towers who was appointed by Governor Moore and Chief Joshua Bunting who was designated to represent the Maryland State Firefighter's Association.

Chair Mowbray asked staff to report on the submission of the interim report to The Maryland General Assembly. Catherine Kelly presented remarks from The Maryland General Assembly Environment and Transportation Committee Chairman Marc Korman shared via email. Chairman Korman said "Let me say that I have followed the Work Group's efforts from afar and while I appreciate everyone's efforts. I am surprised about the continued focus on sprinklers as the General Assembly struck the sprinklers specific study items in favor of searching for alternatives approaches (in part because of cost and practicality issues)."

Workgroup member Dr. McAllister was unable to attend and asked that staff share her thoughts on the way the workgroup can move forward. Dr. McAllister said "I had noted the following as next steps or items that members requested to be addressed by the committee. I am not sure if these are all within the scopes of the committee.

1) In what ways was cost considered when the proposed risk mitigation measures were identified?
2) What is the cost impact of the risk mitigation measures and what are some unique challenges that can impact cost?
3) Is reliable data available on pricing for retrofit sprinkler installation?
4) What has been done to address cost impact in other jurisdictions that have implemented the same risk mitigation measures?

5) What are the successes and challenges that other jurisdictions have faced in implementing the same risk mitigation measures?
6) What alternative methods have been considered and why are they not sufficient?
7) What are best practices for cost effective installation of retrofit sprinklers?"

A discussion followed the remarks. Much of the discussion centered around scopes of alternative solutions and how best for the workgroup to move forward.

The work group staff agreed to maintain a list of issues outside the main scope to be included in the report, which currently contains:

- Financial incentives/recommendations for retro fitting
- Jurisdictional differences/challenges and the need for consistency
- Impact to Fire Department operations, first responders' injuries and deaths
- Existing maintenance of building and if it meets mandated requirements
- Educational protocols for Fire Safety

Chair Mowbray asked the workgroup members how they would like to proceed with the next phase of work. Members agreed to create a list of systems to discuss with any associated known uses and if the systems meet mandated requirements and review the bid package shared by Terin Hopkins. Chair Mowbray encouraged members to be prepared to discuss their list at the next meeting.

Committee was reminded the next meeting will be held virtually on January 27, 2025 at 10:30 a.m.

A request for any new business was made by the Chair, hearing none a motion to adjourn was entertained and passed unanimously. The meeting adjourned at 11:39 a.m.

These minutes are respectfully submitted by Nicole Jordan Jones.

Workgroup to Develop Fire Safety Best Practices for Pre-1974 High Rise Apartment Buildings
Monday, January 27, 2025
Meeting Minutes
Video call link: https://meet.google.com/sov-zoyb-hbq
Or dial: (US) +1 470-466-0153 PIN: 651 290 475#

The meeting was called to order by the Chair, Acting Fire Marshal Jason Mowbray at 10:32 a.m.

Present were the workgroup members: Acting Fire Marshal Jason Mowbray, Babs Shonaiya, Bob Phillips, Brad Patrick, Edward Tochterman, J Bunting, Jamie McAllister, Jeanne Tebera, PE, CFPS, Mike Rudasill, Miriam Hamilton, Terin Hopkins.

Staff in attendance: Ken Bush, MSP/OFSM.

Workgroup staff: Catherine Kelly, MSP and Nicole Jordan Jones, MSP.

Members of the public in attendance: Malcolm Moody, Brian Anieu, Matt Pipkin, Jennifer Haslam Guest, Hugo Cantu.

Absent workgroup members: Senator Sara Love, Delegate Mary Lehman and Mark Dopkin.

Roll call was compiled by workgroup staff. Staff confirmed there was a quorum present.

Minutes from January 13, 2025 meeting of the workgroup were reviewed and approved.

The Chair reminded members during the last meeting the group discussed identifying and creating a list of system alternatives and any of the considerations and factors. The Chair opened the floor for discussion.

The workgroup members discussed cost estimates for an actual building in Montgomery County, along with additional systems. Additional recommendations included: sprinkler retrofit construction, exhaust fan replacement, stair pressurization fan and elevator pressurization fan replacements, as well as replacement of the entire fire alarm system for buildings as a best practice to consider. Further discussion covered the advantages and disadvantages of each alternative system.

The Chair mentioned the workgroup has already discussed the scope of work, particularly in terms of ensuring consistency when implementing proposals or estimates. This includes considering which systems are affected and what kind of remediation or updates might be needed for other related equipment and systems. Naturally, these factors will influence the overall cost of the project. So, it's been a productive discussion regarding the alternatives we're considering.

He also reminded everyone that the group's main responsibility is to identify the risks, figure out the best way to mitigate them, and provide recommendations. These recommendations can include a cost analysis when proposing the most effective solution. Ultimately, it will be up to the senators and delegates to decide how to proceed with the recommendations.

Jeanne Tebera suggested the group consider reaching out to an industrial hygienist to determine what is needed and what can be done as the group recommends alternative systems. The Chair agreed and asked workgroup members to send information for any expert hygienist they would like the group to consider consulting with before the next meeting.

The workgroup was reminded the next meeting will be held virtually on February 10, 2025 at 10:30 a.m.

A request for any new business was made by the Chair, hearing none a motion to adjourn was entertained and passed unanimously. The meeting adjourned at 11:33 a.m.

These minutes are respectfully submitted by Nicole Jordan Jones.

Workgroup to Develop Fire Safety Best Practices for Pre-1974 High Rise Apartment Buildings
Monday, February 10, 2025
Meeting Minutes
Video call link: meet.google.com/axu-yavb-hcc
Or join by phone (US) +1 609-429-5965 PIN: 731 877 860#

The meeting was called to order by the Chair, Acting Fire Marshal Jason Mowbray at 10:33 a.m.

Present were the workgroup members: Acting Fire Marshal Jason Mowbray, Babs Shonaiya, Bob Phillips, Brad Patrick, Edward Tochterman, J Bunting, Jeanne Tebera, Mike Rudasill, Dr. Miriam Hamilton, Senator Sara Love and Terin Hopkins.

Staff in attendance: Ken Bush, MSP/OFSM.

Workgroup staff: Nicole Jordan Jones, MSP.

Members of the public in attendance: Daniel Admasu, Brian Anleu, Joseph Woods, Matt Pipkin, Scott Custer, Steven Hinch.

Absent workgroup members: Delegate Mary Lehman, Dr. Jamie McAllister and Mark Dopkin

Roll call was compiled by workgroup staff. Staff confirmed there was a quorum present.

The meeting was opened by Chair, Acting Fire Marshal Jason Mowbray, who introduced Mr. Daniel Admasu from Apex as an invited guest. Mr. Admasu (who specializes in industrial hygiene, mold assessments, and asbestos inspections), from Apex, LLC has a background in engineering and has been in the industrial hygiene industry for 30 years. The Chair mentioned that, following the previous meeting, the workgroup sought input on asbestos abatement and reached out to members for recommendations. A few responses were received, and staff contacted those representatives to invite them to today's meeting. He further highlighted the workgroup's focus on addressing fire safety risks in non-sprinklered residential high-rise buildings built before 1974 in Maryland, specifically considering various mitigation strategies and their potential impacts, including financial aspects and tenant relocation.

The conversation with Mr. Admasu revolved around the workgroup discussing potential impacts and considerations of asbestos abatement in buildings that are undergoing or in need of fire protection upgrades, such as retrofitting sprinkler systems. The workgroup covered multiple concerns related to asbestos, such as how to handle and mitigate risks when working in older buildings (built pre-1974), the need for proper inspections, and the different ways asbestos may be present in construction materials. Mr. Admasu explained that in high-rise buildings, potential asbestos could be found in areas like fireproofing materials or popcorn ceilings.

The group also touched on practical matters like the cost and logistics of asbestos testing and abatement. Mr. Admasu mentioned that inspecting large buildings like high-rises could cost around $3,000 a day, with teams covering 15,000 to 20,000 square feet per day. Asbestos abatement work, such as removing asbestos around penetrations for sprinkler systems, would be priced separately and depend on the specifics of each project.

After Mr. Admasu's departure, the Chair continued the meeting with a review of the minutes from the January 27th workgroup meeting. The minutes from the previous meeting of the workgroup were reviewed and approved.

The workgroup then continued discussing the next phase of their work. The Chair, highlighted the ongoing deliberations about fire safety in high-rise buildings, particularly the cost and logistics of installing sprinkler systems. Concerns were raised about the affordability of sprinklers and their occasional malfunction, which could lead to significant water damage. It was suggested by Dr. Hamilton that in addition to sprinklers, there should be guidance on how to handle a fire in buildings that don't have sprinklers, noting the importance of educating tenants.

Mr. Patrick emphasized the cost challenges of installing sprinklers but supported finding a common-sense approach to make retrofits more affordable. He mentioned that sprinklers are generally reliable but acknowledged occasional failures due to human error. He suggested that focusing on basic sprinkler systems without unnecessary upgrades could reduce costs. Mr. Patrick also discussed the difficulties in educating tenants, particularly in multi-family housing where constant turnover and language barriers complicate the process.

The discussion turned to the broader issue of fire safety in older buildings, with a recognition that these buildings do not meet modern fire protection standards. There was consensus on the importance of layered protection strategies, including sprinkler systems, fire safety education, and compartmentation. The workgroup also discussed that tenant fire safety education and community outreach visits aren't meant to take the place of sprinklers. Montgomery County's Fire Safety for Seniors program was established as a stopgap measure to minimize fire injuries and deaths until sprinklers could be installed.

The Chair concluded the meeting with a reminder of the next scheduled meeting on February 24th at 10:30 a.m. and a commitment to continue refining recommendations on fire safety for high-rise buildings, focusing on affordability and effectiveness.

A request for any new business was made by the Chair, hearing none a motion to adjourn was entertained and passed unanimously. The meeting adjourned at 11:37 a.m.

These minutes are respectfully submitted by Nicole Jordan Jones.

Workgroup to Develop Fire Safety Best Practices for Pre-1974 High Rise Apartment Buildings
Monday, February 24, 2025
Meeting Minutes
Video call link: https:// meet.google.com/rsb-razk-rqa
Or dial: (US) +1 740-573-5330 PIN: 771 474 395#

The meeting was called to order by the appointed Co-Chairs Dr. Jamie McAllister and Mr. Bradley Patrick, Sr. at 10:33 a.m.

Present were the workgroup members: Babs Shonaiya, Bob Phillips, Brad Patrick, J Bunting, Dr. Jamie McAllister, Jeanne Tebera, PE, CFPS, Dr. Miriam Hamilton, Senator Sara Love, Terin Hopkins.

Staff in attendance: Ken Bush, MSP/OFSM.

Workgroup staff: Catherine Kelly, MSP and Nicole Jordan Jones, MSP.

Members of the public in attendance: Ashley Clark, Brian Anieu, Matt Pipkin, Joseph Woods, Absent workgroup members: Acting Fire Marshal Jason Mowbray, Delegate Mary Lehman, Mark Dopkin, Mike Rudasill, and Edward “Ted” Tochterman.

In Acting Fire Chief Jason Mowbray’s absence, Dr Jamie McAllister and Mr. Bradley Patrick, Sr. were appointed co-chairs of this meeting.

Roll call was compiled by workgroup staff. Staff confirmed there was a quorum present. Minutes from February 10, 2025 meeting of the workgroup were reviewed, changes made and approved.

Dr. McAllister opened the meeting by discussing the progress and next steps in creating an outline for the workgroup's fire safety recommendations and final report, particularly addressing the issue of sprinklers and other fire protection methods. The workgroup had previously discussed the installation of sprinklers and the associated costs but is now shifting its focus to meet the legislative request that established the workgroup by considering alternative fire suppression methods. Dr. McAllister emphasized that sprinklers are the most effective way to reduce risk, but other systems, such as training, fire alarms, and compartmentation, can supplement this approach.

Senator Sara Love informed the workgroup that legislators are interested in understanding all possible fire safety measures, even if they are not as effective as sprinklers, and wants this information to be presented clearly in the report. The Senator mentioned that she is glad the workgroup is focused on moving the conversation forward and avoiding the repetitive debate on sprinklers versus non-sprinklers, acknowledging that both perspectives need to be included in the report.

Ms. Jeanne Tebera shared with the workgroup that alternative systems should not be considered replacements for sprinklers but as supplemental measures. There is also concern about buildings that may not have sprinklers but still require safety upgrades.

Staff read an email from workgroup member Mr. Mark Dopkins in his absence. Mr. Dopkins expressed that “our final report must include the financial impact of retrofitting and possible intermediate alternatives.”

The workgroup members agreed on the importance of providing a clear and layered approach to addressing fire risks, while understanding the challenges posed by existing buildings without sprinklers. They acknowledge the financial constraints but emphasize that the layered approach to fire safety requires a comprehensive system, including sprinklers, fire alarms, evacuation plans, fire doors, and other measures. This approach is seen as the best way to reduce overall costs while enhancing safety.

Mr. Terin Hopkins emphasized that existing codes already offer a layered approach to fire safety. He highlighted that sprinklers are proven to reduce fire risk significantly. He also stressed that alternatives to sprinklers have not been shown to be as effective and could be more expensive. He advocated for a phased approach to fire safety improvements to reduce costs.

Chief Bunting emphasized that while cost is a significant concern, focusing on cheaper alternatives could undermine efforts to install sprinklers, which are a proven and critical safety measure. He suggested exploring options like tax incentives or extended timelines to help buildings meet sprinkler installation requirements.

The overall sentiment from the workgroup is that any recommendations put forward in the final report should include a comprehensive, layered approach to fire safety, but financial constraints should be taken into account.

Dr. McAllister informed the workgroup that she would send the final report outline to staff and have them circulate it to all of the workgroup members for further discussion at the next meeting.

The workgroup was reminded the next meeting will be held virtually on March 10, 2025 at 10:30 a.m.

A request for any new business was made by the Co-Chairs, hearing none a motion to adjourn was entertained and passed unanimously. The meeting adjourned at 11:33 a.m.

Please see the attached document, labeled as Appendix A, for further details.

These minutes are respectfully submitted by Nicole Jordan Jones.

Workgroup to Develop Fire Safety Best Practices for Pre-1974 High Rise Apartment Buildings
Monday, March 10, 2025
Meeting Minutes
Video call link: https:// meet.google.com/xeh-uujm-yge
Or dial: (US) +1 267-630-2046 PIN: 430 503 068#

The meeting was called to order by Chair Acting Fire Marshal Jason Mowbrayat 10:32 a.m.

Present were the workgroup members: Edward Tochterman, J Bunting, Jamie McAllister, Chief Jason Mowbray-, Jeanne Tebera, PE, CFPS, Mark Dopkin, Mike Rudasill, Miriam Hamilton, Senator Sara Love

Staff in attendance: Ken Bush, MSP/OFSM.

Workgroup staff: Catherine Kelly, MSP and Nicole Jordan Jones, MSP.

Absent workgroup members: Delegate Mary Lehman, Babs Shonaiya, Bob Phillips, Brad Patrick,Jr.

Roll call was compiled by workgroup staff. Staff confirmed there was a quorum present.

Minutes from February 27, 2025 meeting of the workgroup were reviewed and approved.

Chair Mowbray asked Dr. McAllister to open the meeting by summarizing the discussion from the previous meeting, where the group began outlining what the final work product should cover. The next steps for committee members involve reviewing the identified topics they wish to contribute to. During this meeting, the goal is to assign tasks and start moving forward with drafting the outline for the workgroup's fire safety recommendations and final report.

Chair Mowbray asked the committee for feedback on a contractor’s estimate for upgrading a building to life safety code. Mr. Hopkins clarified that the estimate was based on a hypothetical 1975 building, with necessary upgrades to meet modern life safety standards, including a fire pump and asbestos inspection/abatement, which are common in older buildings. The bid was similar to other projects in Maryland.

Dr. Hamilton raised concerns that the asbestos abatement cost in the estimate was unreliable, as it was not based on an actual inspection. She stressed that asbestos is a significant issue, particularly in Montgomery County, and that estimates should reflect real inspections. Dr. Hamilton also highlighted the financial burden on lower-income renters, who often spend over 30% of their income on housing. She expressed concern that the cost of retrofitting buildings with sprinklers would be unaffordable for many, especially seniors. Dr. Hamilton acknowledged the importance of sprinklers but remained concerned about the affordability of such upgrades.

Mrs. Tebera, suggested that financial concerns should not be part of the committee's focus, which should be on safety and data-driven decisions. She suggested Dr. Hamilton research cost

comparisons between sprinklered and unsprinklered buildings to assess affordability. Mrs Tebera said safety should not be sacrificed for affordability and that the committee should prioritize fire prevention, even if it increases costs. She also emphasized the necessity of sprinklers, referencing research on the rapid combustion and toxicity of modern furniture.

Mr. Dopkin emphasized presenting clear and factual financial impacts of sprinkler installation, highlighting that the legislature should consider the significant financial implications without speculative or emotional arguments.

Chief Bunting recommended clearly documenting the locations and numbers of high-rise buildings with and without sprinklers across Maryland jurisdictions for legislative insight.

Chair Mowbray reminded the group that their mandate includes addressing cost impacts on residents, including the overall financial burden of the upgrades. He suggested the report should reflect these concerns. He emphasized the need to deliver a complete report to the legislature, outlining best practices and their impacts. This would allow legislators to consider various practical options for implementation.

The group discussed the importance of a layered approach to fire safety. It was agreed that while sprinkler installation remains the ultimate goal, additional and immediate safety improvements should be clearly defined.

Chair Mowbray introduced the appendix from the previous meeting minutes, which outlines the structure for the final report. He confirmed the goal of dividing the workload and forming content for the report through smaller groups, as suggested by Dr. McAllister.

Dr. McAllister confirmed the approach of assigning smaller groups to specific topics to gather content, similar to the initial phase, ensuring the entire committee reviews it later.

Chief Mowbray asked if the previous subcommittees had adequately addressed risk assessment and best practices. Mrs. Tebera responded that the layered approach, crucial to the report, wasn't fully developed and should be emphasized more.

Chief Mowbray agreed with Mrs. Tebera that the layered approach needs more clarity. Dr. McAllister added that while the initial report considered sprinklers as the primary solution, there should also be content on improving other systems (like fire alarms and fire doors) as part of the broader strategy to reduce fire risk before sprinklers are installed. Dr. McAllister also proposed adding content about maintaining and improving existing safety systems, such as ensuring fire alarms are routinely tested and that fire doors are properly maintained, as buildings work towards the eventual installation of sprinklers. This wouldn’t detract from the strong belief that sprinklers are the ultimate solution but would address immediate fire safety needs.

Chief Bunting emphasized the importance of having detailed data about high-rises in jurisdictions, such as the number of sprinklered vs. unsprinklered buildings in areas like Prince George's County. He noted that just knowing the number of unsprinklered buildings is less informative than understanding the proportion.

Chief Mowbray mentioned that Senator Love's office had been working on gathering this information and had reached out to local jurisdictions. He welcomed any updates from Senator Love.

Senator Love explained that gathering the data was more challenging than anticipated. She confirmed that while not all 24 jurisdictions were covered, she had sent some information over two weeks ago and was willing to resend it if needed. Workgroup staff offered to resend the information to everyone to ensure it was easily accessible.

Chief Mowbray reminded the Workgroup that their time together is short and the goal would be to try to have the final report done by May. To help advance the work efficiently toward the final report the Chief established three subcommittees based on the agreed upon report outline. The subcommittee groups and members are:

1. Risk Assessment Subcommittee
- Chief Bunting - Lead
- Terin Hopkins
- Dr. McAllister
- □hief Rudasill
- Ted Tochterman
- Chief Mowbray - Chair
- Ken Bush – Staff

2. Best Practices for Addressing Risks Subcommittee
- Dr. McAllister – Lead
- Chief Mowbray - Chair
- Dr. Hamilton
- Terin Hopkins
- Jeanne Tebera
- Senator Love
- Ken Bush – Staff

3. Impacts of Addressing Risk Subcommittee
- Bradley Patrick, Sr. – Lead
- Dr. Hamilton
- Mark Dopkin
- Babs Shonaiya
- Chief Phillips

- Chief Mowbray - Chair
- Ken Bush - Staff

The workgroup was reminded the next meeting will be held virtually on March 24, 2025 at 10:30 a.m.

A request for any new business was made by Chair Mowbray, hearing none a motion to adjourn was entertained and passed unanimously. The meeting adjourned at 11:34 a.m.

These minutes are respectfully submitted by Nicole Jordan Jones.

Workgroup to Develop Fire Safety Best Practices for Pre-1974 High Rise Apartment Buildings

Monday, March 24, 2025

Meeting Minutes

Video call link: https:// meet.google.com/xeh-uujm-yge

Or dial: (US) +1 267-630-2046 PIN: 430 503 068#

The meeting was called to order by Chair Acting Fire Marshal Jason Mowbray at 10:31 a.m.

Present were the workgroup members: Bob Phillips, Brad Patrick, Edward Tochterman, Jeanne Tebera, Joshua Bunting, Jason Mowbray, Mark Dopkin, Mike Rudasill, Miriam Hamilton, Senator Sara Love and Terin Hopkins.

Staff in attendance: Ken Bush, MSP/OFSM.

Workgroup staff: Nicole Jordan Jones, MSP.

Absent workgroup members: Delegate Mary Lehman, Babs Shonaiya and Dr. Jamie McAllister

Members of the public: Ashley Clark, Brian Anieu, Mary Lee Dichtel, Matt Pipkin

Roll call was compiled by workgroup staff. Staff confirmed there was a quorum present.

Minutes from March 10, 2025 meeting of the workgroup were reviewed and approved.

Chair Mowbray reviewed the tasks from the March 10th meeting as the group moved into the next phase of work. During the previous discussion, members finalized the layout of the final report and assigned sections to breakout groups for drafting.

The following three subcommittees were formed:

- Risk Assessment – Led by Chief Joshua Bunting.

- Best Practices for Addressing Risk – Led by Dr. Jamie McAllister

- Impacts of Addressing Risk – Led by Mr. Brad Patrick

Chair Mowbray asked Mr. Ken Bush to provide an update on the State Fire Prevention Code in response to members' inquiries. Mr. Bush explained that the current code, referenced by the State Fire Prevention Code, includes the 2018 editions of NFPA 1 Fire Code and NFPA 101 Life Safety Code. The process to update to the 2024 editions is in its final stages. Mr. Bush shared the public comment period for the proposed updates has closed, and a public hearing on their adoption is scheduled for March 31st at 10 a.m. at the Laurel City Council Chambers. Following the hearing, the State Fire Prevention

Commission will vote on the final adoption of the updated codes at their meeting on April 17th, also at the Laurel City Council Chambers. Once

approved by the commission and the Maryland State Police Superintendent, the new codes will undergo a 10-day waiting period before they can officially take effect. Currently, the process is awaiting the upcoming public hearing on March 31st.

Ms. Tebera inquired whether the 2024 editions of ICC codes would also be adopted alongside NFPA 1 and NFPA 101. Mr. Bush clarified that ICC code adoption is handled by the Department of Labor (DLLR) under a mandate to review and adopt new editions within 18 months of publication as part of the Maryland Building Performance Standard. The NFPA 72 and NFPA 13 will be referenced through the 2024 editions of the Fire and Life Safety Codes, with 2022 editions being used as applicable.

Dr. Hamilton raised concerns about whether the work group should wait for the 2024 code adoption before finalizing the bid package, which currently references the 2024 NFPA codes. Chair Mowbray noted that risk assessment, best practices, and impact discussions remain largely independent of specific code editions. The bid package still provides relevant information for risk mitigation, particularly regarding sprinkler systems.

Dr. Hamilton emphasized that changes between 2018 and 2024 codes could introduce new or omitted requirements, affecting consistency in the report. Mr. Patrick clarified that the bid package primarily reflects 2018 codes, except for cases involving high-rise buildings with existing life safety systems and balconies. Dr. Hamilton recommended explicitly stating these differences in the report for clarity and consistency.

Chair Mowbray thanked the group for their discussion and transitioned to work group updates, beginning with Chief Bunting's Risk Assessment Subcommittee.

Chief Bunting reviewed the original background and preliminary draft report (SC1), incorporating updates, particularly on the estimated number of non-sprinklered high-rise buildings. He emphasized the importance of presenting a complete picture of affected areas, highlighting differences between jurisdictions like Baltimore and Montgomery County. Ongoing efforts to gather accurate numbers through outreach to state agencies and fire marshals.

Dr. Hamilton conducted an independent analytical estimate based on national statistics and housing studies from major Maryland counties. Her estimate suggested 418 non-sprinklered buildings, differing from previous reports due to varying methodologies in counting buildings.

She requested updated numbers from Ocean City and planned to refine estimates as additional county data became available.

Chief Bunting acknowledged reviewing Dr. Hamilton's report and noted that estimations were inevitable without a comprehensive statewide survey. Discussion on whether to rely on official contacts (fire departments, marshals) for verification or analytical estimates when firm numbers were unavailable.

Senator Love shared additional verified numbers from multiple counties, which Dr. Hamilton agreed to incorporate into her analysis.

Chief Bunting will consolidate various data sources to refine the final report. Dr. Hamilton agreed to coordinate with Chief Bunting to avoid duplication of efforts and ensure efficiency.

Chair Mowbray informed the workgroup that Dr. McAllister was unavailable to meet with the subcommittee last week, but her subgroup has a meeting scheduled for Thursday to begin discussions.

Mr. Patrick reported that his group had limited productivity but is compiling bids and information. They are working with NFPA 2018 101 code to estimate costs for existing systems, potential upgrades, and life safety plans. Dr. Hamilton raised concerns about asbestos-related costs and displacement issues, emphasizing the need for a more detailed assessment of real buildings. Ms. Tebera highlighted the importance of reviewing the entirety of NFPA 101, especially Chapter 43, which outlines renovation requirements beyond just sprinkler installation. The group acknowledged these concerns and will continue discussions in upcoming meetings.

Chair Mowbray summarized the progress of the breakout groups, noting that they are consolidating information for the final report, particularly on risk assessment and its impacts. He acknowledged the incremental progress and invited any additional discussion or new business.

Senator Love requested clarification on the timing of the second workgroup meeting on Thursday, asking for the details to be sent again. Workgroup staff agreed to make sure members have the subcommittee meeting information.

Dr. Hamilton expressed how the report should focused on the importance of resident education in fire safety, alongside existing building codes and sprinkler requirements. She emphasized that while fire codes mandate safety measures like fire drills and escape plans, many buildings do not actively enforce them. Dr. Hamilton stressed that educating residents on fire safety is crucial, especially in older buildings lacking modern fire protection features.

Chair Mowbray noted that these requirements are already part of state fire codes but acknowledged that enforcement and compliance remain challenges. Chief Bunting and Ms. Tebera highlighted issues with building maintenance, code violations, and the lack of regular inspections, which can lead to unsafe conditions.

Dr. Hamilton provided examples of fires where resident behavior significantly impacted outcomes, arguing that education is as critical as sprinkler installation. She suggested that legislators should be encouraged to enforce stricter compliance with fire safety education and maintenance requirements.

Mr. Patrick pointed out the difficulty of implementing consistent fire education in rental properties due to frequent tenant turnover. The discussion concluded with an acknowledgment that a layered fire safety approach including sprinklers, maintenance, and resident education is necessary for effective fire prevention.

Chair Mowbray acknowledged the value of the discussion on human involvement in fire safety education and its complexities. They then opened the floor for additional comments or discussion from workgroup members. Hearing none, he asked staff to remind the group about the next upcoming meeting.

The workgroup was reminded the next meeting will be held virtually on April 7, 2025 at 10:30 a.m.

A request for any new business was made by Chair Mowbray, hearing none a motion to adjourn was entertained and passed unanimously. The meeting adjourned at 11:20 a.m.

These minutes are respectfully submitted by Nicole Jordan Jones.

Workgroup to Develop Fire Safety Best Practices for Pre-1974 High Rise Apartment Buildings

Thursday, April 10 2025

Meeting Minutes

Video call link: https:// meet.google.com/xeh-uujm-yge

Or dial: (US) +1 267-630-2046 PIN: 430 503 068#

The meeting was called to order by Chair Acting Fire Marshal Jason Mowbray at 11:05 a.m.

Present were the workgroup members: Babs Shonaiya, Bob Phillips, Brad Patrick, J Bunting, Dr. Jamie McAllister, Jason Mowbray, Jeanne S. Tebera, PE, CFPS, Mark Dopkin, Mike Rudasill, Dr. Miriam Hamilton

Staff in attendance: Ken Bush, MSP/OFSM.

Workgroup staff: Catherine Kelly and Nicole Jordan Jones, MSP.

Absent workgroup members: Delegate Mary Lehman, Senator Sara Love, Terin Hopkins, Ted Tochterman, Jr.

Members of the public: Mary Lee Dichtel, Bill Castelli, Brendan McCarrick,

Roll call was compiled by workgroup staff. Staff confirmed there was a quorum present.

Minutes from March 24, 2025 meeting of the workgroup were reviewed and approved.

Chair Mowbray discussed the next phase of work under old business. He mentioned that three smaller workgroups have been working independently to finalize content and documentation for their report. The Chair recognized the leaders of those groups and asked for updates, with the goal of finalizing key discussion points by midday to shape the final document and ensure all required criteria are addressed.

Dr. McAllister reported that her subcommittee “Best Practices for Addressing Risk” has a clear outline of needed additions, but more time and contributors are needed to finalize content. She noted progress has been made, with Mr. Hopkins and Mrs. Tebera volunteering to help, but nothing is finalized yet. Chair Mowbray thanked her and then moved on to Chief Bunting for the next update.

Chief Bunting reported that his “Risk Assessment” subcommittee is still in the process of reviewing statewide data, but they’ve found the existing data to be largely inaccurate. He previously sent out a list of questions for feedback and mentioned efforts to obtain more detailed information through the AHJs. Aside from data gathering, most of the report remains unchanged since the previous phase.

Chief Bunting also shared that he has recently been appointed interim Chief in Ocean City, which has increased his responsibilities. As a result, he’s requesting someone else temporarily

take over chairing the subcommittee, though he would like to remain involved in the overall task group.

Chair Mowbray acknowledged the increased demands on Chief Bunting, congratulated him, and agreed to keep him involved. He suggested that the subgroup find a new temporary chair by starting a conversation among its members after the meeting.

The meeting centered around evaluating cost scenarios for bringing existing buildings up to 2018 fire and life safety codes, with and without sprinkler systems. Mr. Patrick reported that the "Impacts of Addressing Risk" subcommittee had developed a foundational outline for estimating costs, noting that figures would vary greatly by building due to differing configurations and needs. The team aimed to calculate costs for maintaining current systems to 2018 code (without sprinklers), implementing county-approved life safety plans, installing basic state-approved sprinkler systems, and fully mandated sprinkler installations. However, because building structures differ, the estimates would be general and not universally applicable.

Dr. McAllister raised a concern about ensuring cost comparisons are useful, questioning if the estimates would allow for a direct comparison across different safety upgrade options within the same building. Mr. Patrick clarified that while per-unit cost data would be developed, the estimates couldn't be standardized across buildings. Chair Mowbray acknowledged the challenge due to building variability and emphasized the need for a consistent baseline scenario to make the comparisons meaningful. He also recommended that any analysis highlight potential cost variations based on building complexities.

Mr. Shonaiya pointed out that existing proposals lacked the detail needed to distinguish between costs for code compliance and sprinkler upgrades, making analysis difficult without deeper inspections of individual buildings. Mr. Patrick reiterated that ideally, each building would be evaluated by engineers and authorities to determine exact needs, but the team would provide as many breakdowns as possible and explain cost variances clearly.

Chair Mowbray and Mr. Patrick discussed that many buildings already require certain safety features (e.g., fire doors, alarms, smoke separation) under original design codes. Upgrades to those systems, such as alarm replacements, might be mistaken as new sprinkler-related costs, even though they are part of ongoing maintenance. Dr. Hamilton added that many buildings may lack compliance with even those basic features, pointing to a fatality in a Silver Spring building that lacked corridor smoke detectors. She supported encouraging buildings to meet all code elements even if sprinklers were unaffordable.

Dr. McAllister noted that "Best Practices for Addressing Risk" subcommittee section of the report would cover the broader concept of layered fire protection, acknowledging that sprinklers are only one part of a comprehensive life safety system. Chair Mowbray inquired whether Mr. Patrick's "Impacts of Addressing Risk" subcommittee would address the occupant displacement impact of retrofitting buildings. Mr. Patrick said this would be included, though only with generalized estimates due to variability—displacement could range from mild inconvenience to full relocation.

Dr. Hamilton shared that she had previously circulated a few rare case studies on sprinkler retrofitting and displacement, noting that there's very limited data because few buildings have undertaken such projects or documented their experiences. Canada had some relevant studies, but most U.S. data is anecdotal.

Chair Mowbray concluded the meeting with a discussion of next steps. Mr. Patrick advocated giving building owners flexibility to choose between different jurisdictional approvals for sprinkler systems.

Chair Mowbray agreed this raised valid concerns about multi-jurisdictional challenges and suggested the work group should consider these issues in their final recommendations. Workgroup staff reminded everyone of upcoming report deadlines, including a draft report by early May and a finalized version by early June 2, 2025 which is the workgroups last scheduled meeting. Chair Mowbray reminded the workgroup they will need a new led for Chief Bunting's subcommittee, and meeting dates in the month of May will shift to accommodate availability. The meeting wrapped up with a review of timelines and next steps, aiming for more detailed drafts from subgroups at the next session.

The workgroup was reminded the next meeting will be held virtually on April 21, 2025 at 10:30 a.m.

A request for any new business was made by Chair Mowbray, hearing none a motion to adjourn was entertained and passed unanimously. The meeting adjourned at 11:37 a.m.

These minutes are respectfully submitted by Nicole Jordan Jones.

Workgroup to Develop Fire Safety Best Practices for Pre-1974 High Rise Apartment Buildings

Monday April 21 2025

Meeting Minutes

Video call link: https:// meet.google.com/xeh-uujm-yge

Or dial: (US) +1 267-630-2046 PIN: 430 503 068#

The meeting was called to order by Chair Acting Fire Marshal Jason Mowbray at 10:33 a.m.

Present were the workgroup members: Babs Shonaiya, Brad Patrick, Edward Tochterman, Chief Joshua Bunting, Dr. Jamie McAllister, Chief Jason Mowbray, Jeanne S. Tebera, PE, CFPS, Mark Dopkin, Chief Mike Rudasill, Dr. Miriam Hamilton, Senator Sara Love and Terin Hopkins

Staff in attendance: Ken Bush, MSP/OFSM.

Workgroup staff: Catherine Kelly and Nicole Jordan Jones, MSP.

Absent workgroup members: Delegate Mary Lehman, and Bob Phillips

Roll call was compiled by workgroup staff. Staff confirmed there was a quorum present.

Minutes from April 10, 2025 meeting of the workgroup were reviewed and approved.

Chair Mowbray discussed the next phase of work under old business. He emphasized the importance of preparing a first draft of the subcommittee work by May 8, with final drafts due by June 2 to allow time for full review and editing of the Workgroup final document. Chief Mowbray acknowledged ongoing challenges in leadership for the risk assessment subgroup, noting that while Chief Bunting remains involved, he cannot take on the lead role. Chief Rudasill has shown interest, but is unsure about his capacity to commit due to workload.

Dr. McAllister reported that her subcommittee is still finalizing their section of the document and plan to circulate it to members for input by the end of the week. She also mentioned pending contributions from Mrs. Tebera, who is working on fire alarm content, and Mr. Hopkins who was asked to provide insight into the lack of success with certain alternative methods. The group agreed that having rough drafts ready by May 8th would be ideal to allow time for collaborative discussion and integration of the subcommittees' work ahead of the June 2nd deadline.

Mr. Patrick reported that his subcommittee is compiling financial information and preparing three proposals for submission. Chief Mowbray acknowledged additional materials shared by Mr. Shonaiya and asked if any support was needed. Mr. Patrick confirmed they were in good shape. Dr. Hamilton raised concerns about the practicality of NFPA 101 Life Safety Code requirements—specifically pressurized and smokeproof stairwells—in older buildings due to structural limitations. Mr. Bush agreed the feasibility depends on building-specific factors and space availability. Mrs. Tebera emphasized the importance of sprinkler systems as a more viable fire protection method, particularly in older buildings where stairwell modifications are difficult. Dr. McAllister added that vestibules may not provide

adequate safety, referencing a fatal fire in Cook County as evidence. Mr. Hopkins echoed her concerns and questioned whether the

requirements were retroactive or simply part of the current code. Mr. Shonaiya clarified that the 2018 NFPA 101 code lists these as requirements for buildings being brought up to current standards, not retrofits, reinforcing that sprinklers remain the most practical solution. Mr. Patrick and Mr. Bush further confirmed that these requirements are integrated into upgrade agreements, particularly in Montgomery County under option-based compliance plans.

In the meeting, Chief Mowbray acknowledged the ongoing leadership transition within the subcommittee, noting that Chief Bunting is currently serving in an acting capacity and that discussions are underway for Chief Rudasill to potentially take over the lead role. Chief Bunting apologized for delays in communication due to being unexpectedly assigned to lead a fire department in Ocean City. He provided a status update, stating his subcommittee is finalizing a consistent set of questions related to risk assessment, which they plan to distribute through the State Fire Marshal's Office. Additionally, they are working on finalizing the language for their subsection of the report, which will include the subcommittee's findings and revised input based on the responses to the questionnaire. Chief Bunting emphasized the importance of determining a cutoff point for data collection in order to complete the report.

Chief Rudasill indicated that while he is less familiar with code specifics, he is confident in his understanding of risk assessment and will coordinate with both Chief Mowbray and Chief Bunting to gain clarity on expectations for the final document.

Chief Mowbray concluded by summarizing the group's progress and reiterating draft deadlines, moving the meeting forward to new business after confirming that all subgroups and timelines had been reviewed.

The workgroup was reminded the next meeting will be held virtually on May 8, 2025 at 10:30 a.m.

A request for any new business was made by Chair Mowbray, hearing none a motion to adjourn was entertained and passed unanimously. The meeting adjourned at 11:00 a.m.

These minutes are respectfully submitted by Nicole Jordan Jones

Workgroup to Develop Fire Safety Best Practices for Pre-1974 High Rise Apartment Buildings
Thursday, May 8, 2025
Meeting Minutes
Video call link: https:// meet.google.com/xeh-uujm-yge
Or dial: (US) +1 267-630-2046 PIN: 430 503 068#

The meeting was called to order by Chair Acting Fire Marshal Jason Mowbray at 10:32 a.m.

Present were the workgroup members: Babs Shonaiya, Brad Patrick, Chief Joshua Bunting, Dr. Jamie McAllister, Chief Jason Mowbray, Jeanne S. Tebera, PE, CFPS, Mark Dopkin, Chief Mike Rudasill, Dr. Miriam Hamilton, Senator Sara Love, Terin Hopkins and Edward Tochterman

Workgroup staff: Catherine Kelly and Nicole Jordan Jones, MSP

Absent Workgroup staff: Ken Bush

Absent workgroup members: Delegate Mary Lehman

Members of the public: Brendan McCarrick

Roll call was compiled by workgroup staff. Staff confirmed there was a quorum present.

Minutes from April 21, 2025 meeting of the workgroup were reviewed and approved.

Chair Mowbray addressed the next phase of work under old business, then handed the meeting over to the subcommittees to present their first draft reports.

Dr. McAllister introduced Mr. Brendan McCarrick to the Workgroup. Mr. McCarrick proceeded to present the first draft of best practices subcommittee report.

Chair Mowbray thanked Dr. McAllister for the presentation and then opened the floor to Mr. Patrick to present impacts on risk reduction subcommittee report.

Mr. Patrick shared that Mr. Babs Shonaiya would present the draft for the subcommittee. Mr. Shonaiya proceeded to present the first draft of the report.

Due to time limitations and a previous conflict Chief Rudasill had to leave the call at 11:30am. He and Chief Mowbray agreed he would have the opportunity to present his subcommittee report at the next meeting. Chief Mowbray then opened the floor for comments from the Workgroup.

Mr. Dopkins expressed concerns about the cost estimates reported by Mr. Shonaiya and requested the subcommittee verify the accuracy of the information.

Mr. Hopkin also had a number of concerns about the presentation and requested an opportunity to review with Mr. Patrick and Mr. Shonaiya after the meeting.

Chief Mowbay concluded the meeting by summarizing the group's progress and reiterating draft deadlines. He requested all subcommittees that presented please send their reports to Mrs. Jordan Jones no later then May 15th, so she can share with the entire group for comments and review before the next meeting.

The workgroup was reminded the next meeting will be held virtually on May 19, 2025 at 10:30 a.m.

A request for any new business was made by Chair Mowbray, hearing none a motion to adjourn was entertained and passed unanimously. The meeting adjourned at 11:56 a.m.

Due to the length of the subcommittee reports, they are not included in the body of the minutes. The documents presented have been attached separately and are included in the appendix for the group’s review.

These minutes are respectfully submitted by Nicole Jordan Jones.

Workgroup to Develop Fire Safety Best Practices for Pre-1974 High Rise Apartment Buildings
Monday, May 19, 2025
Meeting Minutes
Video call link: https:// meet.google.com/xeh-uujm-yge
Or dial: (US) +1 267-630-2046 PIN: 430 503 068#

The meeting was called to order by Chair Acting Fire Marshal Jason Mowbray at 10:33 a.m.

Present were the workgroup members: Dr. Jamie McAllister, Chief Jason Mowbray, Jeanne S. Tebera, PE, CFPS, Mark Dopkin, Chief Mike Rudasill, Dr. Miriam Hamilton, Senator Sara Love, Chief Bob Phillips, Edward Tochterman, and Terin Hopkins

Workgroup staff: Catherine Kelly, Nicole Jordan Jones and Ken Bush, MSP

Absent workgroup members: Delegate Mary Lehman, Chief Joshua Bunting, Brad Patrick and Babs Shonaiya,

Members of the public: Brendan McCarrick

Roll call was compiled by workgroup staff. Staff confirmed there was a quorum present.

Minutes from May 8, 2025 meeting of the workgroup were reviewed and approved.

Chair Mowbray addressed the next phase of work under old business, then handed the meeting over to the subcommittees to present their first draft reports.

Chief Rudasill presented the following in his report:

- Reviewed documents provided by Chief Bunting.
- Noted missing updated jurisdictional data on sprinkler systems.
- Will compile and circulate a draft document to the subgroup shortly.
- Chief Kenneth Bush agreed to coordinate with Rudasill on pending data from agencies.

Dr. McAllister reminded the workgroup her document was revised and submitted. She is still waiting on broader review and feedback from the members of the workgroup.

Mr. Dopkin expressed concerns about feeback he submitted that was not included in the recent version of the "Risk Assessment Subcommittee".

Chief Mowbray requested Mrs. Jones set up a meeting with Mr. Patrick and Mr. Shonaiya to make sure everyones feedback is part of the final report, since they were unable to make this meeting.

Mrs. Jordan Jones remined the group she needs at least two weeks post-June 2 to compile and format the final report for submission to the General Assembly. She requested each subcommittee send their final document as soon as possible.

Dr. Hamilton expressed concerns that the report overemphasizes sprinkler systems while underrepresenting the role of existing building features and resident education.

Dr. McAllister and Chief Mowbray emphasized the importance of a layered safety approach and encouraged submission of suggested content for integration.

Mrs.Tebera and Mr. Tochterman referenced legal precedent and past studies to support the necessity of sprinklers but acknowledged the current transitional period without them.

The importance of technical accuracy and resident-focused language was underscored.

Consensus was reached that while sprinklers are a critical safety component, interim strategies including education, maintenance, and administrative controls are also vital.

Chief Mowbray concluded the meeting by summarizing the group's progress and emphasizing upcoming draft deadlines. He reminded members to submit written contributions if they wish to propose edits or additions to the draft reports. All subcommittees were asked to submit their reports to Ms. Jordan Jones by May 28th, allowing time for distribution to the full group for review and feedback prior to the next meeting.

The workgroup was reminded the next and final meeting will be held virtually on June 2, 2025 at 10:30 a.m.

A request for any new business was made by Chair Mowbray, hearing none a motion to adjourn was entertained and passed unanimously. The meeting adjourned at 10:55 a.m.

Due to the length of the subcommittee reports, they are not included in the body of the minutes. The documents presented have been attached separately.

These minutes are respectfully submitted by Nicole Jordan Jones.

Workgroup to Develop Fire Safety Best Practices for Pre-1974 High Rise Apartment Buildings
Monday, June 2, 2025
Meeting Minutes
Video call link: https:// meet.google.com/xeh-uujm-yge
Or dial: (US) +1 267-630-2046 PIN: 430 503 068#

The meeting was called to order by Chair Acting Fire Marshal Jason Mowbray at 10:32 a.m.

Present were the workgroup members: Chief Jason Mowbray, Babs Shonaiya, Bob Phillips, Brad Patrick, Edward Tochterman, Chief Joshua Bunting, Jeanne S. Tebera, PE, CFPS, Mark Dopkins, Chief Mike Rudasill, Dr. Miriam Hamilton, Senator Sara Love

Workgroup staff: Catherine Kelly and Nicole Jordan Jones, MSP

Absent Workgroup Staff: Ken Bush, MSP

Absent workgroup members: Delegate Mary Lehman, Terin Hopkins and Dr. Jamie McAllister

Members of the public: Brendan McCarrick

Roll call was compiled by workgroup staff. Staff confirmed there was a quorum present.

Minutes from May 19, 2025 meeting of the workgroup were reviewed and approved.

Chair Mowbray addressed the phases of work under old business, then handed the meeting over to the three subcommittees to present their final draft reports.

Chief Rudasill presented on behalf of the subcommittee one which addressed risk assessment. He detailed their continued collection of jurisdictional data on sprinkler systems and outlined key sections of their report, including inspection, the effect of modern home furnishings on fire growth, human behavior under stress, and case studies of notable high-rise fires. He emphasized that while structural upgrades are essential, the human factor and education also play a critical role. Dr. Hamilton raised concerns about the need for stronger emphasis on compartmentation and Mrs. Tebera reasserted the limitations of relying on human behavior in emergencies.

Mr. McCarrick spoke on behalf of Dr. McAllister for subcommittee two. He reviewed recent revisions based on member feedback and emphasized the importance of engineering features such as compartmentation, while also acknowledging the role of resident training. Dr. Hamilton reiterated the need to communicate the benefits of maintaining compartment integrity to readers of the report.

Mr. Patrick and Mr. Shonaiya presented for subcommittee three, which examined costs and impacts of retrofitting buildings to meet fire safety best practices. Their report categorized impacts based on the current condition of buildings and provided real-world examples and cost estimates from contractor bids. Dr. Hamilton suggested refining the scenarios to account for

buildings that are up to code but contain hazardous materials like asbestos, which Mr. Shonaiya agreed to incorporate.

The workgroup members supported Mr. Shonaiya's suggestion to have a single editor unify the three sections for consistency and readability. Workgroup staff confirmed this would be part of the report compilation process and emphasized the need for a firm deadline for final input to avoid delays. Chair Mowbray reinforced the importance of timely feedback and noted the intention to adhere to the submission timeline.

Senator Love expressed appreciation for the group's work and offered to provide additional suggestions to enhance the report's clarity and accessibility for legislators.

Chair Mowbray concluded with a reminder that this would be the last scheduled meeting of the workgroup. He informed members that all future communications about the finalization of the report would be electronic unless a special session was needed. A motion to adjourn was entertained and passed unanimously. The meeting adjourned at 11:13 a.m.

These minutes are respectfully submitted by Nicole Jordan Jones.

RESEARCH FOUNDATION

RESEARCH FOR THE NFPA MISSION

Total Cost of Fire in the United States

FINAL REPORT BY:

Jun Zhuang, Vineet M. Payyappalli, Adam Behrendt, and Kathryn Lukasiewicz

Department of Industrial and Systems Engineering, University at Buffalo
Buffalo, NY, USA

October 2017

© 2017 Fire Protection Research Foundation

1 Batterymarch Park, Quincy, MA 02169-7417, USA
Email: research@nfpa.org | Web: nfpa.org/foundation

FOREWORD

In August 2016, NFPA hosted *Economic Decision Making in Fire and Electrical Safety: A Workshop on Needs and Resources*. The workshop brought together the fire service, enforcers, economists, researchers, and others to discuss the information and research needs around economics and fire and electrical safety. One of the major areas identified for further study is the data and information related to the total economic impact of fire. It was noted by participants that there is a need to compile and update available information on this topic and to introduce consistency on the economic data around fire. This information would be used for fact sheets or similar communications about the cost of fire.

NFPA has provided information about the total cost of fire (i.e. losses plus the costs of protection) for several years with the latest report published in March 2014 (www.nfpa.org/totalcost). This analysis combines the losses caused by fire and the money spent for fire prevention, protection, and mitigation to prevent larger losses. While the workshop participants noted that this is an important analysis and report, they identified a need to better address indirect loss. This includes business interruption, employment, impact on real estate values, information on the indirect costs of injury (both occupant and first responder), etc.

The Foundation initiated this project to revisit the data, methodologies and approach used in NFPA's report *The Total Cost of Fire in the United States* published in March of 2014. This report is an update of this report with the most recent data available in the United States and highlights gaps where additional work is needed to improve the estimates.

The Fire Protection Research Foundation expresses gratitude to the report authors Jun Zhuang, Vineet M. Payyappalli, Adam Behrendt, and Kathryn Lukasiewicz, who are with the Department of Industrial and Systems Engineering, University at Buffalo located in Buffalo, NY, USA. The Research Foundation appreciates the guidance provided by the Project Technical Panelists and all others that contributed to this research effort. Thanks are also expressed to the National Fire Protection Association (NFPA) for providing the project funding.

The content, opinions and conclusions contained in this report are solely those of the authors and do not necessarily represent the views of the Fire Protection Research Foundation, NFPA, Technical Panel or Sponsors. The Foundation makes no guaranty or warranty as to the accuracy or completeness of any information published herein.

About the Fire Protection Research Foundation

The Fire Protection Research Foundation plans, manages, and communicates research on a broad range of fire safety issues in collaboration with scientists and laboratories around the world. The Foundation is an affiliate of NFPA.

About the National Fire Protection Association (NFPA)

Founded in 1896, NFPA is a global, nonprofit organization devoted to eliminating death, injury, property and economic loss due to fire, electrical and related hazards. The association delivers information and knowledge through more than 300 consensus codes and standards, research, training, education, outreach and advocacy; and by partnering with others who share an interest in furthering the NFPA mission.

All NFPA codes and standards can be viewed online for free.

NFPA's membership totals more than 65,000 individuals around the world.

Keywords: fire statistics, cost, economic losses, loss estimates, fire losses, economic impact

Report number: FPRF-2017-21

PROJECT TECHNICAL PANEL

Brian Ashe, Australian Building Codes Board

Brett Brenner, Electrical Safety Foundation International (ESFI)

Dave Butry, NIST

Jeff Case, Phoenix Fire Department

Gregg Cleveland, City of Lacrosse

Butch Diekemper, City of Lenexa FD

Bill Jenaway, VFIS

Larry Krasner, FM Global

Jeff Prestimon, US Forest Service

Dave Waterhouse, Montreal Fire Department

Marty Ahrens, NFPA Research, Data, and Analytics

Russ Sanders, NFPA Metro Chief Liaison

PROJECT SPONSOR

NFPA

Total Cost of Fire in the United States

Jun Zhuang, Vineet M. Payyappalli, Adam Behrendt, Kathryn Lukasiewicz
Department of Industrial and Systems Engineering, University at Buffalo

October 31, 2017

Abstract: This report presents the total cost of fire in the United States for the years 1980 to 2014. The cost of fire for the years 2015 and later are not calculated as most of the data sources used are available only until 2014. The total cost of fire is defined as the collective of all net expenditure on fire protection and all net losses due to fire incidents. For 2014, the total is $328.5 billion, which was 1.9% of the U.S. Gross Domestic Product (GDP). The expenditures constitute $273.1 billion (83.1% of total) and the losses constitute $55.4 billion (16.9% of total). The fire safety costs in building construction is the largest component at $57.4 billion (17.5% of total). This report provides updated prevention, protection, and mitigation costs. This has been achieved through (a) creating a taxonomy for mutually exclusive expenditures and losses based on findings from extensive literature review to ensure a complete accounting of the cost of fire, and (b) using analytical methodologies from literature review of fire and other hazard impacts to account for each defined facet of cost and loss. These methods will guide the calculation of the total cost of fire in being complete, precise, and standardized for future application by the National Fire Protection Association (NFPA) community. Future research directions, including regression analysis to find relationships between quantifiable factors of costs and losses, are also provided.

Acknowledgments: We are thankful to many colleagues for providing support and constructive feedback on all phases of this project. Firstly, we thank Amanda Kimball (Fire Protection Research Foundation) for administering meetings and coordinating the communication and feedback between the research team and the project panel. We are also grateful to Amanda for connecting us with experts from fire protection and insurance sectors, who provided highly valuable information and comments. Next, we thank our project panel members for sharing their valuable expertises and experiences: Marty Ahrens (NFPA Research), Brian Ashe (Australian Building Codes Board), Brett Brenner (Electrical Safety Foundation International), Dave Butry (National Institute of Standards and Technology), Jeff Case (Phoenix Fire Department), Gregg Cleveland (City of Lacrosse Fire Department, WI), Butch Diekemper (City of Lenexa Fire Department, KS), Dr. Bill Jenaway (Volunteer Firemen's Insurance Service, Inc.), Larry Krasner (FM Global), Jeff Prestemon (U.S. Forest Service), Russ Sanders (NFPA Metro Chief Liaison), and Dave Waterhouse (Montreal Fire Department). We extend our gratitude to the project sponsor representatives: Kathleen Almand (NFPA), Ray Bizal (NFPA), and Meghan Housewright (NFPA). The panel members as well as the project sponsor representatives provided valuable information, suggestions, and feedback, which played a significant role in shaping this report. We also thank other contacts for the project including Dave Finger (National Volunteer Fire Council), Mary-Anne Firneno (Insurance Information Institute), and Nancy A. Narisi (Insurance Services Office), for sharing information that was pivotal in developing the section on the value of time donated by volunteer firefighters as well as net fire insurance expenditure. Finally, we thank Robert Polk (National Association of State Fire Marshals) and Kenneth E. Bush (Maryland State Fire Marshal's Office) for providing valuable comments on the report. The authors assume all errors.

Contents

Abstract viii

Acknowledgments viii

Executive Summary and Illustrations 1

1 Introduction 7

2 Expenditure Components of the Total Cost of Fire 13
2.1 Active Protection Expenditure 13
2.2 Passive Protection Expenditure 19
2.3 Net Fire Insurance Expenditure 22

3 Loss Components of the Total Cost of Fire 24
3.1 Direct Loss 24
3.2 Indirect Loss 27

4 Discussion, Conclusion, and Future Work 39
4.1 Discussion 39
4.2 Conclusion 41
4.3 Future Work 43

Executive Summary and Illustrations

In response to an increased demand for data to aid decision making in fire protection at the strategic and operational levels, this report aims to provide data on the cost of fire[1] in the United States to anyone with an interest in understanding or using this data. This report is an update of a previous version (*The Total Cost of Fire in the United States*; NFPA, 2014b, which calculated the total cost of fire from 1980 to 2011) to provide more updated prevention, protection, and mitigation costs, with critical attention on estimating the economic impact of fire. In addition to providing updated methodologies for calculating the total cost of fire and its components, this report also identifies the areas where more future work is needed to improve the accuracy of estimating the total cost of fire.

The total cost of fire in the United States in 2014 was $328.5 billion, which was 1.9% of the U.S. Gross Domestic Product (GDP). The components of the total cost of fire are given in Table 1. The total cost of fire has been broken down into mutually exclusive categories of “expenditure" and “loss" and their sub-categories. The expenditures constitute $273.1 billion (83.1% of total) and the losses constitute $55.4 billion (16.9% of total).

Table 1: Components of the total cost of fire in the U.S. in 2014. All values are in billion U.S. dollars.

Breakdown of the total cost of fire in the U.S., 2014				Value (in billion $)
Expenditure (273.1)	Direct (90.1)	Active fire protection expenditure (90.1)	Local fire department expenditures	41.9
			Value of donated time of volunteer firefighters	46.9
			Donations to fire departments	1.3
	Indirect (183.0)	Passive fire protection expenditure (159.4)	Fire safety costs in building construction	57.4
			Fire grade products	54.0
			Fire maintenance	36.5
			Fire retardants	7.5
			Disaster planning	3.4
			Preparing/maintaining standards	0.6
		Net fire insurance		23.6
Loss (55.4)	Direct (53.5)	Human loss (40.4)	Cost of statistical deaths	31.4
			Cost of statistical injuries	9.0
		Property loss		13.2
	Indirect losses			1.9
Total				328.5

Some important highlights/findings from the analysis presented in this report are:

- For each cost component and for all the years from 1980 to 2014, the actual dollar values as well as the 2014 dollar equivalent have been calculated. The 2014 dollar values are estimated from the actual values, using inflation rates in Table 4. The costs discussed in this summary are inflation-adjusted values.
- Over the years 1980 to 2014, the total cost of fire has increased by 50.3%. However, over the same period of time, the total cost of fire as a percentage of U.S. GDP has decreased by 75.3% (from 7.6% in 1980 to 1.9% in 2014).

[1] This report only considers structural fires; wildfires and vehicle fires are excluded from analysis. Some other costs that are not considered are: the cost of industry-owned-fire-departments; the cost of water for firefighting; and the costs of enhancing the fire protection features of already constructed buildings.

- The fire safety costs in building construction ($57.4 billion) constitute the largest share (17.5%) of the total cost in 2014. Cost of fire grade products, the value of donated time of volunteer firefighters, and local fire department expenditure are the second, third, and fourth largest shares (16.4% at $54.0 billion, 14.3% at $46.9 billion, and 12.8% at $41.9 billion, respectively).

- Due to a significant decrease in the number of deaths and injuries (civilian and firefighter) over the years 1980 to 2014, the cost of statistical deaths and injuries has decreased by 49.7% (from $62.4 billion to $31.4 billion) and 50.3% (from $18.1 billion to $9.0 billion), respectively.

- This report documents multiple calculation methods for certain cost components. In such cases, we selected the most reasonable methods in which the data required was the most readily available. For example, five different methods are presented in Section 2.1 to calculate the value of donated time of firefighters. Since unavailability of accurate data hinders estimation of donated time, this report adopts the most reasonable method (in terms of data availability), which defines the value of donated time as the “cost to replace all volunteer fire departments with career," rather than calculating “the actual value of the donated time of volunteer firefighters." Adoption of this method should not be interpreted as an acknowledgment that eventually all volunteer firefighters would be replaced by career firefighters. The most important and the most difficult-to-estimate value of volunteer firefighters is their availability in the community and their readiness to respond at any hour of the day without being compensated.

- This report defines the ‘economic impact of fire’ as the net monetary downstream effects of fires on the economy. In other words,the economic impact of fire is the sum of all indirect losses due to fire incidents, which is a subset of the total cost of fire. Indirect losses, especially from large-loss fires, are expected to be significantly high and hence would impact the regional economy considerably. However, lack of adequate data on indirect losses makes it difficult to quantify the actual economic impact of fire.

Figure 1 shows the breakdown of the total cost of fire in the U.S. in 2014 into various components. The components are sorted from largest to smallest (top to bottom) in Figure 2. Although highly dependent on the parameters[2] used for calculation, the cost of statistical deaths and the cost of statistical injuries form almost 12.3% of the total cost, or $40.4 billion. Fire maintenance costs ($36.5 billion) and net fire insurance costs ($23.6 billion) also have significant shares of the total cost (11.1% and 7.2%, respectively). Interestingly, direct and indirect property losses ($13.2 billion and $1.9 billion respectively) together constitute only 4.6% of the total cost of fire. Moreover, all of the loss components ($55.4 billion) add up to only 16.9% of the total cost, while the expenditure components ($273.1 billion) add up to the remaining 83.1%. While at first, this may appear imbalanced, in a counterintuitive sense, this highlights the importance of savings provided by the active and passive fire protection efforts, including the fire service. Nevertheless, a conventional cost-benefit analysis may not be practical in the case of fire protection as the potential losses of the resources that are at stake are immense.

Figure 3 shows the trend of the total cost of fire in the U.S. for the years 1980 to 2014. Over the years 1980 to 2014, the total cost has increased by 50.3%. However, an increase in the total cost is expected due to economic factors such as increases in manufacturing, construction, population, and technological improvements. GDP is the best indicator of these changes in the economy. Hence, the total cost of fire is calculated and plotted as a percentage of U.S. GDP for the period of 1980 to 2014. It is seen that this percentage has decreased by 75.3% (from 7.6% in 1980 to 1.9% in 2014). Figure 4 uses the same data as in Figure 3, to show that the total cost as a percentage of GDP has an exponentially decreasing trend in the total cost. During the period 1980-2014, the total losses have

[2]For details on parameters such as the value of statistical life and the value of statistical injury, refer Section 3.1.

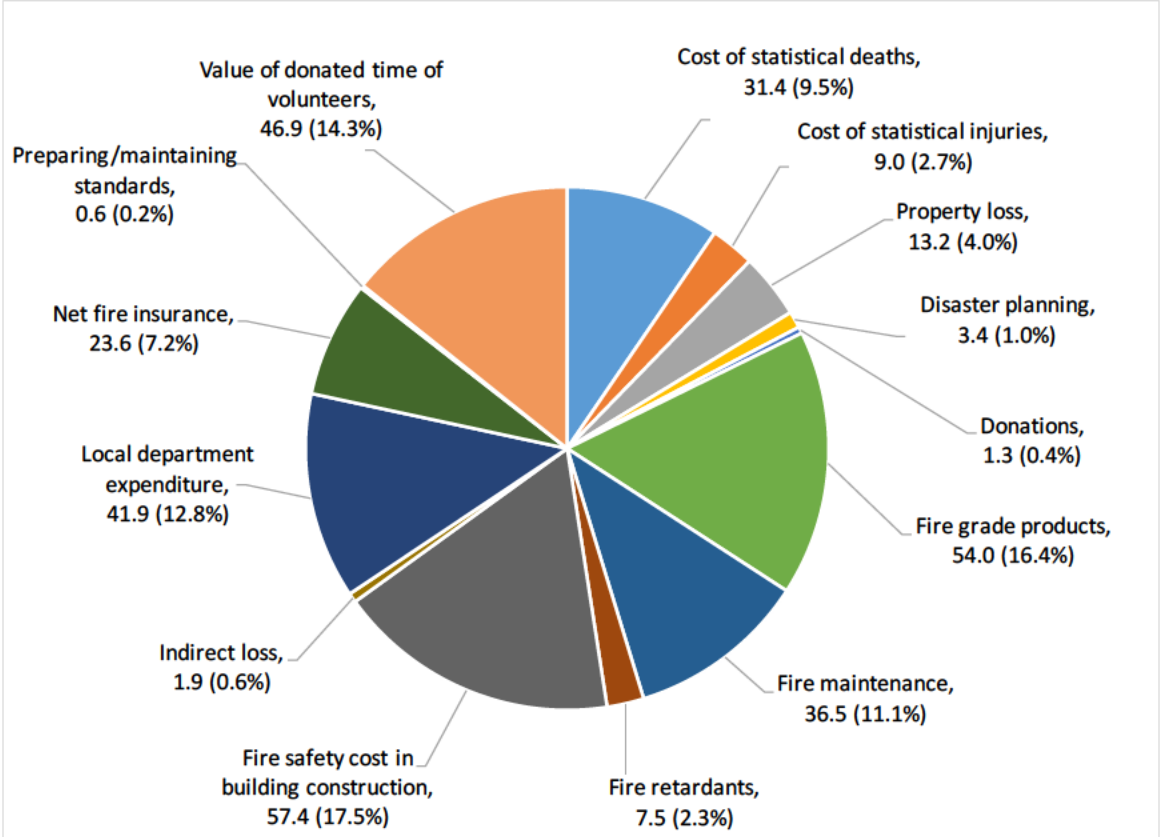


Figure 1: Values (in billion $) and percentage shares of the components of the total cost of fire ($328.5 billion) in the U.S. in 2014.

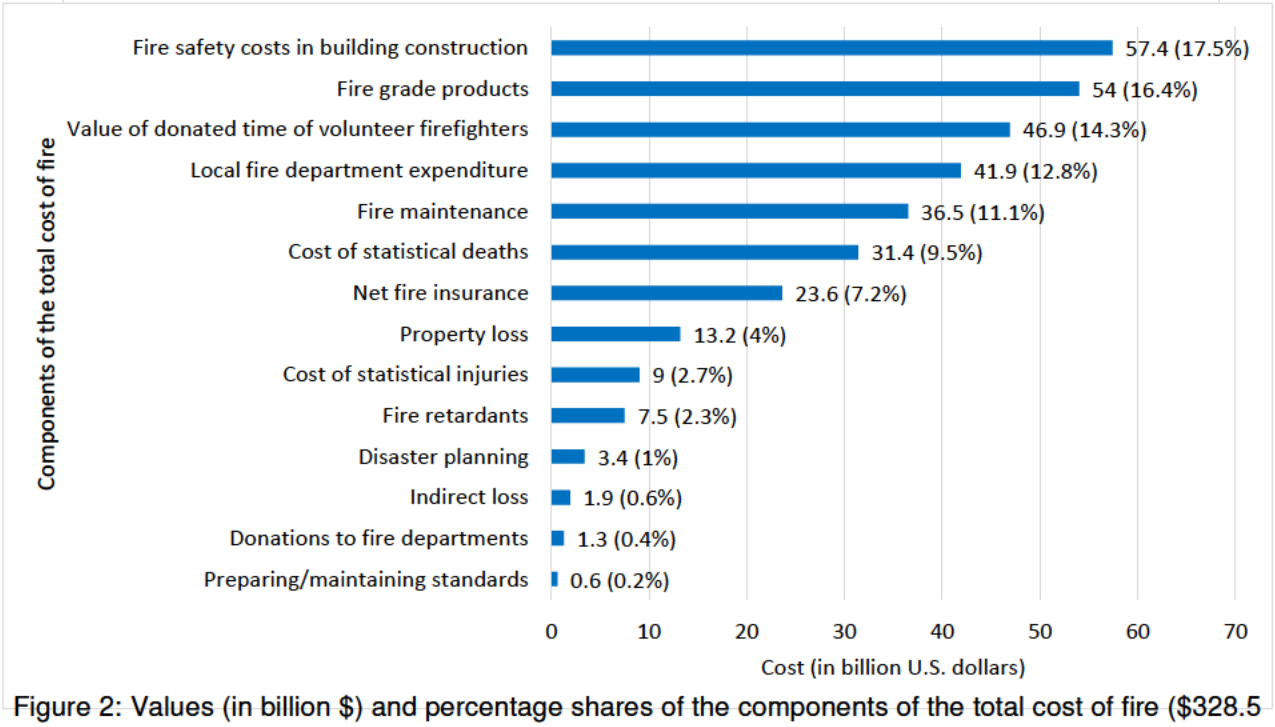


Figure 2: Values (in billion $) and percentage shares of the components of the total cost of fire ($328.5 billion) in the U.S. in 2014, arranged in decreasing order from top to bottom.

decreased by $49.6 billion (47.2%) from $105.0 billion to $55.4 billion, while the total expenditures have increased by $159.6 billion (140.6%) from $113.5 billion to $273.1 billion (Figure 5). Figure 6 shows that the ratio of the total losses to the total expenditures have decreased from 0.93 in 1980 to 0.20 in 2014 (see Table 2 for these ratios). This is attributed to the increased in expenditure over the years, and also to the savings from fire protection efforts, which are impossible to calculate but are very large. Figure 7 shows that losses have decreased in expenditure with decreasing marginal losses.

In summary, this report presents a comprehensive analysis of the total cost of fire in the United States for the years 1980 to 2014, and describes the impact of fire on various sectors of the U.S. economy.

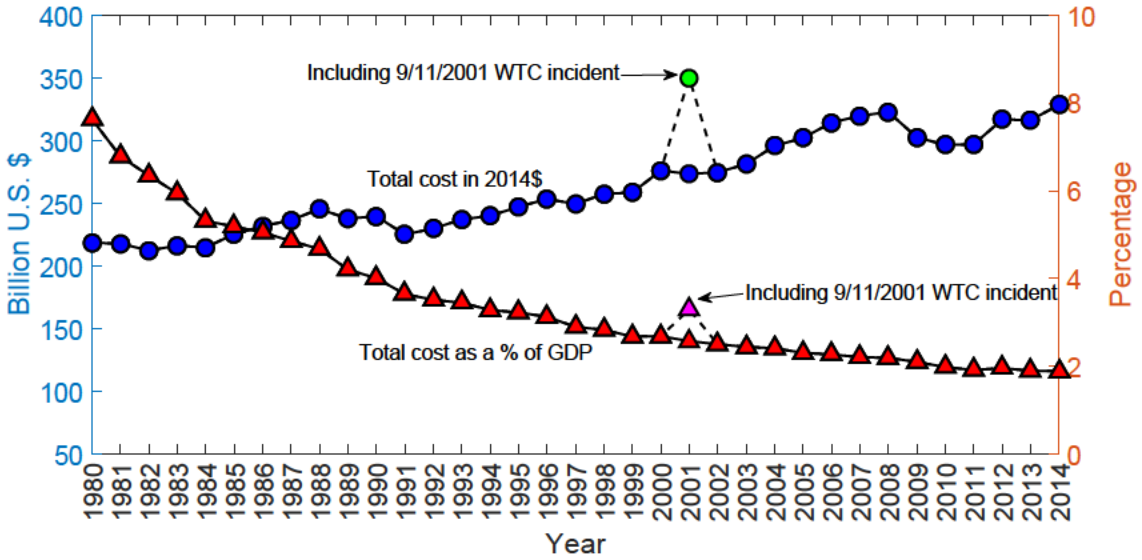


Figure 3: Changes in the total cost of fire in the U.S., for the years 1980 to 2014 (in 2014 dollars), compared with U.S. GDP. For each trend line, the spike point with dotted lines shows the corresponding value when the losses associated with the World Trade Center incident of September 11, 2001 are included.

Table 2: Ratio of losses to expenditures. “2001a" represents 2001 value including the 9/11 Word Trade Center incident, and “2001b" represents 2001 value excluding the 9/11 Word Trade Center incident.

Year	Ratio	Year	Ratio	Year	Ratio	Year	Ratio
1980	0.93	1989	0.61	1998	0.37	2006	0.26
1981	0.94	1990	0.55	1999	0.35	2007	0.25
1982	0.83	1991	0.56	2000	0.35	2008	0.26
1983	0.80	1992	0.53	2001a	0.66	2009	0.25
1984	0.70	1993	0.51	2001b	0.32	2010	0.23
1985	0.76	1994	0.45	2002	0.32	2011	0.23
1986	0.66	1995	0.45	2003	0.30	2012	0.21
1987	0.65	1996	0.46	2004	0.28	2013	0.20
1988	0.68	1997	0.38	2005	0.28	2014	0.20

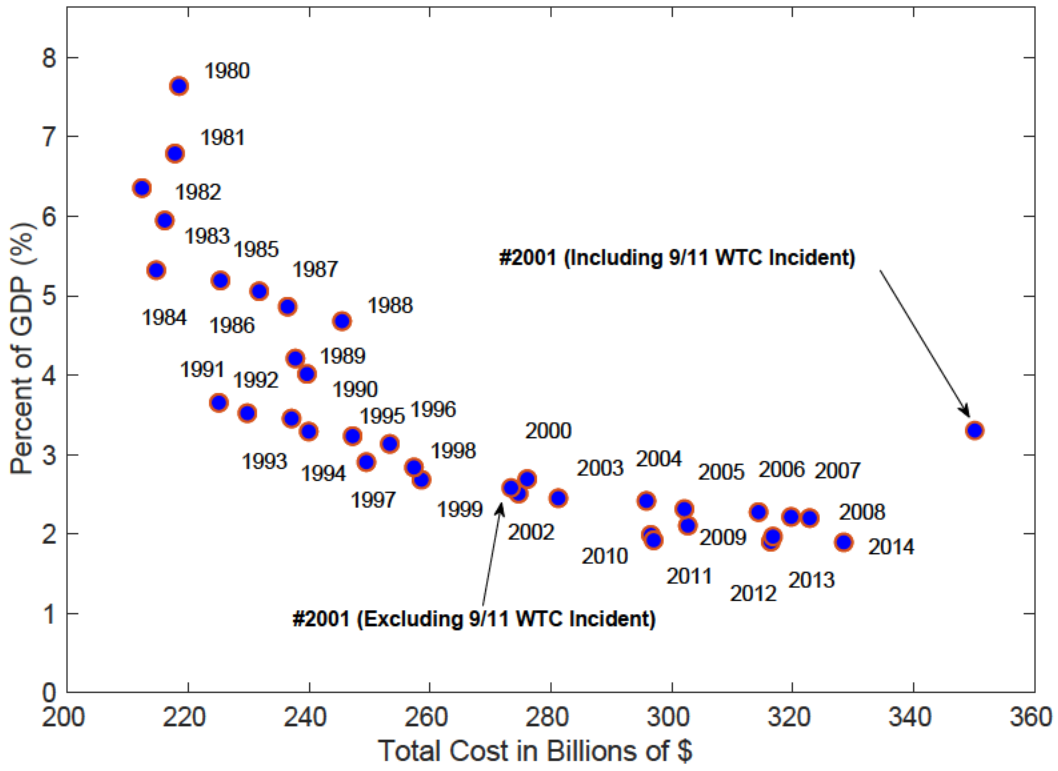


Figure 4: Scatter plot that compares the total cost of fire in the U.S. against the total cost as a function of GDP, for the years 1980 to 2014.

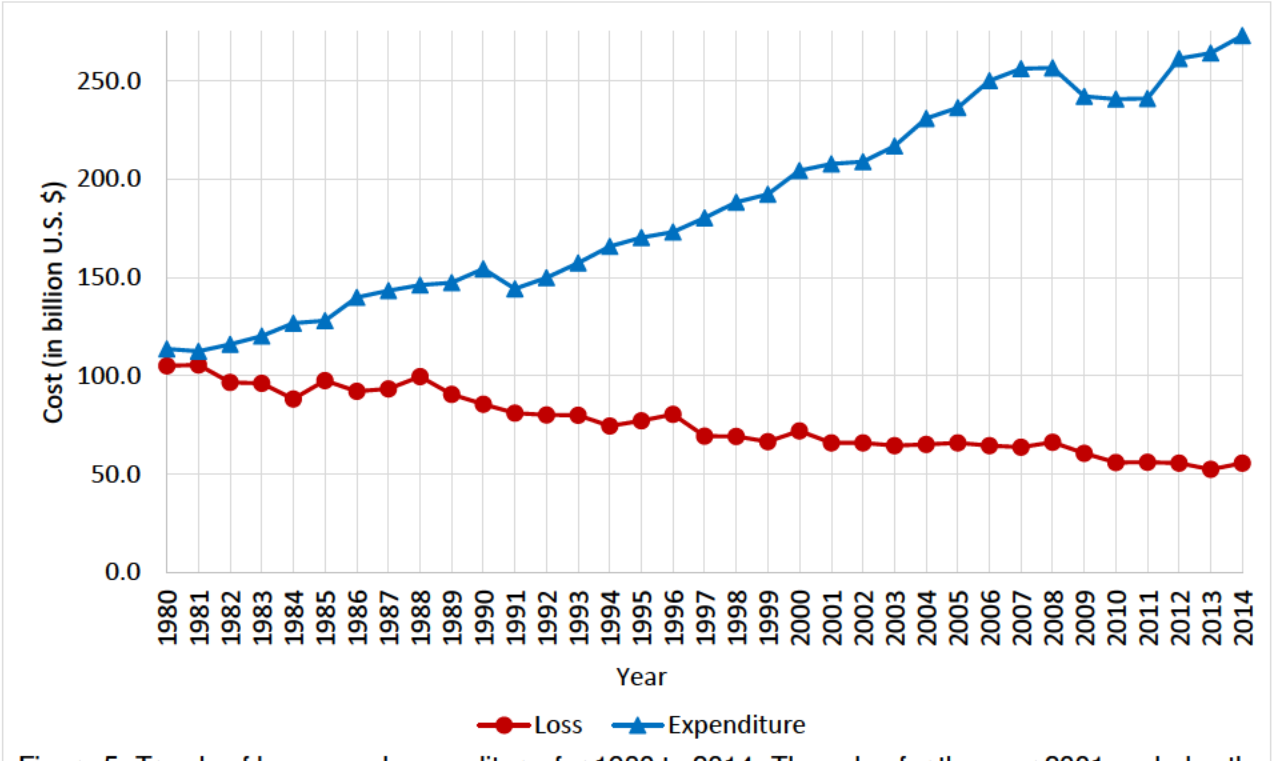


Figure 5: Trends of losses and expenditure, for 1980 to 2014. The value for the year 2001 excludes the 9/11 Word Trade Center incident.

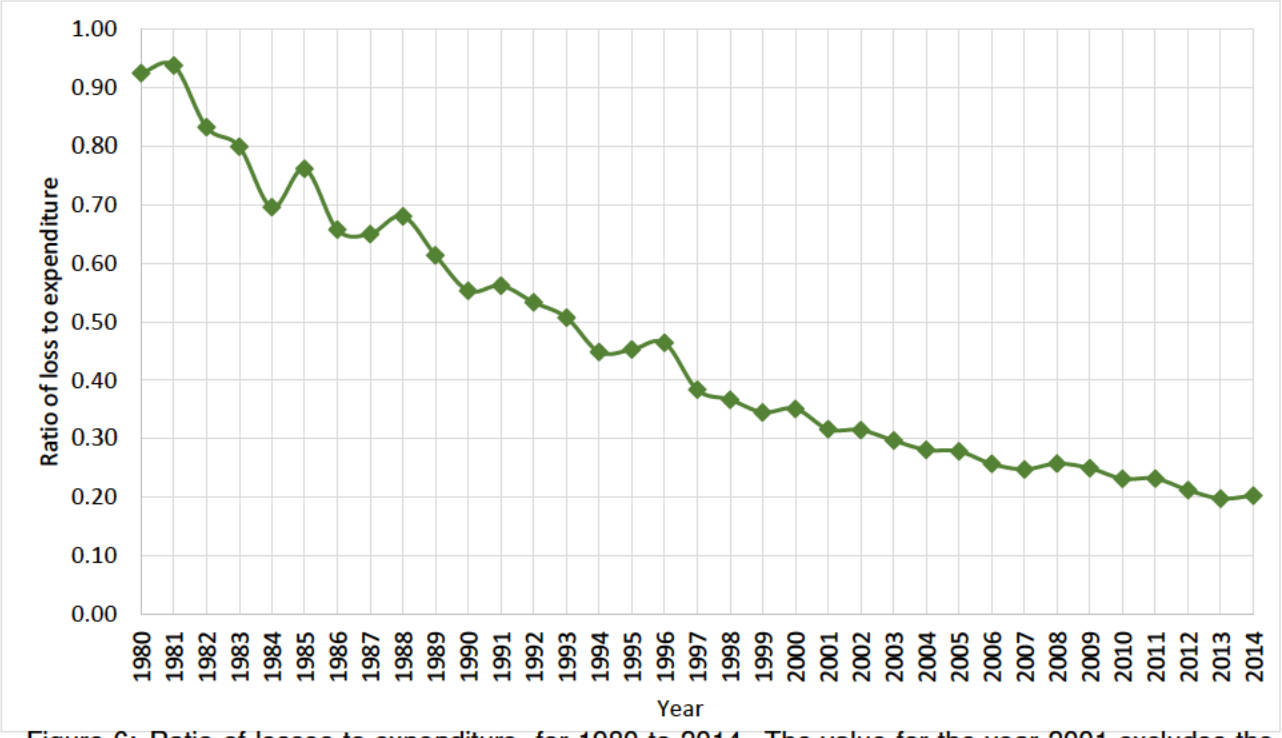


Figure 6: Ratio of losses to expenditure, for 1980 to 2014. The value for the year 2001 excludes the 9/11 Word Trade Center incident.

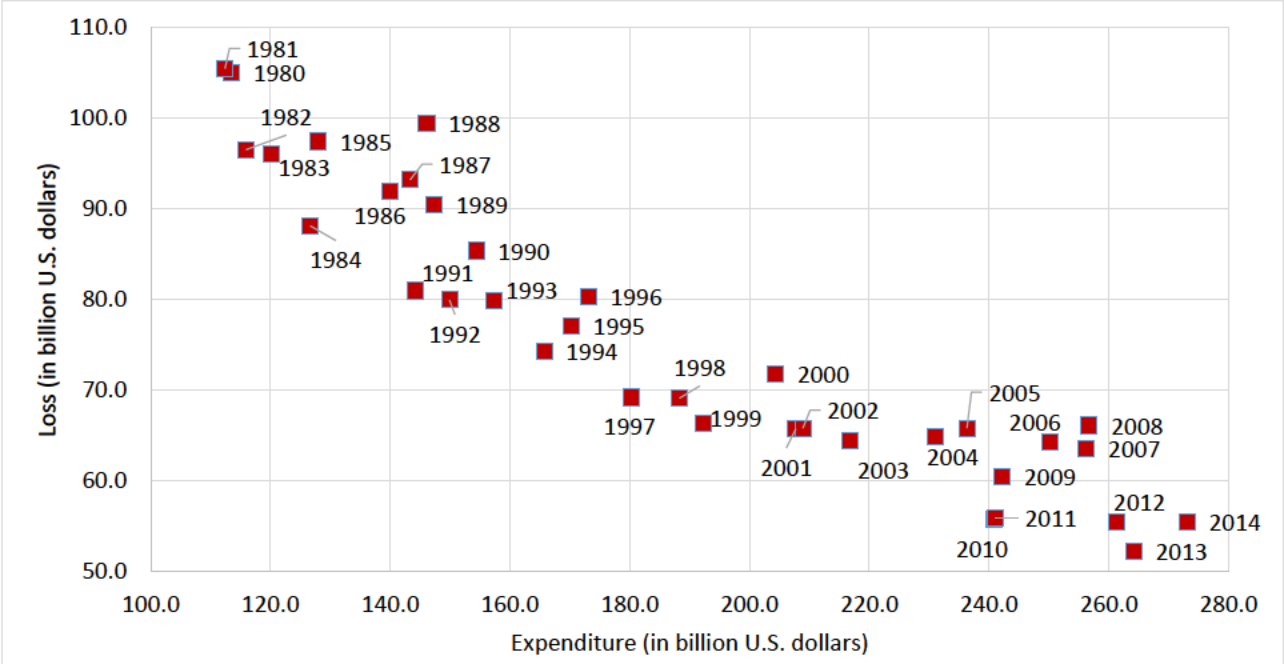


Figure 7: Losses versus expenditures diagram for 1980 to 2014, which shows that losses have decreased in expenditures, with decreasing marginal losses. The value for the year 2001 excludes the 9/11 Word Trade Center incident. Note that the X-axis (expenditure axis) and the Y-axis (loss axis) start from $100 billion and $50 billion respectively, and not from $0 billion.

Total Cost of Fire in the United States

1 Introduction

The fire service and fire protection personnel in the United States rely on the analysis of fire incident and fire activity data for improving decision making at all levels. At the strategic end, government analysts may use this data to draft future policies. From an operations perspective, firefighters may use this data for designing community risk-reduction programs such as risk-based inspections. In light of this increased demand for data, this report aims to provide the cost of fire[3] in the U.S. to anyone with an interest in understanding or using this data.

This report provides definitions and calculations for accurate prevention, protection, and mitigation costs, with critical attention on estimating the economic impact of fire, or the combination of all indirect losses and downstream effects of fire incidents. The downstream effects are significant specifically for large fires with high losses. This report accounts for the total cost of fire (excluding wildland fires) in the U.S. to governmental and non-governmental organizations, fire departments, businesses, property owners, and the public at large, at various levels of the national economy. Two fundamental terms used in this report are defined below.

Definition 1 Total cost of fire: *This report defines the total cost of fire as the collective of all net expenditure on fire protection and all net losses due to fire incidents.*

The net expenditure on fire protection constitutes the money spent on fire prevention and suppression, and the components of net losses are direct and indirect losses. Direct losses include all losses to property, as well as losses due to deaths and injuries; and indirect losses include business interruptions as well as the inconvenience caused to individuals and the public at large as a result of fires. The breakdown of the total cost into its components is shown in Figure 8. A glossary that provides the definitions of these components is provided at the end of this section.

Definition 2 Economic impact of fire: *This report defines the economic impact of fire as the net monetary downstream effects of fires on the economy. In other words,the economic impact of fire is the sum of all indirect losses due to fire incidents, which is a subset of the total cost of fire.*

Indirect losses may refer to a reduction in turnover dollars for an interrupted or closed business, or jobs that are lost. In the case of lost business, it must be acknowledged that the losses to one party may be gains to another. For example, an interrupted business loses turnover dollars whereas another competing business can use this opportunity to increase its turnover dollars. In this way, illustrating the loss to one business as a loss to the community would be incorrect. While it may be possible at a microlevel (e.g., a city) to use input-output models or other econometric models to calculate the economic impact of fire with high accuracy, to our best knowledge, it appears to be very complicated to perform a similar calculation at the national level. Hence, indirect losses are a single component, although further subdivisions, such as business interruption costs, lost jobs and salaries, and economic impact on real estate, are possible.

As we define the economic impact of fire as the indirect losses, the challenges in estimating these indirect losses must first be enumerated. Lack of available and applicable data heavily constrains this effort. Also, beyond simply the values involved, indirect loss estimation methodology, some of which

[3] This report only considers structural fires; wildfires and vehicle fires are excluded from analysis. Some other costs that are not considered are: the cost of industry-owned-fire-departments; the cost of water for firefighting; and the costs of enhancing the fire protection features of already constructed buildings.

is used in other hazard/disaster contexts, is not often appropriate to be adapted in the context of fire. The issue of scalability plays a large role in making it difficult to adapt existing models. For example, methods such as REMI and RIMSII that some researchers have used to calculate the effect of fire on the economy (see Section 3.2 for details), are not able to be applied at a national level, primarily because those methods require case-to-case analyses of thousands of fire incidents that would be nearly impossible to complete. Furthermore, large loss fires (that result in mass damage) are statistical outliers in loss/cost calculations, because the losses are hundreds or thousands of times more than other fires. We acknowledge that the economic impact of (indirect losses from) such fires could be significantly high. NFPA (2016b) documented 27 large-loss fires and explosions (defined as an event in which the property damage amounts to at least $10 million) in 2015, which totaled $2.5 billion in property losses. That report categorizes 260 fire incidents that occurred during 2006-2015 as large-loss fires. These fires had a combined property damage of $13.3 billion (adjusted to inflation, in 2014 dollars). Transposing this to the national level to attempt to quantify the indirect losses due to large-loss fires would require extensive case studies of statistical samples to represent not only the overall list of incidents, but also to represent the various (e.g., manufacturing, public assembly, educational) sectors affected. An approximation would be possible by assigning proper weights to various sub-groups within the statistical sample selected from the 260 incidents. Moreover, the indirect loss value is estimated as $1.9 billion, which is only 0.6% of the total cost. We would expect a larger value, especially because the economic impact of large-loss fires and all small fires summed together is expected to be significant.

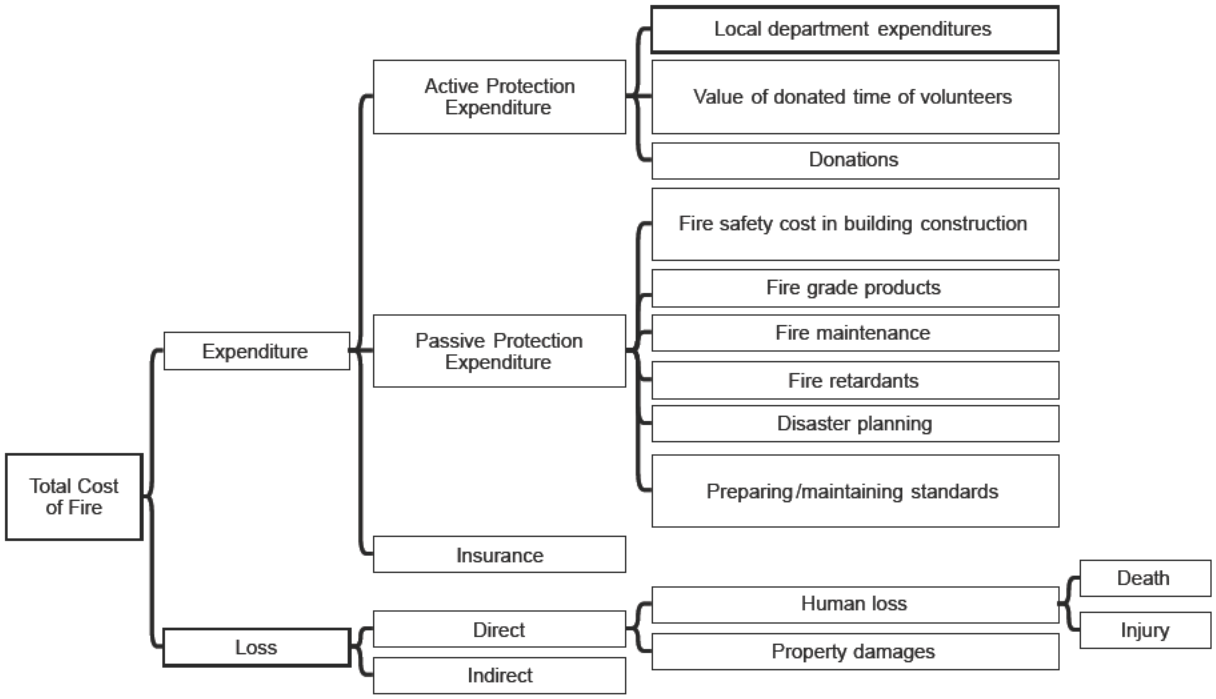


Figure 8: The taxonomy organizes and illustrates the expenditures and losses associated with the total cost of fire in the U.S. Each component shown is addressed in the calculations in Sections 2 and 3 to determine the 2014 total.

Uniform Protocol: One key contribution of this report is the development of a uniform protocol with the goal of clarifying fire economics language into mutually exclusive and quantifiable divisions. A uniform protocol is established to (a) define mutually exclusive costs and losses as well as ensure complete accounting of the cost of fire; and (b) highlight the need for calculating human loss values (injury and death) in the specific context of fire to create Value of Statistical Life (VSL) figures for firefighters and civilians. Firstly, the taxonomy in Figure 8 provides definitive categories and subsets of the total cost of fire which allows for a uniform distinction to be made between different types of cost. The breakdown of the total cost of fire into mutually exclusive expenditure and loss components are shown. In this taxonomy, expenditures reflect proactive spending on prevention, mitigation, and response while losses represent the damages caused by fire incidents. Direct losses are defined as stock values of tangible damage caused by fire. Indirect costs are defined as flow values which reflect intangible economic effects on the micro- and macroeconomic scales. Another aspect of the uniform protocol is the calculation of human losses. As explained in Section 3.1, this report develops a new term called the value of statistical injury (VSI). In addition, Section 3.1 also highlights the need for calculating the value of statistical life (VSL) specifically for the fire protection context. Current calculations of human losses are based on U.S. Consumer Product Safety Commission (CPSC) and the Department of Transportation (DoT), which may not always be fit to be used in cost-benefit analysis specific to fire protection. With regards to the methodology being used to calculate the values of the various subsets of costs, each section in the report provides the computation, along with the explanation and sample calculations, of each category allowing for these methods to be reproducible in coming years. Table 3 summarizes the various data sources used for calculating the total cost of fire. The “Remarks" column mentions the methods followed to estimate missing data, if any, from available data using extrapolation. The “Uncertainty score" column provides a relative uncertainty score, which is discussed in detail in Section 4.1.

Table 3: Data sources used for calculating the total cost of fire. Simple linear trend extrapolation was used to estimate missing data values. The uncertainty score represents a relative index of data availability, calculation convenience, and availability of uncertainty estimates of data sources. A score of 1 indicates lowest uncertainty and a score of 5 represents the highest uncertainty.

Components of cost	Data sources	Years	Uncertainty score	Remarks
Local fire department expenditure	NFPA, "The Total Cost of Fire in the United States"	1980-2011	2	Data for 1992 to 2011 is also available for download from U.S. Census Bureau's website.
	U.S. Census Bureau, "State & Local Government Finance: Historical data"	2012-2014		
Value of donated time of volunteer firefighters	NFPA, "U.S. Fire Department Profile"	1986-2014	3	Data for 1980-1985 was estimated using extrapolation
	NVFC provided the following estimates: Number of recruitments for all-volunteer and mostly-volunteer departments, FICA, Medicare, pension, and health insurance.	2017		The recruitment numbers were assumed the same for all years. Other estimates were reverse-calculated using percentage of salary estimates.
	Independent Sector, "The Value of Volunteer Time"	2001-2016		Data for 1980-2001 was estimated using extrapolation
	Bureau of Labor Statistics, "Occupational Outlook Handbook"	1996-2014		Data for 1980-1995 was estimated using extrapolation
Donations to fire departments	NFPA, "U.S. Fire Department Profile"	1986-2014	4	Data for 1980-1985 was estimated using extrapolation
Fire safety costs in building construction	U.S. Census Bureau, "Value of Construction Put in Place"	1993-2015	3	NFPA report has been used to obtain values for 1980-2011. For 2012-2014, the census data is used.
	NFPA, "The Total Cost of Fire in the United States"	1980-2011		
Fire maintenance	Meade, William P., "A first pass at computing the cost of fire in a modern society"; Local fire department expenditure	1993; 1980-2014	5	Meade's estimates for 1980-2014 were estimated based on the 1993 estimate and the local fire department expenses for 1980-2014.
Disaster planning			5	
Fire grade products	Meade, William P., "A first pass at computing the cost of fire in a modern society"; Federal Reserve Bank of St. Louis, "Manufacturing Sector: Real Output"	1993; 1987-2016	5	Meade's estimates for 1980-2014 were estimated based on the 1993 estimate and the US manufacturing outputs for 1980-2014. The manufacturing output values for 1980-1986 were estimated using extrapolation.
Fire retardants			5	
Preparing/maintaining standards			5	
Net fire insurance	NFPA, "The Total Cost of Fire in the United States"	1980-2011	4	Data for 2012-2014 was extrapolated from 1980-2011
Property loss	NFPA, "Fire loss in the United States"	2003-2015	3	Data for 1980-2002 was extrapolated from 2003-2015 data
Cost of statistical deaths	NFPA, "Fire loss in the United States"	2003-2015	2	Data for 1980-2002 was extrapolated from 2003-2015 data
	U.S. Department of Transportation, "Revised departmental guidance on valuation of a statistical life in economic analysis"	2010-2016		Data for 1980-2009 was estimated using extrapolation
Cost of statistical injuries	NFPA, "US Firefighter injuries"	1981-2014	2	Data for 1980 was estimated using extrapolation
	U.S. Department of Transportation, "Revised departmental guidance on valuation of a statistical life in economic analysis"	2010-2016		Data for 1980-2009 was estimated using extrapolation
Indirect loss	NFPA, "Fire loss in the United States"	2003-2015	5	Data for 1980-2002 was extrapolated from 2003-2015 data

Inflation Rate Calculation and Adjustment

For adjusting the actual costs to inflation, the Consumer Price Index inflation calculator provided by the Bureau of Labor Statistics (2017a) is used. Inflation rates calculated using the CPI are shown in Table 4.

Table 4: Inflation rates calculated using the Consumer Price Index. The inflation rate for each year shows the 2014 dollar equivalent of one dollar in that year, with the base month for each year being July. Source: Bureau of Labor Statistics (2017a).

Year	Inflation rate	Year	Inflation rate	Year	Inflation rate	Year	Inflation rate
1980	2.88	1989	1.92	1998	1.46	2007	1.14
1981	2.60	1990	1.83	1999	1.43	2008	1.08
1982	2.44	1991	1.75	2000	1.38	2009	1.11
1983	2.38	1992	1.70	2001	1.34	2010	1.09
1984	2.29	1993	1.65	2002	1.32	2011	1.05
1985	2.21	1994	1.61	2003	1.30	2012	1.04
1986	2.18	1995	1.56	2004	1.26	2013	1.02
1987	2.09	1996	1.52	2005	1.22	2014	1.00
1988	2.01	1997	1.48	2006	1.17		

Glossary of Definitions: Components of the Total Cost of Fire

This section provides concise definitions for the components of the total cost of fire. Detailed calculation methods and references to those methods are presented in Sections 2 and 3.

- **Local fire department expenditure:** The U.S. Census Bureau, provides the estimates the fire protection expenditure of local and state governments, which is presumably the sum of “all costs of local career fire departments and direct purchases by volunteer fire departments using funds from special taxes or transfers from other local agencies" (NFPA, 2014b). 95% of this estimated expenditure is presented in this report as the local fire department expenditure. The remaining 5% of the expenditure is assumed to be for non-fire-related incidents, e.g., medical emergencies.

- **Value of donated time of volunteer firefighters:** This is the cost of replacing the volunteer services with career services. This definition makes it clear that the objective of calculating the value of donated time of volunteer firefighters not to assign a dollar value to the donated number of hours, instead, is to calculate the value of the volunteer firefighters to the community. The actual value is derived not only from the services offered when volunteer firefighters are on duty, but from their availability in the community and their readiness to respond at any hour of the day without being compensated.

- **Donations to fire departments:** This includes all donations and support grants to fire departments from non-governmental organizations.

- **Fire safety costs in building construction:** This refers to new building “construction expenditures that are needed solely because of fire safety and fire protection considerations, such as compartmentalization features, built-in fire protection systems, and treatments of or limitations on exterior surfaces" (NFPA, 2014b). The costs of enhancing the fire protection features of already constructed buildings are not considered, however, these are expected to be captured to an extent by the ‘fire maintenance’ component.

- **Expenditure on fire grade products:** This is the “cost of meeting ‘fire grade’ standards in the manufacture of equipment, particularly electrical systems equipment and ‘smart’ equipment with its greater use of computer components" NFPA (2014b). A fire grade product is “an equipment that complied with Underwriters Laboratories or other standards designed to reduce the propensity of products to contribute to fires as a heat source or fuel source" (Meade, 1991).

- **Expenditure on fire maintenance:** This includes the “costs of fire maintenance, which was defined to include system maintenance, industrial fire brigades, and training programs for occupational fire protection and fire safety" (NFPA, 2014b).

- **Expenditure on fire retardants:** This is defined as the “costs of fire retardants and all product testing associated with design for fire safety" (NFPA, 2014b).

- **Expenditure on disaster planning:** This component represents the “costs of disaster recovery plans and backups" (NFPA, 2014b).

- **Expenditure on preparing/maintaining standards:** This includes the “costs of preparing and maintaining standards" (NFPA, 2014b).

- **Net fire insurance expenditure:** This is defined as the difference between the insurance premiums paid by property owners (personal and commercial) for insuring their property from fire and the damages claimed from insurers. There are multiple insurance types considered, such as exclusive fire insurances as well as homeowner, commercial, and farm owner multi-peril insurances. The fire insurance part of multi-peril premiums are estimated as a fraction of the total multi-peril premiums, and the damages claimed are estimated as a fraction of the total property losses (direct and indirect).

- **Direct property loss:** This represents the dollar value of the total damages to properties and contents, due to fires.

- **Cost of statistical deaths:** This is defined as a monetary equivalent of all deaths due to fire, and is calculated using the value of statistical life (VSL). The concept of VSL is to quantify the monetary value of increased safety, and in particular, the value of reducing the risk of mortality (Andersson and Treich, 2011). Also sometimes referred to as the “value of life," VSL is “the monetary value of a mortality risk reduction that would prevent one statistical death." The (U.S. Department of Transportation, 2017) defines VSL as “the additional cost that individuals would be willing to bear for improvements in safety (that is, reductions in risks) that, in the aggregate, reduce the expected number of fatalities by one," and calculates VSL using the Willingness to Pay (WTP) approach. In short, each death due to fire is considered to be associated with a cost equivalent to the VSL value.

- **Cost of statistical injuries:** This is defined as a monetary equivalent of all injuries due to fire, and is calculated using the value of statistical life (VSI). The VSI is a new term created in this report, which is constructed based on the Department of Transportation’s (DoT) term: ‘value of preventing injuries.’ The concept of this term, and in turn that of the VSI, is to assign a monetary value to an injury that would be a fraction of the VSL, based on the severity of the injury.

- **Indirect loss:** Also defined as the ‘economic impact of fire,’ indirect losses represent the net monetary downstream effects of fires on the economy. Indirect losses from commercial/industrial building fires may refer to a reduction in turnover dollars for an interrupted or closed business, or jobs that are lost, due to fires. Indirect losses in the context of residential building fires may refer

to the various inconvenience-related costs to primarily the residents and also the public, due to fire.

2 Expenditure Components of the Total Cost of Fire

Expenditure is defined as the money spent by society (including governments, fire departments, and others) on fire protection. There are three expenditure components: active fire protection expenditure, passive fire protection expenditure, and net fire insurance. It is agreed that there could be differences in passive/active fire protection measures for different types of fires (such as residential or commercial). However, to our best knowledge, sufficient data is not currently available to segregate these expenditure components into fire types.

The definitions used for active and passive fire protection expenditures in this report differ slightly from their conventional definitions. In this report, active fire protection expenditure is defined as society's expenditure on human-led prevention and suppression efforts, or in other words, fire department activities. Passive fire protection expenditure is the expenditure on static or non-human-led prevention and suppression devices and programs. Conventionally, "active fire protection" encompasses the electrical/mechanical suppression systems that are activated only when fire is present (e.g., fire sensors and alarms, notification systems, sprinklers, water supplies, and smoke management systems). A "passive fire protection" system is an integral part of the building layout and materials of construction (e.g., partitions to confine the fire or fire-resistive materials used for construction).

Also, some other expenditures (e.g., cost of water for firefighting) are either partially or completely excluded from the calculations in this report. These are discussed in Section 4.1.

2.1 Active Protection Expenditure

Active protection expenditure includes local department expenditures, the value of donated time of volunteer firefighters, and donations to fire departments. The local department expenditures are directly reported by fire-departments, and thus require no estimation, unlike the donated time of volunteers and donations to fire departments.

Local Fire Department Expenditure
Most fire departments are funded by local governments. Industrial fire departments and forest fire departments are exceptions, as the former is funded by private companies and the latter is funded by federal/state governments. The former is excluded from this report as they are very few in number, and the latter is not considered as wildfires are excluded from the analysis. All previous reports on the total cost of fire in the U.S. have used the Statistical Abstract of the United States (U.S. Census Bureau, 2017e) as the source for local fire department expenditure. However, the Census Bureau discontinued the publishing of the Statistical Abstract of the United States in 2012, thus, in this report, the Census Bureau's reports[4] on State & Local Government Finance (U.S. Census Bureau, 2017c) are used as the alternate source of data for calculating the local fire department expenditure.

The expenditures of fire departments are not solely for providing fire protection services. Fire departments provide emergency medical services (EMS) including ambulance and other specialty services such as for emergency management, hazardous materials, and technical rescue. These services together may be represented using the term 'non-fire-related,' and the corresponding expenses need to be subtracted from the Census-Bureau-reported expenditure values, to calculate the 'fire-related' expenses. The potential significance of non-fire-related expenses in relation to the total fire department

[4]This data is available for download from the Census Bureau's website for the years 1992-2014 (U.S. Census Bureau, 2017c). For years prior to 1992, the data is available upon request (U.S. Census Bureau, 2017d).

expenses is underlined by: (i) the total number of fire-related calls to fire departments has dropped from 2.3 million to 1.3 million (40.8%); and (ii) the total number of non-fire-related calls (that include calls for medical aid, false alarms, mutual aid, hazardous materials, and other reasons) has increased from 9.6 million to 32.3 million (235.7%) (NFPA, 2017a). Of all the non-fire-related services, EMS is inevitable and the most prominent, and the provision of EMS incurs operational expenses that are already accounted for in the local government funding. Only 39% of fire departments do not offer EMS (NFPA, 2016d). Furthermore, NFPA (2016a) reports that out of the $\approx$ 33.6 million calls received by fire departments across the U.S. in 2015, $\approx$ 21.5 million (64%) were for medical aid responses (ambulance, EMS, and rescue). USFA (2017a) also reports that 64% of the fire department calls in 2014 required EMS and rescue services. However, this information is not sufficient to estimate the expenses on EMS and other medical-aid-related services that fire departments provide. Reviewing the annual budgets of all fire departments (or at least a representative sample) would help estimate the non-fire-related expenditure of fire departments across the U.S., however this is beyond the scope of this report. Nevertheless, we present three cases: (i) In 2013, roughly 5% of the expenditures of the City of Burlington Fire Department's (Vermont) were EMS-related (City of Burlington Fire Department, Vermont, 2013); (ii) in 2016, nearly 8% of the total expenditures of the City of Seattle Fire Department's were for EMS responses, wages, and equipment maintenance (Seattle Fire Department, 2016); and (iii) San Diego Fire Department's 2012 expenditures show that 8% of expenses were for lifeguard services (San Diego Fire Department, 2012). These three examples indicate that the percentage expenditure of fire departments on non-fire-related (primarily medical-aid-related) services are significant (at least 5%), however, not necessarily as high as the percentage of non-fire-related calls (64% as per USFA, 2017a). Thus, we propose that 95% of the expenditure on fire protection as listed by the U.S. Census Bureau is fire-related, whereas the remaining 5% is spent on non-fire related services. It may be possible that a review of annual budgets of more fire departments would reveal a higher percentage figure for the non-fire-related expenses, however we do not want to overestimate without any solid evidence. Arguably, the 5% figure for non-fire-related services is large enough to be significant (compared with 0% in the previous version of this report; NFPA, 2014b) and small enough to be a safe first step towards more accurate calculation. Future works could explore fire department budgets extensively and provide a more accurate estimate of fire-related and non-fire-related expenditures.

Sample calculation on local fire department expenditures:
State & local government expenditure on fire protection (from US Census) = $44.1 billion;
Net fire protection expenditure = $44.1 billion$\times$ 0.95 = $41.9 billion.

Value of Donated Time of Volunteer Firefighters

Volunteer fire services form an indispensable component of fire protection in the U.S. While it is extremely important to measure the value of time donated by volunteer firefighters, this valuation is not easily tractable. This report identifies two broad approaches to calculate the value of donated time of volunteer firefighters. The first approach attempts to assess the value of the volunteer services. The second approach calculates the cost of replacing the volunteer services with career services. The National Volunteer Fire Council (NVFC) strongly supports the second approach, which is thus used in this report. Adoption of this method should not be interpreted as an acknowledgment that eventually all volunteer firefighters would be replaced by career firefighters. If the quantity of time is the sole measure of the value of time donated by volunteer firefighters, and these hours are used in the calculations explicitly (e.g., by estimating the value of services each hour on the call, using the median annual salary of a firefighter of $45,970 provided by the Bureau of Labor Statistics (Bureau of Labor Statistics, 2017b)) it will underestimate the actual value of the volunteer services. For example, if a volunteer firefighter responds to an emergency from 2:00 A.M. to 4:00 A.M., assigning an hourly dollar value to to those

two hours of volunteer time is futile. The actual value is derived not only from the services offered when volunteer firefighters are on duty, but from their availability in the community and their readiness to respond at any hour of the day without being compensated. Moreover, considering that this report is intended to act as a resource to policymakers and decision makers in fire protection, the more meaningful approach from a public policy perspective should account for the value of volunteer services as well as the value of availability and readiness. Nevertheless, the following paragraphs list the various methodologies broadly classified into the two approaches, as mentioned earlier, and present pros and cons of each method.

The methodology (Method 1) used in NFPA (2014b) follows the second approach. In that report, the value of donated time of volunteer firefighters is defined as "the alternative cost if all communities currently covered by volunteer fire departments were to be protected by career firefighters." However, calculating the number of firefighters needed to cover a particular region based only on its population density may not give the best results. The reasons are: (i) the distribution of population varies largely across the country, due to terrain and other geographical features; and (ii) the average time donated by a volunteer firefighter is far less compared to the average full time that a career firefighter works.

Another potential method (Method 2) that follows the second approach is using the rates of career firefighters per 1000 people protected for different population sizes ($<$2,500, 2,500 to 4,999, ... 500,000 to 999,999, and $>$1,000,000) (NFPA, 2016d). These rates could be extrapolated to find the population groups currently being served by volunteer firefighters, in order to get the number of career firefighters needed to replace volunteer firefighters. The expenditure on these career firefighters would be the value of volunteer firefighters' donated time. Although reasonable, this also may not be the most appropriate method, as most career firefighters serve urban or semi-urban areas that have high population densities. The high career firefighter rates for these areas cannot be applied to rural areas with low population densities.

An alternative (Method 3) using the first approach is to estimate the actual donated time by all volunteer firefighters, and then calculate the number of career firefighters needed to cover this total time. This will require more data (e.g., from NFPA Fire Service Survey or from NFPA Survey of Fire Departments for U.S. Fire Experience). In the absence of data, the next best option is to use estimates for the average number of hours donated by a volunteer firefighter as well as for the average number of working hours of a career firefighter. Based on the input from NVFC, it is estimated that a volunteer firefighter donates 10 hours per week. Also, it is safe to assume that a career firefighter works for at least 50 hours per week (Bureau of Labor Statistics, 2017c). Using these estimates, the number of career firefighters needed to cover the total time donated by volunteer firefighters is 788,250$\times$ 10/50 = 157,650. The corresponding cost is calculated as 157,650$\times$ 41.9/346,150 = \$19.0 billion, which is far less than the \$140 billion estimated by NFPA (2014b). Our report uses an alternate and simple approach, which replaces the existing volunteer firefighters with the same number of career firefighters. The corresponding cost, although almost 30% less compared to NFPA (2014b) estimate, could be reasonable since as mentioned previously, volunteer firefighters donate far less time than career firefighters. Here, we use the cost of local fire department expenditure for fire-related incidents = \$41.9 billion (instead of the personnel expenses = 0.85$\times$ \$44.1 = \$37.4 billion), because replacing 788,250 volunteer firefighters with career firefighters would require relocating many existing fire departments and/or locating new fire departments, which would incur much more than personnel expenses.

Another method (Method 4), along the first approach, is to use the 'national value of volunteer time,' which is \$24.14 per hour in 2016, as given by Independent Sector (2017). Multiplying this hourly rate with the estimated national total of hours contributed by all volunteer firefighters will give the value of donated time of volunteer firefighters. For example, for the year 2014, the value of volunteer time is \$23.07 per hour (Independent Sector, 2017). The number of volunteer firefighters in 2014 was 788,250 (NFPA, 2016d). Using the NVFC estimate of 10 hours per week donated by a volunteer

firefighter, the total value for 2014 would be: \$23.07$\times$788,250$\times$10$\times$52 = \$9.4 billion. A 1993 study (Pilsworth, 1993) estimates the "economic worth or the value of volunteer labor used in the provision of fire protection services to the State of Montana" to be \$12.4 million. That study mentions that there were 8,845 estimated volunteer firefighters in Montana in 1993. The corresponding national figure was 795,400 (NFPA, 2016d). Extrapolating the data given in Independent Sector (2017), the national value of volunteer time (\$11.89 per hour) is estimated to be 3.07 times that of Montana (\$3.87 per hour)[5]. Hence, the \$12.4 million figure of Montana in 1993 could be extrapolated to find the national figure as \$12.4 million $\times$795,400/8,845$\times$3.07 = \$3.4 billion for 1993, assuming that the average number of hours contributed by volunteer firefighters was the same for all states. The previous methodology that uses the 10 hours per week estimate gives a corresponding value of \$11.89$\times$795,400$\times$10$\times$52 = \$4.9 billion. Although this is about 44% greater than the value extrapolated from the Montana study result of \$3.4 billion, these two calculations are closer when compared with the other methodologies that provide values in the order of \$100 billion. However, the value of volunteer hours methodology is not adopted in this report.

Finally, based on detailed inputs from NVFC, we find the following method (Method 5) to be the most comprehensive and meaningful. This method is along the second approach, and hence estimates the cost of replacing volunteer firefighters with career firefighters. NVFC points out that the Bureau of Labor Statistics (BLS) estimate of the median annual firefighter salary (\$45,970 in 2014) does not include benefits or taxes. After adding Federal Insurance Contributions Act (FICA) taxes at 6.20%, Medicare at 1.45%, workers compensations insurance (WCI) at 5.00%, with a \$2,500 pension, and \$14,000 health insurance, the revised median annual salary is \$68,285. The calculation of how many new firefighters need to be recruited needs to be based on the four tiers of departments and personnel demography: all-volunteer, mostly-volunteer, mostly-career, and all-career (NFPA, 2016d). We consider only all-volunteer and mostly-volunteer departments for our calculation. Again, based on NVFC inputs, every department ideally would have a minimum of eight firefighters available per shift to respond. However, it is very likely that all-volunteer and mostly-volunteer departments have lower call volumes and protect communities with small tax bases. Hence the NVFC estimates an average of six firefighters needed per shift. They also conclude that mostly-volunteer departments already have half of the career personnel in place that they need. The NVFC suggest using a standard 4.2 shift system and a 5:1 member-to-officer ratio. Hence, the respective personnel requirements are calculated as 6 $\times$ 4.2 = 25.2 + 5 officers = 30 career personnel for all-volunteer and 3 $\times$ 4.2 = 12.6 + 3 officers = 16 career personnel for mostly-volunteer. The 19,915 all-volunteer and 5,580 mostly-volunteer fire departments (NFPA, 2016d) would require 686,730 (19,915$\times$30 + 5,580$\times$16) newly recruited career firefighters to replace the existing volunteer firefighters. With a median annual salary of \$45,970, the total cost of replacement is \$46.9 billion.

The \$46.9 billion calculated using Method 5, although significantly less than Method 1's estimate of about \$140 billion, presents a more reasonable figure based on the number of volunteer fire departments that could be replaced with career personnel, also accounting for existing career personnel in mostly-volunteer fire departments. Method 5 calculates that 686,730 career firefighters need to be recruited in 2014 (to add to the 346,150 on payroll) to replace the 788,250 volunteer firefighters. Method 1 estimates the actual need of the community in terms of response time, by calculating the cost to replace volunteer firefighters with four times the number of career firefighters (which is 1,384,600 in addition to the existing 346,150 in 2014). This is two times the number proposed in Method 5.

While Method 5 is the most reasonable, we would like to note that: (i) All of the career firefighters hired will be full-time, when in fact, many departments may rely on part-time career personnel. (ii) The number of active volunteer firefighters who are available for service could be less than the number of

[5]It is unclear whether Independent Sector (2017) gives 2016 dollar values for all years or the actual dollar values.

volunteers on the fire departments' roster. (iii) The staffing formula used to calculate the number of career firefighters needed to replace volunteers may not be necessarily representative for all career fire departments. (iv) The average firefighter salary may not be the best choice for the salary of a career firefighter who would replace a volunteer firefighter, since career firefighters are mostly from large urban cities and population centers, in which the number of volunteer firefighters is very few. (v) There will be no department consolidation, which is actually likely to occur if smaller departments were to hire career personnel. (vi) All departments are considered to have only one station, when there could be some that have multiple stations, particularly in areas where consolidation has already occurred. (vii) Replacing volunteers in mostly-career departments are not considered. (viii) The cost of upgrading stations, equipment, and vehicles, which would be necessary in departments in many states in order to meet Occupational Safety and Health Administration requirements, is ignored. (ix) The 2017 estimates for insurance and pension benefits have been used for all years from 1980 to 2014. Some of these benefit plans may not have been instated from 1980, and the benefit numbers vary. As these benefits constitute about 50% of the final estimate of salary, a considerable margin of uncertainty could be expected, although less for the recent years.

In summary, this report presents Method 5 as the most reasonable method. Other methods too offer many valid contributions, and may be used if supplemented with more accurate data which is currently difficult to obtain. Methods 1 through 5 clearly present the trade-off between the definitions of "cost to replace all volunteer fire departments with career" and "the actual value of the donated time of volunteer firefighters." This report documents an exhaustive description of all these methods in order to motivate more research that could fill the existing gaps in methodology and data required to calculate the value of donated time of volunteer firefighters.

Sample calculation for the value of time donated by volunteer firefighters (using Method 5):

$$\begin{aligned}
\text{Number of all-volunteer departments} &= 19,915 \\
\text{Number of mostly-volunteer departments} &= 5,580 \\
\text{Member to officer ratio for each department} &= 5:1 \\
\\
\text{Number of career personnel needed for each} & \\
\text{all-volunteer department, based on a 4.2 shift system} &= 6 \times 4.2 = 25.2 \text{ members} \\
&\quad + 5 \text{ officers} \approx 30 \\
\\
\text{Number of career personnel needed for each} & \\
\text{mostly-volunteer department, based on a 4.2 shift system} &= 3 \times 4.2 = 12.6 \text{ members} \\
&\quad + 3 \text{ officers} \approx 16 \\
\\
\text{Total number of career personnel needed} & \\
\text{to replace volunteer personnel} &= (19,915 \times 30) + (5,580 \times 16) \\
&= 686,730 \\
\\
\text{BLS estimate of a firefighter's annual salary} &= \$45,970 \\
\\
\text{NVFC estimate of a firefighter's annual salary adding } 6.2\% & \\
\text{FICA, } 1.45\% \text{ Medicare, } 5\% \text{ WCI, \$2,500 pension, and} & \\
\text{\$14,000 health insurance to the BLS estimate} &= \$68,285 \\
\\
\text{Total cost of replacement} &= 686,730 \times 68,285 \\
&= \$46.9 \text{ billion.}
\end{aligned}$$

Donations to Fire Departments

As the value of donated time of volunteer firefighters is included as a component in the total cost of fire, it should follow that all fire-related donations be included. Although donations are just an operational need of the fire departments and are not expenditure from the point of view of fire departments, it could be seen as the community's expenditure. That is why in the taxonomy in Figure 8, "donations" is a component of "active protection expenditure," instead of merging with "local department expenditure." Due to lack of funding, these fire departments rely on donations and support grants from non-governmental organizations such as Firefighters Support Foundation (FSF), as many fire departments in the U.S. are underfunded and volunteer-based (FSF, 2017). The extent of donations may vary between different regions. In Tennessee, roughly one-quarter of fire departments (181 out of 730) rely on donations for more than 50% of their revenue (TACIR, 2013). Almost all of these (177 out of 181) are volunteer fire departments. Lack of publicized reports of these donations makes it difficult to perform a nationwide analysis. However, there are some articles about substantially large donations: (1) Local firefighter associations donated equipment worth $36,000 to Canton Fire Department, Connecticut; (2) The Clayton and Katherine Dockstader Foundation donated $500,000 to the Galway Volunteer Fire Department, New York, to break ground on a new fire station (FireChief.com, 2016); (3) A local nonprofit organization

donated $245,000 to Lincolnville Fire Department, Maine, for a “Fire Truck Fund" reserve account, for building a new fire station, and for personnel recruitment and retention (FireApparatusMagazine.com, 2011); (4) Duracell committed to donate a minimum of 20 million batteries to volunteer fire departments through the “Power Those Who Protect Us" program (Fire Engineering, 2011).

Although it is very likely that donations would be only a small fraction of the total cost of fire, this report documents an estimation method as follows. Estimating this component helps not only in improving accuracy in the measurement of the total cost, but also in understanding by how much the volunteer fire departments are underfunded. If the Tennessee data (TACIR, 2013) is extrapolated to get a rough estimate for the lower bound for donations to fire departments in the U.S., a quarter of the fire departments in the U.S. (29,980/4 = 7,495, in the year 2014) depend on donations for 50% of their revenue. Assuming that these fire departments receiving donations are the ones with the lowest expenditures, it is possible to approximate the lower bound on the donations if the distribution of fire departments' expenditures is available. However, as that data is not available, we assume that the fire department expenditures follow a ‘truncated normal distribution.’ The truncated normal function has characteristics similar to that of the popularly used normal distribution (Burkardt, 2014), with the advantage that truncation enables defining appropriate lower bound (≥ 0) and upper bound ($\leq$ total expenditure). In this way, we generated simulated distributions for the expenditures of 29,980 departments in the U.S. for the years 1980-2014, such that the mean and the standard deviation of individual fire department expenditures are 3.3% and 5% of the total expenditure. For each year, the total donations were estimated as 50% of the sum of the lowest quarter of fire departments expenditures. For example, for 2014, the estimated total amount of donations to fire departments is $1.3 billion.

Sample calculation for donations to fire departments:

$$\begin{aligned} \text{Number of fire departments} &= 29,980 \\ \text{Local fire department expenditures} &= \$41.9 \text{ billion} \\ \text{Sum of expenditures of a quarter of fire departments} &= \$2.6 \text{ billion} \\ \text{(assuming a truncated normal distribution of expenditures)} & \end{aligned}$$

$$\begin{aligned} \text{Lower bound on donations} &= 50\% \text{ of } \$2.6 \text{ billion} \\ &= \$1.3 \text{ billion} \end{aligned}$$

2.2 Passive Protection Expenditure

Passive expenditure consists of all “non-active" expenditure components which include the fire protection part of building construction expenditure and the “costs of fire protection not included in building construction part of core" as explained in NFPA (2014b).

Fire Safety Costs in Building Construction

The objective is to estimate the national-level cost of building construction for fire safety. All previous NFPA reports on the Total Cost of Fire in the U.S. have used the Statistical Abstract of the United States (U.S. Census Bureau, 2017e) as the source for getting the annual building construction costs in the U.S. These costs were grouped into four categories (private residential, public building, private non-residential, and other private building). Then, multipliers based on Apostolow et al. (1978) and Meade (1991) were used to calculate what fraction of these costs were due to fire protection. The formula used

by NFPA (2014b) is:

$$\begin{aligned}\text{Cost of building fire protection} = {} & [2.5\% \text{ x value of private residential building construction})] \\ & + [12.0\% \text{ x (value of nonresidential construction excluding communications, power, and railroad)}] \\ & + [4.0\% \text{ x (value of state and local government construction excluding runways, railroads, power, highways and streets, sewage and waste disposal, water supply, conservation and development)}]\end{aligned}$$

We use an alternate method for calculating the building construction costs for fire protection, as it is very likely that the multipliers used in the nearly 40-year-old WPI study need updating. In this report, the Census Bureau's Value of Construction Put in Place Survey (VIP) (U.S. Census Bureau, 2017b) is the source of data for calculating the building construction costs for each year.[6] We use the same methodology in NFPA (2014b) to calculate the building safety costs in fire protection. The data for 2012 to 2014 is updated using U.S. Census Bureau (2017a) data. There is some discontinuity observed in the 2011 to 2013 values. Also, not all states have adopted current codes or editions of codes, which introduces variability in the calculations since independent state-level analyses are aggregated to form a national-level estimate. However, as the scope of this report is to estimate an average at the national level, not necessarily on a state level, performing an analysis of every state to estimate the corresponding fire safety costs in building construction is beyond the scope of this project. In the sample calculation below, 'value of construction put in place' is the term used by the Census Bureau to denote the value of construction in the United States, as the calculation is done at the national level.

Sample calculation for fire safety costs in building construction:

$$\begin{aligned}\text{Value of construction put in place (private residential)} &= \$369,793 \text{ million} \\ \text{Value of construction put in place (private non-residential)} &= \$359,707 \text{ million} \\ \text{Value of construction put in place (public total)} &= \$276,128 \text{ million} \\ \text{Fire safety costs in building construction} &= 2.5\% \text{ of } \$369,793 \text{ million} \\ &\quad + 12.0\% \text{ of } \$359,707 \text{ million} \\ &\quad + 4.0\% \text{ of } \$276,128 \text{ million} \\ &\quad = \$57.4 \text{ billion.}\end{aligned}$$

Expenditure on Fire Grade Products, Fire Maintenance, Fire Retardants, Disaster Planning, and Preparing/Maintaining Standards

These components of costs are compiled in the section titled "Other Economic Costs" in NFPA (2014b), and named as "Costs of Fire Protection Not Included in Building Construction Part of Core." For each of these components, the same definitions used in NFPA (2014b) are supported in this report, as given below:

- Expenditure on Fire Grade Products: "Costs of meeting 'fire grade' standards in the manufacture of equipment, particularly electrical systems equipment and 'smart' equipment with its greater use of computer components. 'Fire grade' is the term used in Meade (1991) for equipment that complied with Underwriters Laboratories or other standards designed to reduce the propensity of products to contribute to fires as a heat source or fuel source."

[6] This data is available for download from U.S. Census Bureau's website for the years 1993-2016 (U.S. Census Bureau, 2017a).

- Expenditure on Fire Maintenance: “Costs of fire maintenance, which was defined to include system maintenance, industrial fire brigades, and training programs for occupational fire protection and fire safety."
- Expenditure on Fire Retardants: “Costs of fire retardants and all product testing associated with design for fire safety."
- Expenditure on Disaster Planning: “Costs of disaster recovery plans and backups."
- Expenditure on Preparing/Maintaining Standards: “Costs of preparing and maintaining standards."

For estimating five miscellaneous categories (fire grade products, fire maintenance, fire retardants, disaster planning, and preparing/maintaining standards) of passive fire protection expenditure, Meade (1991) remains by far the best available data source. However, this study calculated the expenditure for the year 1991, and this value had been used as a constant ($27.8 billion, which is equivalent to $45.9 billion in 2011 dollars using the Consumer Price Index) for every year (1980-2011), in (NFPA, 2014b). Adjustment of these values with respect to inflation does not accurately reflect the actual changes in these values since or prior to the 1991 study. In order to standardize the calculation of passive protection costs, the expenditure on fire grade products, fire retardants, and preparing/maintaining standards have been adjusted to the U.S. manufacturing output (Federal Reserve Bank of St. Louis, 2017). This has been done so as the production and consumption of fire grade products and fire retardants, as well as the expenditure on standards are all expected to be related to the manufacturing output. The expenditure on fire maintenance and disaster planning are adjusted to the fire department expenditure calculated in Section 2.1. This has been done so as maintenance activities and disaster planning are expected to be related to fire department activities. These five categories of passive fire protection expenditure have similar calculation methodologies, and hence could be merged into a single category. This has been left for future work, as the definitions of these five categories may need to be revised as well, as explained in Section 4.1.

Sample calculation for passive protection expenditure:

$$
\begin{aligned}
\text{U.S. Manufacturing ouput indicator in } 1991 &= 74.3 \\
\text{U.S. Manufacturing ouput indicator in } 2014 &= 127.4 \\
\text{Fire department expenses in } 1991 &= \$13.0 \text{ billion} \\
\text{Fire department expenses in } 2014 &= \$41.9 \text{ billion} \\
\text{Consumer Price Index for 2014 based on } 1991 &= 1.8 \\
\text{Expenditure on Fire Grade Products in } 1991 &= \$18.0 \text{ billion} \\
\text{Expenditure on Fire Grade Products in } 2014 &= \$18.0 \times 1.8 \times 127.4/74.3 = \$54.0 \text{ billion} \\
\text{Expenditure on Fire Maintenance in } 1991 &= \$6.5 \text{ billion} \\
\text{Expenditure on Fire Maintenance in } 2014 &= \$6.5 \times 1.8 \times 41.9/13.0 = \$36.5 \text{ billion} \\
\text{Expenditure on Fire Retardants in } 1991 &= \$2.5 \text{ billion} \\
\text{Expenditure on Fire Retardants in } 2014 &= \$2.5 \times 1.8 \times 127.4/74.3 = \$7.5 \text{ billion} \\
\text{Expenditure on Disaster Planning in } 1991 &= \$0.6 \text{ billion} \\
\text{Expenditure on Disaster Planning in } 2014 &= \$0.6 \times 1.8 \times 41.9/13.0 = \$3.4 \text{ billion}
\end{aligned}
$$

$$
\begin{aligned}
\text{Expenditure on Preparing/} \\
\text{Maintaining Standards in } 1991 &= \$0.2 \text{ billion}
\end{aligned}
$$

$$
\begin{aligned}
\text{Expenditure on Preparing/} \\
\text{Maintaining Standards in } 2014 &= \$0.2 \times 1.8 \times 127.4/74.3 = \$0.6 \text{ billion}
\end{aligned}
$$

$$
\begin{aligned}
\text{Total} &= \$(54.0 + 36.5 + 7.5 + 3.4 + 0.6) \text{ billion} \\
&= \$102.0 \text{ billion}
\end{aligned}
$$

2.3 Net Fire Insurance Expenditure

We use the same formula used in (NFPA, 2014b) to calculate the net fire insurance expenditure:

$$
\begin{aligned}
\text{Net fire insurance} = \{&(\text{Premiums}) \text{ estimated as } [\text{Fire insurance premiums}] \\
&+ [21\% \times (\text{homeowner, commercial, \& farm owner multi-peril premiums})]\} \\
&- \{(\text{Losses}) \text{ estimated as } [\text{NFPA estimate of direct property damage in fires} \\
&\quad \text{reported to fire departments, excluding vehicle and outdoor properties}] \\
&- [50\% \times (\text{NFPA estimate of indirect loss})]\}
\end{aligned}
$$

The National Association of Insurance Commissioners (NAIC) 2015 report NAIC (2015) gives information about homeownersâĂŹ, commercial, and farm ownersâĂŹ multiple peril property and casualty premium values as $86.3 billion, $38.9 billion and $13.6 billion, respectively, in the US in 2014. The 2014 report (NFPA, 2014b) estimated that 21% of these multi-peril premiums were for fire and lightning. The fire premium was $12.6 billion. Thus, the total fire insurance premium for 2014 is estimated as $0.21 \times$($86.3 billion + $38.9 billion + $13.6 billion) + $12.6 billion = $41.8 billion. To calculate the net fire insurance expenditure, again the same methodology is followed from the 2014 report, that is: Net fire insurance expenditure for 2014 = premiums - direct property loss estimate - 50% of indirect property

loss estimate = $41.8 billion - $9.8 billion - $1.9 billion = $30.9 billion. Direct loss of $9.8 billion is from NFPAâĂŹs report: Fire Loss in the United States (NFPA, 2016a). The total direct property loss is $11.6 billion, however, from this, outdoor fires (wildland/grass/shrub) and vehicle/highway fires are excluded. One challenge in calculating the net fire insurance costs for years prior to 2014 is the availability of NAIC data on the premium values for those years. There is no publicly available report or source that provides this information.

We acknowledge that there could be year-to-year variations, however, we use estimates of 21% and 50% for premiums and indirect loss claims, respectively, as used in NFPA (2014b). That report says that the 21% estimate was generated in the 1990's based on a conversation with a staff person at the Insurance Services Office (ISO), and that this number has been verified for the 1998-2002 period as well. Furthermore, as the losses used in the NFPA formula above are those reported by fire departments (arguably well before the insurance claim is written), these reported losses may not be the same as the actual losses recovered by the property owners through insurance. The accuracy of the net fire insurance calculation could be improved significantly if the actual un-recovered losses could be estimated. However, this is an area that could be flagged for future research, as accurate estimation of the actual un-recovered losses would be possible only with more data from the insurance industry that is currently unavailable.

For this report, the ISO and the Insurance Information Institute (III) shared some inputs from the insurance industry's perspective. The ISO estimate for the total fire losses for a particular year is the sum of their estimates for three lines of business: Commercial Fire, Commercial Multiple Peril (CMP), and Homeowners. ISO's Fast Track data, A. M. Best's data, as well as FAIR plan loss data[7] are used for calculating "blow-up factors" and subsequently the fire losses, as shown in the equation below.

$$\begin{aligned} \text{Fire losses for each line of business} &= (\text{Fast Track incurred losses}) \times (\text{blow-up factor}) \\ &\quad \times (\% \text{ of losses reported as fire}) \\ \text{Blow-up factor} &= (\text{Ratio of A.M. Best to Fast Track}) \\ &\quad \times (\text{FAIR Plan loading factor}) \\ &\quad \times (\text{factor to account for uninsured losses}) \end{aligned} \tag{1}$$

The percent of fire losses reported for a particular line of business is the ratio of losses reported under the fire subline for that line divided by corresponding total losses. ISO and III provided the values of the above parameters for 2012, 2013, and 2014, which were 19.9%, 21.0%, and 25.2% (average = 22.0%) for CMP and 25.0%, 29.9%, and 21.1% (average = 25.3%) for Homeowners, respectively. Obviously, the fire losses are 100% of the total losses for Commercial Fire every year. A reasonable assumption is made that the portion of premiums for a line of business that provide insurance for the losses under the fire subline is equal to the respective percentage estimate of fire losses. If the total premiums for the three lines of businesses are available, then the fire portion of premiums can be calculated using the aforementioned methodology. These values can be used in the NFPA formula for net fire insurance, provided the insurance industry's own estimate of the direct and indirect property losses are due to fire. However, due to the following reasons, the recent ISO/III data is not used for the final calculations: (i) ISO's data on percentage estimates on the 'fire-share' of losses for farm-owners insurance as well as indirect property losses due to fire are not available. (ii) Although the percentage values for 2012, 2013, and 2014 are available, there appears to be large year-to-year variations in these. Consequently, it will be difficult to estimate the values for other years (1980-2011) from these, using regression or other techniques. Nevertheless, it is possible to calculate the net fire insurance expenditure component more

[7] For more information, visit: http://www.verisk.com/insurance/products/iso-actuarial-service.html; http://www.ambest.com/sales/statementus/; and http://www.iii.org/article/what-if-i-cant-get-coverage.

accurately by replacing the 21% constant value used in Equation 2.3 with yearly percentage values that can potentially be obtained from the insurance industry.

Sample calculation for net fire insurance:

$$\begin{aligned}\text{Total fire-related premiums for 2014} &= \$37.7 \text{ billion}\\ \text{Direct property loss in 2014} &= \$13.8 \text{ billion}\\ \text{Indirect property loss in 2014} &= \$2.0 \text{ billion}\\ \text{Net fire insurance} &= \$(37.7 - 13.8 - 0.5 \times 2.0) \text{ billion}\\ &= \$23.6 \text{ billion}\end{aligned}$$

3 Loss Components of the Total Cost of Fire

3.1 Direct Loss

Direct loss from fires includes human losses and property losses. It is necessary to define the value of statistical life to evaluate the damage from human loss in fire incidents. Property damage, on the other hand, is a sum from the collection of reported data from fire departments. This is thus, already standardized. However, while estimating the direct losses may appear straightforward, it involves many challenges that are described in Section 4.1.

Direct Property Loss
The direct property loss is obtained from the NFPA's yearly report on Fire Loss in the United States NFPA (2016a). That report separates direct property losses into: public assembly; educational; institutional; residential; stores and offices; industry, utility, and defense; storage in structures; and special structures. As the Fire Loss report already presents details on the breakdown of direct property loss, they are not described here.

Sample calculation for direct property loss:
Property loss = $13.2 billion (NFPA, 2016a).

Human Losses
We use the NFPA's statistics on firefighter and civilian deaths and injuries (NFPA, 2016a,c, 2017b) to calculate the total human losses due to fires. To estimate the cost of deaths, we use the value of statistical life (VSL), and to estimate the cost of injuries, we introduce a new term, namely "the Value of a Statistical Injury (VSI)." We acknowledge that the cost of deaths do not consider the effects of long-term injuries or illnesses.

The VSL has been widely studied in welfare economics, and one of its primary application areas has been transportation risk analysis. Andersson and Treich (2011) explain that the concept of VSL is to quantify the monetary value of increased safety, and in particular, the value of reducing the risk of mortality. Also sometimes referred to as the "value of life," VSL is "the monetary value of a mortality risk reduction that would prevent one statistical death." The (U.S. Department of Transportation, 2017) defines VSL as "the additional cost that individuals would be willing to bear for improvements in safety (that is, reductions in risks) that, in the aggregate, reduce the expected number of fatalities by one," and calculates VSL using the Willingness to Pay (WTP) approach. This report will use DoT's VSL of $9.6 million for 2016 as the baseline value, and use the following formula suggested by DoT to calculate VSL for the previous years: $VSL_T = VSL_0 * (P_T/P_0) * (I_T/I_0)^{\epsilon}$, where 0 = Original Base Year; T =

Updated Base Year; P_T = Price Index in Year T; I_T = Real Incomes in Year T; and ϵ = Income Elasticity of VSL (U.S. Department of Transportation, 2017).

The new concept of VSI that we propose is similar to that of VSL. DoT uses the term "value of preventing injuries," and calculates this by the following method: "Each type of accidental injury is rated (in terms of severity and duration) on a scale of quality-adjusted life years (QALYs), in comparison with the alternative of perfect health. These scores are grouped according to the Maximum Abbreviated Injury Scale (MAIS), yielding coefficients that can be applied to VSL to assign each injury class a value corresponding to a fraction of a fatality" (U.S. Department of Transportation, 2017). The six MAIS levels are: 'minor,' 'moderate,' 'serious,' 'severe,' 'critical,' and 'unsurvivable.' The corresponding fraction values of VSL are: 0.003, 0.047, 0.105, 0.266, 0.593, and 1.000. Assuming that 'moderate' is the median injury level, the VSI would be 0.047$\times$\$9.4 million = \$448,000, which is much higher than the CPSC estimate of \$166,000 per civilian injury which is used currently. NFPA (2014a) statistics of non-fatal home fire injuries during 2007-2011 reveal that 61% of those were 'minor,' 26% were 'moderate,' 7% were 'severe', and 6% were 'life-threatening.' This implies that the median fire injury type is 'minor,' however, this could result in significant underestimation of total injury costs, as more severe injury types would get underrepresented. Hence, we consider the 'moderate' MAIS level as a better choice for the median injury type. NFPA (2012) provides detailed cost calculations for civilian injuries, using CPSC's injury cost model (CPSC, 2000). Firefighter injuries are divided into different categories based on the type of duty during which the injury happened. NFPA (2016c) documents five types: responding to or returning from an incident, fireground, non-fire emergency, training, and others. NFPA (2014b) groups these into three major categories: fireground injuries that happen between the moment of arrival at the scene and departure time, for e.g., during setup, extinguishing, or overhaul) non-fireground injuries (that happen during on-duty activities other than fireground and excluding non-fire emergencies, for e.g., inspection, maintenance, training, or while responding to or returning from an incident), and injuries at non-fire emergencies (that happen while responding to calls related to EMS, rescue, HazMat, and natural disasters).

NFPA (2014b) documents a study conducted in 2013 to estimate differences in the cost of injuries to firefighters and civilians. That study used the CPSC figures for VSL and VSI, and found that "firefighter fireground injuries and non-fireground injuries had estimated costs of 30% and 10% of the CPSC average for civilian fire injuries." That study also said that the "average severity of a civilian injury reported to a fire department was considerably less than that reported to a hospital emergency room." Hence, NFPA (2014b) estimated the actual cost of a civilian injury as 60% of the CPSC figure. We use the same percentage multipliers (30%, 10%, and 60% for firefighter fireground, firefighter non-fireground, and civilian) alongside the DoT figures (instead of the CPSC figures).

NFPA's report (NFPA, 2016c) on fireground injury incidence patterns across age profiles during 2012-2014 shows that the firefighters aged 40-44 have experienced the most injuries (17%), followed by the 35-39 and 45-49 age groups (15% and 14%), respectively. That report also provides the distribution of the severity of firefighter fireground injuries by the age of victim (Table 5). The severity levels are "minor," "moderate," and "severe," for which no claims/cost estimates are given. Using the data given in that report as well as the MAIS coefficients for minor, moderate, and severe injuries (0.003, 0.047, and 0.266, respectively of the VSL value of \$9.4 million for 2014), the total cost of firefighter fireground injuries (yearly average for 2012-2014) is calculated as $Z \times \sum_{i=1}^{N} \sum_{j=1}^{M} (f_i \cdot t_{ij})$ = \$6.1 billion, for 2014. This is less than the previously calculated value of \$9.0 billion. Here $Z = 30,290$ is the yearly average number of firefighter fireground injuries for 2012-2014, f_i is the percentage of fireground injuries for age group i, t_{ij} is the percentage number of injuries for age group i and severity type j, $N = 11$ is the number of age groups, and $M = 3$ is the number of injury severity types.

A recent study (Griffin et al., 2016) analyzes the cost savings of the Tuscon (Arizona) Fire Department's Probationary Firefighter Fitness (PFF-Fit), which was aimed at decreasing injuries and compen-

Table 5: Firefighter fireground injuries and severity by age of victim, 2010-2014 annual averages. Source: NFPA (2016c).

Age of victim		15-19	20-24	25-29	30-34	34-39	40-44	45-49	50-54	55-59	60-64	≥ 65
Fireground injuries (%)		1	7	12	13	15	17	14	10	5	2	1
Injury type	Minor	79	77	72	70	67	65	65	65	65	65	76
	Moderate	20	22	26	29	31	33	33	32	31	29	18
	Severe	1	0	2	1	2	2	3	3	4	6	7

sation claims/costs. The program was piloted in 2012-2013 during the recruit academy and over the probationary year. The study shows that the mean claims cost per recruit was $1,241 for the control classes (2007, 2008, and 2009), and that it dropped to $208 for the intervention class of 2012. These values are, however, much less compared to the CPSC and DoT values used in the previous calculations. Two important points to note here about the (Griffin et al., 2016) study are: (i) The claims could be for direct medical expenditures only, and hence might not cover the inconvenience costs due to injury. (ii) Only the new firefighter recruits are considered; firefighters with more than a year's experience are not included in the study.

Some gaps in the fire prevention literature exist regarding the value of life and firefighter injuries. For example, a WTP approach has not been directly applied to a fire protection context. This approach allows for estimates of the value of human life to be calculated specifically for fire protection context. NIST (2005) reviews five relevant studies that seek to quantify the costs of injuries in different contexts and attempts to apply the methodologies to firefighters. This study shows the variation of estimates and how firefighter injury quantification has additional losses associated with it, including city expenditure for firefighter insurance, prevention efforts, investigations of injuries, legal fees, worker's compensation, additional overtime, paperwork, and data collection.

Sample calculation for human losses:

$$\begin{aligned}
\text{Total number of civilian deaths} &= 3,275 \\
\text{Total number of on-duty firefighter deaths} &= 64 \\
\text{Total deaths} &= 3,275 + 64 = 3,239 \\
\text{Total cost of deaths} &= 3,239 \times \$9.4 \text{ million} = \$30.4 \text{ billion} \\
\text{Number of civilian injuries} &= 15,775 \\
\text{Number of firefighter injuries} &= 63,350 \\
\text{Number of firefighter fireground injuries} &= 27,015 \\
\\
\text{Number of firefighter injuries} & \\
\text{at non-fire emergencies} &= 14,595 \\
\\
\text{Number of firefighter non-fireground injuries} & \\
\text{(excluding injuries at non-fire emergencies)} &= 63,350 - (27,015 + 14,595) = 21,740 \\
\\
\text{Cost of civilian injuries} &= 15,775 \times 0.6 \times \$448,000 = \$4.3 \text{ billion} \\
\text{Cost of firefighter fireground injuries} &= 27,015 \times 0.3 \times \$448,000 = \$3.6 \text{ billion} \\
\text{Cost of firefighter non-fireground injuries} &= 21,740 \times 0.1 \times \$448,000 = \$1.1 \text{ billion}
\end{aligned}$$

$$\begin{aligned}\text{Total cost of injuries} &= \$4.3 \text{ billion} + \$3.6 \text{ billion} + \$1.1 \text{ billion} \\ &= \$9.0 \text{ billion}\end{aligned}$$

$$\text{Total human loss (deaths and injuries)} = \$30.4 \text{ billion} + \$9.0 \text{ billion} = \$39.4 \text{ billion}$$

3.2 Indirect Loss

Indirect loss, referred to as the “economic impact of fire" in this report, is arguably the most difficult cost component to estimate. For example, the difficulty in estimating the indirect property losses is evident from the previous discussion in Section 3.1 on the challenges in accurately estimating direct property losses. Previously, NFPA estimated that indirect losses are four times that of direct losses in business closures. It was also estimated that 2% of reported non-residential structure fires result in business closings (NFPA, 2014b). However, this methodology could be outdated for use today as fires of different severities can have varying impacts on different businesses. Larger fires, logically, have a much higher impact, in which case, Meade (1991)’s formula (NFPA, 2014b) could be used. Moreover, for non-closure cases, the NFPA uses their own estimates for constant multipliers (e.g., 65% for manufacturing and industrial properties), which may or may not be accurate for different types of businesses. It is also necessary to consider the potential indirect effects of a fire in a high-rise building in an urban area to near-by buildings. Even when the fire is not severe, the news/rumor of fire may lead to businesses in adjacent buildings closing down for a few hours or for a day, which leads to indirect losses. The magnitude of such losses depend on many factors such as population density, type of building, and adjacent businesses. By collecting such data from sources, including the U.S. Census, potential indirect losses can be estimated.

One method for calculating the economic impact of fire is using econometric input-output models. For example, economic forecasting tools developed by Regional Economic Models, Inc. (REMI) have been used for studies related to the economics of fire. The State of Wyoming (2005) used REMI’s Policy Insight (Regional Economic Models, Inc., 2017) tool to study the economic impact of fire on Wyoming’s economy from a business perspective. That study uses the idea that the various indirect effects of fire on a business firm (such as decline in output sales, relocation, or closure) would result in employment reduction. This reduction in employment, termed as “employment shock," is induced into the Policy Insight model, and the changes in the economy are calculated. For example, a reduction of 10 employees due to a fire in a small retail trade firm has the following effects on Wyoming’s economy: the total employment decreases by 2, the output sales decrease by $133,522, the Gross State Product drops by $77,852, and the personal income decreases by $42,657 (please note that the values are in 2005 dollars). That analysis considers a single fire to a specific type of business, namely a retail firm. However, attempting to perform a similar calculation for the whole of the U.S. requires that information be available on the number of fires that affected different types of businesses. An important drawback of the REMI model seems to be that it cannot be used for calculating the indirect losses from residential fires.

REMI’s tools have also been used by Evans (2017) to measure the economic impact of the City of Phoenix Fire Department’s successful intervention of fires. The study looks into eight fires that affected thirteen commercial organizations in the period of June 1 to August 31, 2012, which were extinguished successfully by the City of Phoenix Fire Department. The results show that the intervention efforts saved 2,322 jobs throughout the state of Arizona and $196 million (2012 $) out of Gross State Product, which could have been lost over the course of one year. Both The State of Wyoming (2005) and Evans (2017) use the REMI model to measure the economic impact of fire, however, from two

different perspectives. The former tries to measure the losses due to fire occurrences, which is in line with the definition of the “economic impact of fire" used in this report, whereas the latter measures savings from successful fire interventions. Yet, it is recognized that both of these uses are important in understanding the fire problem in the U.S. The former approach can address the magnitude and severity of fires in the U.S., whereas the latter can be used to quantify the savings that the fire service brings to society. Another recent study by Delorme and Waterhouse (2017) shows that the Montréal City Fire Department’s successful intervention of 110 fires (there were 274 successful interventions in total, out of which 110 are analyzed) in 2015 resulted in a savings of $1.89 billion Canadian dollars to the Quebec province. One drawback with using the same methodology for calculating the economic impact of fire in the U.S. is that these studies require extensive data collection with respect to each business that was affected by fire. Hence, unless a statistically strong sample of businesses affected by fire is obtained, it is almost impossible to use these econometric models for a nationwide study. Another drawback is that the economic impact of residential fires cannot be estimated using econometric models. It could be argued that the economic impact of a residential fire is likely to be much less when compared to a fire in a commercial facility. However, the following two points suggest that the aggregate indirect losses of all resident fires may be significant: (i) the number of residential fires were 79.2% of the total structure fires during the period 2010-2014 (NFPA, 2017); and (ii) CPSC (2009) reported that for 65,000 residential fires during 2004-2005, “the conditions after the fire required families to stay out of the residence for one night or more."

There are tools available from the public sector to calculate the economic impact of fire. For example, Regional Input-Output Modeling System (RIMS II) “a regional economic model, is a tool used by investors, planners, and elected officials to objectively assess the potential economic impacts of various projects" (Bureau of Economic Analysis, 2013).

We use the following NFPA (2014b) formula for calculating indirect losses:

$$
\begin{aligned}
\text{Indirect damage in fires} = \{&(\text{Business interruption} + \text{Temporary lodging} + \text{Intangible losses}) \\
&\text{estimated as the sum of three terms :} \\
&[65\% \text{ x (direct damage in reported fires in manufacturing} \\
&\text{or industrial structures)}] \\
&+[25\% \text{ x (direct damage in reported fires in public assembly,} \\
&\text{educational, institutional, store, or office structures)}] \\
&+[10\% \text{ x ((direct damage in reported fires in residential, storage,} \\
&\text{or special structures)}]\} \\
&+\{(\text{Value of closed businesses) estimated as [4 x 2\% x (direct damage} \\
&\text{in reported fires in non-residential structures} \\
&\text{excluding storage and special structures)}]\}.
\end{aligned}
$$

The sample calculation presented below uses the NFPA formula mentioned above. All direct and indirect losses include reported losses and unreported losses. The unreported losses are estimated as 13.6% of reported losses, based on CPSC (2009).

Sample calculation of indirect loss:

$$\begin{aligned}
\text{Direct damage in manufacturing or industrial} &= \$0.71 \text{ billion} \\
\text{Indirect damage in manufacturing or industrial} &= 0.65 \times \$0.71 \text{ billion} = \$0.46 \text{ billion} \\
\\
\text{Direct damage in assembly, educational,} & \\
\text{institutional, store, or office} &= \$1.40 \text{ billion} \\
\\
\text{Indirect damage in assembly, educational,} & \\
\text{institutional, store, or office} &= 0.25 \times \$1.40 \text{ billion} = \$0.35 \text{ billion} \\
\\
\text{Direct damage in residential, storage,} & \\
\text{or special structures} &= \$9.07 \text{ billion} \\
\\
\text{Indirect damage in residential, storage,} & \\
\text{or special structures} &= 0.1 \times \$9.07 \text{ billion} = \$0.91 \text{ billion} \\
\\
\text{Direct damage in non-residential} & \\
\text{(excluding storage and special structure)} &= \$2.12 \text{ billion} \\
\\
\text{Indirect damage in non-residential} & \\
\text{(excluding storage and special structure)} &= 4 \times 0.02 \times \$2.12 \text{ billion} = \$0.17 \text{ billion} \\
\\
\text{Total indirect damage} &= \$(0.46 + 0.35 + 0.91 + 0.17) \text{ billion} \\
&= \$1.9 \text{ billion}
\end{aligned}$$

Table 6 provides the breakdown of the total cost of fire in the U.S. into components, in billions of U.S. dollars (1980-2014). Table 7 presents the total cost of fire by year (1980-2014), in actual and 2014 dollars and as percentage values in comparison with U.S. GDP.

Table 6: Breakdown of the total cost of fire in the United States into components, in billion US dollars, 1980-2014 (Part 1 of 8)

Components of Cost	1980		1981		1982		1983		1984	
	actual$	2014$	actual$	2014$	actual$	2014$	actual$	2014$	actual$	2014$
Expenditure	39.4	113.5	43.2	112.4	47.5	115.9	50.5	120.1	55.3	126.7
Direct expenditure	20.5	59.0	21.9	57.0	23.6	57.5	25.0	59.5	26.4	60.4
Active fire protection expenditure	20.5	59.0	21.9	57.0	23.6	57.5	25.0	59.5	26.4	60.4
Local fire department expenditure	5.4	15.6	6.0	15.5	6.7	16.3	7.2	17.1	7.7	17.7
Value of donated time of volunteer firefighters	14.9	42.9	15.8	41.0	16.7	40.7	17.6	41.8	18.4	42.1
Donations to fire departments	0.2	0.5	0.2	0.5	0.2	0.5	0.2	0.5	0.2	0.6
Indirect expenditure	18.9	54.5	21.3	55.5	23.9	58.4	25.5	60.7	28.9	66.3
Passive fire protection expenditure	15.7	45.2	18.3	47.6	20.2	49.4	21.6	51.4	24.3	55.7
Fire safety costs in building construction	3.9	11.2	4.7	12.1	5.0	12.2	5.4	12.7	6.8	15.5
Fire grade products	8.7	25.1	10.0	26.0	11.0	26.8	11.6	27.7	12.4	28.5
Fire maintenance	1.6	4.7	2.0	5.2	2.4	5.8	2.6	6.3	2.9	6.8
Fire retardants	1.2	3.5	1.4	3.6	1.5	3.7	1.6	3.8	1.7	4.0
Disaster planning	0.2	0.4	0.2	0.5	0.2	0.5	0.2	0.6	0.3	0.6
Preparing/maintaining standards	0.1	0.3	0.1	0.3	0.1	0.3	0.1	0.3	0.1	0.3
Insurance	3.2	9.3	3.0	7.8	3.7	9.0	3.9	9.3	4.6	10.6
Loss	36.5	105.0	40.6	105.5	39.6	96.5	40.4	96.1	38.5	88.1
Direct loss	35.1	101.2	39.2	101.9	38.2	93.2	39.0	92.7	37.1	84.9
Property loss	7.2	20.6	7.6	19.8	7.3	17.7	7.5	17.8	7.6	17.4
Human loss	28.0	80.6	31.6	82.2	30.9	75.4	31.5	74.9	29.5	67.5
Cost of statistical deaths	21.7	62.4	24.7	64.3	23.7	57.8	23.8	56.7	22.0	50.4
Cost of statistical injuries	6.3	18.1	6.9	17.9	7.2	17.6	7.6	18.2	7.5	17.1
Indirect loss	1.3	3.9	1.4	3.5	1.4	3.4	1.4	3.3	1.4	3.3
Total	75.9	218.6	83.8	217.9	87.1	212.4	90.8	216.2	93.8	214.8

Notes: All values are in billion U.S. dollars. "Actual$" gives the actual cost in the corresponding year, and "2014$" gives the cost adjusted to inflation, in 2014 dollar equivalents. Refer to the report: *The Total Cost of Fire in the United States* (2017), for (i) the definitions of different components of the total cost of fire; (ii) calculation methodology and changes from previous version of this report (2014); and (iii) data sources used for calculation.

Table 6: Breakdown of the total cost of fire in the United States into components, in billion US dollars, 1980-2014 (Part 2 of 8)

Components of Cost	1985		1986		1987		1988		1989	
	actual$	2014$	actual$	2014$	actual$	2014$	actual$	2014$	actual$	2014$
Expenditure	57.9	127.9	64.1	139.8	68.6	143.3	72.7	146.1	76.7	147.4
Direct expenditure	27.6	61.1	31.9	69.6	33.9	70.8	36.5	73.3	37.9	72.7
Active fire protection expenditure	27.6	61.1	31.9	69.6	33.9	70.8	36.5	73.3	37.9	72.7
Local fire department expenditure	8.0	17.7	9.1	19.8	9.9	20.8	11.1	22.4	11.3	21.6
Value of donated time of volunteer firefighters	19.4	42.8	22.6	49.2	23.6	49.4	25.0	50.3	26.3	50.4
Donations to fire departments	0.2	0.5	0.3	0.6	0.3	0.6	0.3	0.7	0.3	0.7
Indirect expenditure	30.3	66.9	32.2	70.2	34.7	72.5	36.2	72.7	38.9	74.6
Passive fire protection expenditure	26.8	59.2	28.2	61.6	30.1	62.8	33.0	66.3	36.0	69.1
Fire safety costs in building construction	8.0	17.8	8.3	18.2	8.8	18.5	9.6	19.4	11.3	21.7
Fire grade products	13.3	29.4	13.9	30.2	14.5	30.3	15.7	31.6	16.6	31.9
Fire maintenance	3.2	7.0	3.6	7.9	4.1	8.7	4.8	9.7	5.1	9.8
Fire retardants	1.8	4.1	1.9	4.2	2.0	4.2	2.2	4.4	2.3	4.4
Disaster planning	0.3	0.6	0.3	0.7	0.4	0.8	0.4	0.9	0.5	0.9
Preparing/maintaining standards	0.1	0.3	0.2	0.3	0.2	0.3	0.2	0.4	0.2	0.4
Insurance	3.5	7.7	4.0	8.6	4.6	9.7	3.2	6.4	2.9	5.5
Loss	44.1	97.5	42.2	92.0	44.6	93.2	49.5	99.4	47.1	90.4
Direct loss	42.7	94.3	40.7	88.8	43.1	90.1	48.0	96.4	45.6	87.5
Property loss	8.3	18.3	7.6	16.6	8.2	17.1	9.5	19.2	9.9	19.0
Human loss	34.4	75.9	33.1	72.2	34.9	73.0	38.4	77.2	35.7	68.5
Cost of statistical deaths	26.9	59.3	25.7	56.1	26.7	55.9	29.7	59.7	27.1	52.0
Cost of statistical injuries	7.5	16.6	7.4	16.1	8.2	17.2	8.7	17.5	8.6	16.6
Indirect loss	1.4	3.2	1.5	3.2	1.5	3.1	1.5	3.0	1.5	2.9
Total	102.0	225.4	106.3	231.8	113.2	236.5	122.1	245.5	123.9	237.8

Notes: All values are in billion U.S. dollars. "Actual$" gives the actual cost in the corresponding year, and "2014$" gives the cost adjusted to inflation, in 2014 dollar equivalents. Refer to the report: *The Total Cost of Fire in the United States* (2017), for (i) the definitions of different components of the total cost of fire; (ii) calculation methodology and changes from previous version of this report (2014); and (iii) data sources used for calculation.

Table 6: Breakdown of the total cost of fire in the United States into components, in billion US dollars, 1980-2014 (Part 3 of 8)

Components of Cost	1990		1991		1992		1993		1994	
	actual$	2014$	actual$	2014$	actual$	2014$	actual$	2014$	actual$	2014$
Expenditure	84.3	154.3	82.4	144.1	88.2	149.9	95.3	157.3	102.9	165.7
Direct expenditure	40.1	73.3	41.9	73.4	43.8	74.4	45.9	75.8	47.4	76.3
Active fire protection expenditure	40.1	73.3	41.9	73.4	43.8	74.4	45.9	75.8	47.4	76.3
Local fire department expenditure	12.5	22.8	13.0	22.8	13.6	23.2	14.6	24.0	15.3	24.6
Value of donated time of volunteer firefighters	27.2	49.8	28.5	49.9	29.7	50.5	30.9	51.0	31.7	51.0
Donations to fire departments	0.4	0.7	0.4	0.7	0.4	0.7	0.4	0.7	0.5	0.7
Indirect expenditure	44.3	81.0	40.4	70.7	44.4	75.5	49.4	81.6	55.5	89.3
Passive fire protection expenditure	40.5	74.1	38.6	67.6	41.0	69.6	45.8	75.6	50.0	80.4
Fire safety costs in building construction	13.9	25.4	10.8	19.0	10.9	18.6	13.5	22.3	15.1	24.4
Fire grade products	17.5	32.0	18.0	31.5	19.5	33.1	20.8	34.3	22.4	36.1
Fire maintenance	5.9	10.9	6.5	11.4	7.0	11.9	7.7	12.7	8.3	13.3
Fire retardants	2.4	4.4	2.5	4.4	2.7	4.6	2.9	4.8	3.1	5.0
Disaster planning	0.5	1.0	0.6	1.1	0.6	1.1	0.7	1.2	0.8	1.2
Preparing/maintaining standards	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4
Insurance	3.8	6.9	1.8	3.1	3.4	5.8	3.6	5.9	5.5	8.9
Loss	46.7	85.4	46.3	81.0	47.0	80.0	48.4	79.8	46.2	74.3
Direct loss	45.1	82.6	44.7	78.3	45.5	77.3	46.8	77.2	44.5	71.7
Property loss	8.9	16.2	10.8	18.9	9.4	16.0	9.7	15.9	9.3	15.0
Human loss	36.3	66.4	33.9	59.4	36.0	61.2	37.1	61.3	35.2	56.7
Cost of statistical deaths	27.2	49.8	24.6	43.0	26.6	45.2	26.9	44.3	25.6	41.2
Cost of statistical injuries	9.0	16.5	9.4	16.4	9.5	16.1	10.3	16.9	9.6	15.5
Indirect loss	1.5	2.8	1.6	2.7	1.6	2.7	1.6	2.6	1.6	2.6
Total	131.0	239.7	128.6	225.1	135.2	229.8	143.7	237.1	149.1	240.0

Notes: All values are in billion U.S. dollars. "Actual$" gives the actual cost in the corresponding year, and "2014$" gives the cost adjusted to inflation, in 2014 dollar equivalents. Refer to the report: *The Total Cost of Fire in the United States* (2017), for (i) the definitions of different components of the total cost of fire; (ii) calculation methodology and changes from previous version of this report (2014); and (iii) data sources used for calculation.

Table 6: Breakdown of the total cost of fire in the United States into components, in billion US dollars, 1980-2014 (Part 4 of 8)

Components of Cost	1995		1996		1997		1998		1999	
	actual$	2014$	actual$	2014$	actual$	2014$	actual$	2014$	actual$	2014$
Expenditure	109.1	170.2	113.9	173.1	121.8	180.3	129.0	188.3	134.4	192.2
Direct expenditure	50.0	77.9	52.2	79.4	53.0	78.4	54.9	80.1	57.1	81.6
Active fire protection expenditure	50.0	77.9	52.2	79.4	53.0	78.4	54.9	80.1	57.1	81.6
Local fire department expenditure	16.2	25.2	16.8	25.5	18.3	27.1	19.3	28.1	20.0	28.7
Value of donated time of volunteer firefighters	33.3	51.9	35.0	53.2	34.1	50.4	35.0	51.1	36.4	52.1
Donations to fire departments	0.5	0.8	0.5	0.8	0.6	0.8	0.6	0.9	0.6	0.9
Indirect expenditure	59.2	92.3	61.6	93.6	68.9	101.9	74.1	108.2	77.3	110.6
Passive fire protection expenditure	54.2	84.6	59.1	89.9	66.5	98.4	71.3	104.0	75.6	108.1
Fire safety costs in building construction	16.7	26.0	19.0	28.9	22.3	33.0	24.9	36.3	26.3	37.6
Fire grade products	24.1	37.5	25.7	39.1	28.2	41.8	29.4	42.9	31.2	44.7
Fire maintenance	9.0	14.1	9.6	14.6	10.8	16.0	11.5	16.8	12.2	17.5
Fire retardants	3.3	5.2	3.6	5.4	3.9	5.8	4.1	6.0	4.3	6.2
Disaster planning	0.8	1.3	0.9	1.3	1.0	1.5	1.1	1.6	1.1	1.6
Preparing/maintaining standards	0.3	0.4	0.3	0.4	0.3	0.5	0.3	0.5	0.3	0.5
Insurance	4.9	7.7	2.5	3.8	2.4	3.5	2.8	4.1	1.7	2.5
Loss	49.4	77.0	52.8	80.3	46.8	69.2	47.3	69.1	46.4	66.4
Direct loss	47.7	74.5	51.2	77.8	45.1	66.7	45.6	66.6	44.7	63.9
Property loss	10.1	15.8	10.7	16.2	9.7	14.3	9.8	14.3	11.4	16.2
Human loss	37.6	58.7	40.5	61.6	35.4	52.4	35.9	52.4	33.4	47.7
Cost of statistical deaths	28.2	44.0	31.5	47.8	26.4	39.0	26.6	38.8	24.2	34.6
Cost of statistical injuries	9.4	14.7	9.1	13.8	9.1	13.4	9.3	13.6	9.2	13.1
Indirect loss	1.6	2.6	1.7	2.5	1.7	2.5	1.7	2.5	1.7	2.5
Total	158.5	247.3	166.7	253.4	168.6	249.5	176.3	257.4	180.9	258.6

Notes: All values are in billion U.S. dollars. "Actual$" gives the actual cost in the corresponding year, and "2014$" gives the cost adjusted to inflation, in 2014 dollar equivalents. Refer to the report: *The Total Cost of Fire in the United States* (2017), for (i) the definitions of different components of the total cost of fire; (ii) calculation methodology and changes from previous version of this report (2014); and (iii) data sources used for calculation.

Table 6: Breakdown of the total cost of fire in the United States into components, in billion US dollars, 1980-2014 (Part 5 of 8)

Components of Cost	2000		2001 (Including 9/11 WTC incident)		2001 (Excluding 9/11 WTC incident)		2002		2003	
	actual$	2014$	actual$	2014$	actual$	2014$	actual$	2014$	actual$	2014$
Expenditure	148.1	204.3	157.5	211.0	153.7	207.7	158.3	208.9	166.8	216.8
Direct expenditure	59.7	82.4	62.1	83.2	62.1	84.9	64.4	85.0	66.3	86.2
Active fire protection expenditure	59.7	82.4	62.1	83.2	62.1	84.9	64.4	85.0	66.3	86.2
Local fire department expenditure	21.9	30.2	23.7	31.8	23.7	31.8	24.1	31.8	25.1	32.6
Value of donated time of volunteer firefighters	37.1	51.2	37.7	50.5	37.7	52.2	39.6	52.2	40.4	52.6
Donations to fire departments	0.7	0.9	0.7	0.9	0.7	0.9	0.7	1.0	0.8	1.0
Indirect expenditure	88.4	121.9	95.4	127.8	91.6	122.7	93.9	123.9	100.5	130.7
Passive fire protection expenditure	84.1	116.1	85.2	114.1	85.2	114.1	83.3	110.0	87.4	113.7
Fire safety costs in building construction	29.6	40.9	30.3	40.6	30.3	40.6	28.3	37.4	30.3	39.4
Fire grade products	34.2	47.2	33.1	44.3	33.1	44.3	32.7	43.2	33.7	43.8
Fire maintenance	13.8	19.1	15.4	20.7	15.4	20.7	15.9	21.0	16.8	21.9
Fire retardants	4.8	6.6	4.6	6.2	4.6	6.2	4.5	6.0	4.7	6.1
Disaster planning	1.3	1.8	1.4	1.9	1.4	1.9	1.5	1.9	1.6	2.0
Preparing/maintaining standards	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5
Insurance	4.3	5.9	10.2	13.7	6.4	8.6	10.5	13.9	13.1	17.0
Loss	52.0	71.8	103.8	139.1	49.6	65.7	49.9	65.8	49.6	64.4
Direct loss	50.3	69.4	101.2	135.7	47.8	63.4	48.1	63.5	47.8	62.2
Property loss	12.7	17.6	45.4	60.8	12.0	16.1	11.7	15.4	14.0	18.2
Human loss	37.6	51.9	55.8	74.8	35.8	47.3	36.4	48.0	33.9	44.0
Cost of statistical deaths	28.3	39.0	46.6	62.4	27.0	35.6	27.4	36.2	25.1	32.7
Cost of statistical injuries	9.3	12.9	9.3	12.4	8.8	11.7	9.0	11.9	8.7	11.3
Indirect loss	1.7	2.4	2.6	3.4	1.8	2.4	1.8	2.3	1.7	2.2
Total	200.1	276.1	261.3	350.1	203.3	273.4	208.1	274.7	216.4	281.3

Notes: All values are in billion U.S. dollars. "Actual$" gives the actual cost in the corresponding year, and "2014$" gives the cost adjusted to inflation, in 2014 dollar equivalents. Refer to the report: *The Total Cost of Fire in the United States* (2017), for (i) the definitions of different components of the total cost of fire; (ii) calculation methodology and changes from previous version of this report (2014); and (iii) data sources used for calculation.

Table 6: Breakdown of the total cost of fire in the United States into components, in billion US dollars, 1980-2014 (Part 6 of 8)

Components of Cost	2004		2005		2006		2007		2008	
	actual$	2014$	actual$	2014$	actual$	2014$	actual$	2014$	actual$	2014$
Expenditure	183.3	230.9	193.7	236.3	213.7	250.1	224.8	256.3	237.7	256.7
Direct expenditure	71.0	89.5	72.6	88.6	78.0	91.2	82.0	93.5	86.3	93.2
Active fire protection expenditure	71.0	89.5	72.6	88.6	78.0	91.2	82.0	93.5	86.3	93.2
Local fire department expenditure	26.9	33.9	29.6	36.1	32.6	38.2	35.1	40.0	38.2	41.2
Value of donated time of volunteer firefighters	43.3	54.5	42.1	51.4	44.4	51.9	45.8	52.3	47.0	50.7
Donations to fire departments	0.8	1.0	0.9	1.1	1.0	1.2	1.1	1.2	1.1	1.2
Indirect expenditure	112.3	141.4	121.1	147.7	135.7	158.8	142.8	162.8	151.4	163.5
Passive fire protection expenditure	97.5	122.9	106.9	130.4	119.5	139.9	127.1	144.8	138.6	149.7
Fire safety costs in building construction	35.3	44.5	38.4	46.8	43.7	51.1	44.9	51.2	49.3	53.3
Fire grade products	36.5	45.9	39.5	48.2	42.9	50.2	45.9	52.4	48.4	52.2
Fire maintenance	18.6	23.5	21.1	25.8	24.3	28.4	26.8	30.6	30.8	33.3
Fire retardants	5.1	6.4	5.5	6.7	6.0	7.0	6.4	7.3	6.7	7.3
Disaster planning	1.7	2.2	2.0	2.4	2.2	2.6	2.5	2.8	2.8	3.1
Preparing/maintaining standards	0.4	0.5	0.4	0.5	0.5	0.6	0.5	0.6	0.5	0.6
Insurance	14.7	18.5	14.2	17.3	16.2	18.9	15.7	17.9	12.8	13.8
Loss	51.5	64.9	54.0	65.8	55.0	64.3	55.7	63.5	61.2	66.1
Direct loss	50.0	63.0	52.4	63.9	53.1	62.2	53.6	61.1	58.5	63.2
Property loss	11.1	14.0	12.2	14.8	12.8	15.0	16.6	18.9	17.6	19.0
Human loss	38.9	49.0	40.2	49.0	40.3	47.1	37.0	42.2	40.9	44.2
Cost of statistical deaths	30.1	37.9	30.9	37.6	30.2	35.4	27.5	31.3	30.8	33.2
Cost of statistical injuries	8.8	11.1	9.4	11.4	10.1	11.8	9.6	10.9	10.1	10.9
Indirect loss	1.5	1.9	1.6	2.0	1.8	2.2	2.1	2.4	2.7	3.0
Total	234.8	295.8	247.6	302.1	268.7	314.4	280.5	319.8	298.9	322.8

Notes: All values are in billion U.S. dollars. "Actual$" gives the actual cost in the corresponding year, and "2014$" gives the cost adjusted to inflation, in 2014 dollar equivalents. Refer to the report: *The Total Cost of Fire in the United States* (2017), for (i) the definitions of different components of the total cost of fire; (ii) calculation methodology and changes from previous version of this report (2014); and (iii) data sources used for calculation.

Table 6: Breakdown of the total cost of fire in the United States into components, in billion US dollars, 1980-2014 (Part 7 of 8)

Components of Cost	2009		2010		2011		2012		2013	
	actual$	2014$	actual$	2014$	actual$	2014$	actual$	2014$	actual$	2014$
Expenditure	237.7	256.7	218.2	242.2	220.9	240.8	229.6	241.1	251.2	261.3
Direct expenditure	86.3	93.2	86.7	96.2	88.3	96.2	88.2	92.7	87.8	91.3
Active fire protection expenditure	86.3	93.2	86.7	96.2	88.3	96.2	88.2	92.7	87.8	91.3
Local fire department expenditure	38.2	41.2	38.2	42.4	40.1	43.7	40.2	42.2	40.3	41.9
Value of donated time of volunteer firefighters	47.0	50.7	47.3	52.5	47.0	51.2	46.9	49.2	46.3	48.1
Donations to fire departments	1.1	1.2	1.2	1.3	1.2	1.3	1.2	1.3	1.2	1.3
Indirect expenditure	151.4	163.5	131.5	146.0	132.6	144.5	141.3	148.4	163.4	170.0
Passive fire protection expenditure	138.6	149.7	116.3	129.1	115.0	125.4	122.8	128.9	143.1	148.8
Fire safety costs in building construction	49.3	53.3	39.6	44.0	30.5	33.2	31.0	32.6	48.0	49.9
Fire grade products	48.4	52.2	38.2	42.4	43.0	46.9	48.1	50.5	50.6	52.6
Fire maintenance	30.8	33.3	30.0	33.3	32.1	35.0	33.4	35.0	33.8	35.1
Fire retardants	6.7	7.3	5.3	5.9	6.0	6.5	6.7	7.0	7.0	7.3
Disaster planning	2.8	3.1	2.8	3.1	3.0	3.2	3.1	3.2	3.1	3.2
Preparing/maintaining standards	0.5	0.6	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.6
Insurance	12.8	13.8	15.2	16.9	17.6	19.2	18.5	19.5	20.4	21.2
Loss	61.2	66.1	54.5	60.5	51.2	55.8	53.3	56.0	53.4	55.5
Direct loss	58.5	63.2	52.4	58.2	49.4	53.8	51.4	54.0	51.5	53.6
Property loss	17.6	19.0	14.2	15.8	13.2	14.4	13.3	14.0	14.1	14.6
Human loss	40.9	44.2	38.2	42.4	36.2	39.5	38.2	40.1	37.4	38.9
Cost of statistical deaths	30.8	33.2	29.0	32.2	26.7	29.1	28.6	30.0	27.7	28.8
Cost of statistical injuries	10.1	10.9	9.2	10.3	9.6	10.4	9.6	10.0	9.7	10.1
Indirect loss	2.7	3.0	2.1	2.3	1.8	2.0	1.8	1.9	1.9	1.9
Total	298.9	322.8	272.7	302.7	272.1	296.6	282.9	297.0	304.6	316.8

Notes: All values are in billion U.S. dollars. "Actual$" gives the actual cost in the corresponding year, and "2014$" gives the cost adjusted to inflation, in 2014 dollar equivalents. Refer to the report: *The Total Cost of Fire in the United States* (2017), for (i) the definitions of different components of the total cost of fire; (ii) calculation methodology and changes from previous version of this report (2014); and (iii) data sources used for calculation.

Table 6: Breakdown of the total cost of fire in the United States into components, in billion US dollars, 1980-2014 (Part 8 of 8)

Components of Cost	2014	
	actual$	2014$
Expenditure	273.1	273.1
Direct expenditure	90.1	90.1
Active fire protection expenditure	90.1	90.1
Local fire department expenditure	41.9	41.9
Value of donated time of volunteer firefighters	46.9	46.9
Donations to fire departments	1.3	1.3
Indirect expenditure	183.0	183.0
Passive fire protection expenditure	159.4	159.4
Fire safety costs in building construction	57.4	57.4
Fire grade products	54.0	54.0
Fire maintenance	36.5	36.5
Fire retardants	7.5	7.5
Disaster planning	3.4	3.4
Preparing/maintaining standards	0.6	0.6
Insurance	23.6	23.6
Loss	55.4	55.4
Direct loss	53.5	53.5
Property loss	13.2	13.2
Human loss	40.4	40.4
Cost of statistical deaths	31.4	31.4
Cost of statistical injuries	9.0	9.0
Indirect loss	1.9	1.9
Total	328.5	328.5

Notes: All values are in billion U.S. dollars. "Actual$" gives the actual cost in the corresponding year, and "2014$" gives the cost adjusted to inflation, in 2014 dollar equivalents. Refer to the report: *The Total Cost of Fire in the United States* (2017), for (i) the definitions of different components of the total cost of fire; (ii) calculation methodology and changes from previous version of this report (2014); and (iii) data sources used for calculation.

Table 7: Total cost of fire, by year, 1980-2014

Year	Total Cost of Fire		U.S. GDP		Total Cost of Fire as a Percentage of GDP
	actual $	2014 $	actual $	2014 $	
1980	75.9	218.5	993.9	2,862.5	7.6%
1981	83.8	217.9	1,235.0	3,211.0	6.8%
1982	87.1	212.4	1,370.9	3,345.0	6.4%
1983	90.8	216.2	1,528.6	3,638.1	5.9%
1984	93.8	214.8	1,764.5	4,040.7	5.3%
1985	102.0	225.4	1,966.8	4,346.7	5.2%
1986	106.3	231.8	2,105.6	4,590.2	5.1%
1987	113.2	236.5	2,330.2	4,870.2	4.9%
1988	122.1	245.5	2,613.2	5,252.6	4.7%
1989	123.9	237.8	2,946.7	5,657.7	4.2%
1990	131.0	239.7	3,267.5	5,979.6	4.0%
1991	128.6	225.1	3,528.0	6,174.0	3.6%
1992	135.2	229.8	3,846.6	6,539.3	3.5%
1993	143.7	237.1	4,168.9	6,878.7	3.4%
1994	149.1	240.0	4,539.6	7,308.8	3.3%
1995	158.5	247.3	4,912.9	7,664.1	3.2%
1996	166.7	253.4	5,329.1	8,100.2	3.1%
1997	168.6	249.5	5,816.6	8,608.5	2.9%
1998	176.3	257.4	6,225.5	9,089.2	2.8%
1999	180.9	258.6	6,755.7	9,660.6	2.7%
2000	200.1	276.1	7,452.7	10,284.8	2.7%
2001 (9/11 included)	261.3	350.1	7,926.7	10,621.8	3.3%
2001 (9/11 excluded)	203.3	273.4	7,926.7	10,621.8	2.6%
2002	208.1	274.7	8,316.3	10,977.5	2.5%
2003	216.4	281.3	8,854.4	11,510.7	2.4%
2004	234.8	295.8	9,742.0	12,274.9	2.4%
2005	247.6	302.1	10,732.6	13,093.7	2.3%
2006	268.7	314.4	11,842.6	13,855.9	2.3%
2007	280.5	319.8	12,699.7	14,477.6	2.2%
2008	298.9	322.8	13,628.3	14,718.6	2.2%
2009	272.7	302.7	12,989.9	14,418.7	2.1%
2010	272.1	296.6	13,728.8	14,964.4	2.0%
2011	282.9	297.0	14,779.0	15,517.9	1.9%
2012	304.6	316.8	15,533.9	16,155.3	2.0%
2013	310.2	316.4	16,364.2	16,691.5	1.9%
2014	328.5	328.5	17393.1	17,393.1	1.9%

Notes: All values are in billion U.S. dollars. "Actual$" gives the actual cost in the corresponding year, and "2014$" gives the cost adjusted to inflation, in 2014 dollar equivalents. Refer to the report: *The Total Cost of Fire in the United States* (2017), for calculation methodology, changes from previous version of this report (2014), data sources used for calculation, and other details.

4 Discussion, Conclusion, and Future Work

4.1 Discussion

While this report makes significant contributions to measure the economic impact of fire, there is a considerable number of assumptions that need to be acknowledged. In addition, this section presents a projection of the total cost of fire and its components using regression analysis.

The first point of discussion is the cost of water for fire protection. Fire hydrants and the associated infrastructure form an inevitable component of active fire protection. These are built and maintained by water utilities, and the associated costs are recovered from the public through water bills in most places and through property taxes in others. The former system is based on the consideration that fire protection is a public good which is associated with the amount of water the people use, and the latter system is implemented in places where it costs the utility companies more to provide this public good than to solely deliver water for typical demand (Tiger, 2012). The American Water Works Association's (AWWA) manual AWWA (2012) mentions that "the total quantity of water used for fire fighting is minimal in comparison to other uses and is ignored in some studies. In other studies, a nominal amount of base use (between 0.5 and 1.0 percent) is assigned to fire protection because flow from fire hydrants is rarely metered." However, the cost of water is likely to increase in time, and hence it is reasonable to include the cost of water for firefighting. The AWWA (2012) manual also states that "The cost associated with public fire protection is typically charged to a municipal government where it is recovered through the ad valorem property tax system and perhaps other tax sources (e.g., sales taxes)." There are certain disadvantages for this method; for example, tax-exempt property owners do not pay ad valorem property taxes, and this issue becomes important in communities that have a significant value share (nearly 30%) of tax-exempt property. However, this method remains popular because this "may reflect local policy preferences for this method, may be required by state law, or could be the preferred method stipulated by a state regulatory commission" (AWWA, 2012). In addition to 'public fire protection service' (hydrants etc. located on public right-of-way), water utilities also provide 'private fire protection services' (hydrants, standpipes, sprinkler connections) to individual customers. The infrastructure costs for the latter are accounted for in Fire Safety Costs in Building Construction in Section 2.2, while the associated water costs are not. Neither for the former nor for the latter are the total nationwide costs of water utilities available. Analytics data from the private sector suggests that the total revenue of 294 water utilities across the U.S. was nearly $24 billion in 2012 Baum (2015). The cost of water for public fire protection service would be $0.18 billion, if estimated as 0.75% of the water utilities' net revenue. This number, although only a fraction of the total cost of fire calculated in this report, is significant enough to be acknowledged. The importance of the cost of water is expected to grow in the future years, along with challenges such as sustainability and firefighting in drought.

Second, although this report uses NFPA's national estimates directly, calculating those estimates is challenging. The incompleteness and heterogeneity in the two major sources of local data, namely (i) the NFPA's annual Survey of Fire Departments for U.S. Fire Experience and (ii) NFIRS, need to be removed. As fire losses vary among communities primarily because of their population sizes, NFPA divides the fire departments into ten strata based on the population size of community protected by that department(NFPA, 2016a). For each fire statistic (e.g., property loss, fatalities), sample loss rates are calculated for each stratum, which are multiplied with population weighting factors to provide the overall national estimate. Furthermore, the USFA's methodology to calculate national estimates is to scale up raw NFIRS data, which is not based on a statistically selected sample of incidents or fire departments using estimates from NFPA's annual survey (USFA, 2017b). Hall. Jr. and Harwood (1989) documented the joint efforts by NFPA and USFA in preparing guidelines to be used in calculation rules to produce estimates of national fire statistics, which have been followed for more than two decades

(USFA, 2017b). At the raw data level, there may be inconsistencies in fire incident data reporting. There are clear guidelines, such as those from USFA's NFIRSGram (USFA, 2017c) that helps fire department personnel to calculate fire losses for accurately documenting fire incidents (in NFIRS database). USFA's NFIRSGram recommends using the International Code Council's Building Valuation Data (BVD) formula to help fire departments in estimating the dollar loss from fires. BVD provides average construction cost per square foot, which can be used to estimate of the cost fire damage. However, not all fire departments in the U.S. use the same format. The assessments of square footage loss of property and more importantly that of the contents loss due to a fire could have inherent subjective factors. However various state- and local-level efforts have been aimed at minimizing these inconsistencies. A good example is the Property Loss Estimation Tool (PLET), a free spreadsheet-based tool developed by the Kansas State Fire Marshal's Office (SFMO), then updated by the Massachusetts SFMO and the Atlanta Fire Rescue. PLET has been endorsed by a few states (e.g., New Hampshire Department of Safety, 2017), and some others have independent guidelines (e.g., Oregon Office of State Fire Marshal, 2017). A more uniform adoption of PLET or similar standard tools, preferably in the form of an application that can be run on mobile phones and tablets, by states and fire departments across the country would improve the accuracy of local fire loss estimation and in turn, that of the national estimates.

While this report presents a comprehensive analysis of the total cost of fire in the United States for the years 1980 to 2014, a caveat is that some of the methods used for calculation of certain components may have wide bands of uncertainty. Based on the information available, Sections 2 and 3 mention the accuracy of data sources used for calculations. In any case, the fact that fire has a huge impact on the U.S. economy is indisputable. While it is traditionally assumed that costs have a negative impact, there have been recent studies (Evans, 2017; Delorme and Waterhouse, 2017) that highlight the benefits from incurring this cost. These studies quantify the savings that the fire service provides to the economy, thereby showing the positive impact of fire protection costs. The cost studies and the savings studies are interrelated, and both contribute to aiding in decision making in fire protection.

Building codes could be one of the key determinants of the total cost of fire, contributing to both expenditure as well as losses. In the United States, there is no uniform building code for all the states to follow. Codes vary between states, and while some states enforce mandatory building codes, other states leave the discretion to local governments (Simmons et al., 2017). The Insurance Institute for Business and Home Safety (IBHS) assigns scores to 18 states "most vulnerable to catastrophic hurricanes along the Atlantic Coast and Gulf of Mexico," by evaluating and comparing "the quality of regulations and processes governing residential dwelling construction" in those states. Such a rating may be required for more informed policymaking on fire protection.

Finally, NFIRS is a potential source to get most of the data that is needed for estimating the total cost of fire. However, currently, participation of fire departments in the NFIRS data entry process is not uniform across the U.S. Hence, extrapolation of NFIRS data to find national estimates of the total cost of fire is difficult at this point.

Uncertainty: The report lists all the data sources that were used to calculate the components of the total cost of fire in Table 3, as well as in the individual sections where the calculations are described. While some estimates could be highly accurate (e.g., local fire department expenditure), some others may have wide bands of uncertainty (e.g., indirect losses). Hence, the uncertainty level gets magnified from individual data sources through the cost components to the total cost of fire. The difficulty in quantifying the uncertainties in the data provided by individual sources forms the biggest challenge in quantifying the uncertainty of the total cost of fire. Only very few of the data sources (e.g., the U.S. Census Bureau) provide uncertainty/error in their data. As a result, the traditional method of estimating 95% confidence intervals to quantify uncertainty is not applicable. In order to assign due importance to uncertainty, we introduce the "uncertainty score," provided in Table 3, which is a relative index of

uncertainty between the various cost components. That score is subjectively estimated as a combination of three factors: data availability, calculation convenience, and availability of uncertainty estimates of individual data sources. A score of 1 indicates lowest uncertainty and a score of 5 represents the highest uncertainty. All components have scores greater than or equal to 2, which implies that there is scope for improvement for all components, with respect to one or more of the three factors mentioned previously. The local fire department expenditure is one of the components with the lowest score (least uncertainty), and most of the required data is obtained directly from the U.S. Census Bureau's estimates of state and local governments' finance data (U.S. Census Bureau, 2017c). It can be argued that these estimates are quite accurate and are the best available. The calculation convenience is also high, as there is no calculation required in this case, since the values for every year are directly available. However, due to the difficulty in estimating the percentage share of non-fire-related expenditures, which needs to be subtracted from the total fire department expenses to calculate the fire-related expenses, we assign a score of 2 to the local fire department expenditure component. On the contrary, indirect losses are hard to estimate due to non-availability of data, calculation challenges, and difficulty in obtaining accurate information on uncertainty levels. Hence, that component is assigned with a score of 5 (similar to other components such as donations to fire departments, fire maintenance, disaster planning, fire grade products, fire retardants, and preparing/maintaining standards). The uncertainty scores have been provided to indicate the confidence level on the estimates of the cost components. As seen in Table 3, six out of the fourteen components of cost have the highest uncertainty score of 5. While this acknowledges that the total cost of fire as calculated in this report has a high band of uncertainty, we perceive this as an avenue for future research. A higher uncertainty score for a particular component of cost represents not only a higher variability but also a more critical necessity of future work in improving estimates for that component. In general, the uncertainty scores will help future works in identifying where more data is needed and in understanding how that could improve the total cost estimates.

Regression Analysis: The individual components of the total cost of fire have been described in detail in Sections 2 and 3. This section presents the results of regression analysis on each component, in particular the 95% confidence intervals (Figure 9). The 'dots' in each figure represent the real values of the corresponding cost component, for all years in the period 1980 to 2014. Each figure also shows a nonlinear-fitted regression line which shows the trend of that particular cost component during the period 1980 to 2014. The shaded regions over the lines show the 95% confidence intervals. Overall, expanding the regression fitting and the confidence intervals to future years would be helpful for predicting the future cost of fire (expenditures and losses).

4.2 Conclusion

This document presents the latest report on the total cost of fire in the U.S. The literature relevant to calculating the total cost of fire is presented alongside the gaps in these prior studies. The shortcomings of previous methodology used are also presented beside the new methodologies that are followed in this paper. Additionally, the assumptions used in these new methodologies and the respective pros and cons are addressed. One key contribution of this report is the development of a uniform protocol (discussed in Sections 1), which includes the novel taxonomy and unique definitions for the various components of the total cost of fire. The discussion presented on defining and measuring the Value of Statistical Life (VSL) specifically for the fire protection context is also part of the uniform protocol.

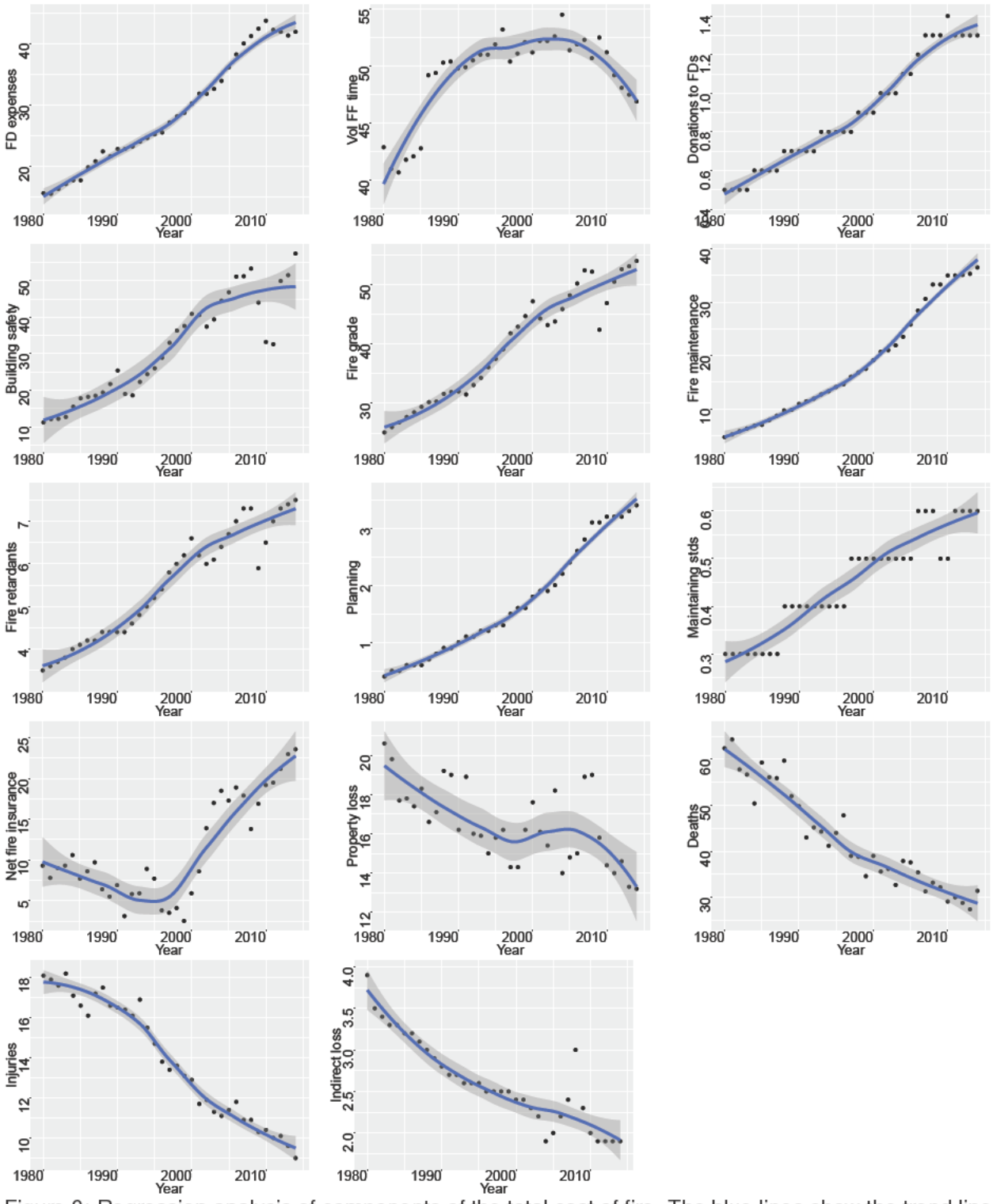


Figure 9: Regression analysis of components of the total cost of fire. The blue lines show the trend line and the gray band shows the 95% confidence interval.

4.3 Future Work

During the process of this project, we identified several future research directions related to many components of the total cost of fire. The higher a cost component's uncertainty score (given in Table 3), the more critical is the need for future work in collecting data and/or improving the accuracy of estimating that component. As discussed in Section 4.1, more study is required to improve the estimates of cost components, most critically for those with the highest uncertainty score given in Table 3. Specific to a few cost components, this report presents many areas which need in-depth study and analysis, which will be useful for future works related to the economic impact of fire and firefighting. This section consolidates such areas and presents research questions that may be pursued.

Volunteer firefighters are key to firefighting operations throughout the sub-urban and rural areas of the country. Various methodologies, some of which are mentioned in Section 2.1 of this report, may be used to calculate the value of time donated by volunteer firefighters. This value varies significantly between different methodologies, and the absence of a standard definition makes the task of selecting the most appropriate method challenging. Besides a consensus on a standard definition, more data collection and research on the amount of time donated by volunteer firefighters will be useful for more accurate calculations. Another important research direction is to calculate the value of hours donated by a volunteer firefighter, which is more specific than the value of a volunteer hour calculated by Independent Sector (2017). Such a calculation may take the additional factors into consideration, including the cost of injuries to volunteer firefighters in terms of the wages lost while away from their primary jobs.

There are certain aspects related to fires that are not considered in this report, wildfires being the most important. The techniques for prevention and suppression of wildfires are highly different from those of structural fires considered in this report. Moreover, wildland firefighting is funded by federal/state governments. Future studies may integrate the economic as well as the environmental costs of wildfires into the total cost of fire. Because forests and related natural resources are valued for the provision of many kinds of market-based and non-market goods and services, it is important to assign costs to wildland fire damages.

Future studies could prepare surveys and collect responses (from engineers, architects, building and property owners, construction contractors, and manufacturers of active and passive fire protection equipment) to estimate new, updated multipliers for calculating fire protection part of building construction expenditure. In addition to the costs of new building construction, costs of built-in fire protection could be considered, as a share of the capital investment. The surveys will also help to estimate the recurring maintenance costs of existing fire protection installations.

Another cost that is not accounted for in this report is the expenditure of various public services (other than fire departments) that attend to fires. For example, a fire in a high-rise building in the middle of a city will be attended to by a significant amount of police forces, medical services, and hazard relief and mitigation teams. This can incur additional costs which are not normally accounted for by these public services. This cost may be addressed in future research.

For estimating indirect property losses, one potential future research direction is to find potential relations between direct and indirect losses, using regression techniques. This may use the approach followed by Ramachandran (2002), in establishing "power" relationship between direct and indirect losses. That is, $IL = c(DL)^b$; where IL and DL are indirect and direct losses respectively. This report, in contrast, uses constant multipliers developed by NFPA (e.g., 65% for manufacturing and industrial properties) (NFPA, 2014b), which may or may not be accurate for different types of businesses. Ramachandran (2002) develops separate sets of parameters for each context in the UK (e.g., local, national, mercantile, manufacturing, non-manufacturing, warehouses). Future research may use case studies, sampled from different types of recent historical fires (e.g., high/medium/small losses, residential/non-residential, public/private, manufacturing/warehouse/business center), to test various

regression models and subsequently select statistically significant models for each type of fire. Commonly used regression functions (e.g., linear, exponential, power form) may be explored to assess the relationship between direct and indirect losses. As discussed in Section 4.1, regression analysis could be performed on the total cost of fire as well as the individual components, in order to predict the future costs, expenditures, and losses. This would help in improved policymaking with considerations to future scenarios. NFPA (2016b) provides summary statistics of large-loss fires and the resulting economic damage. More elaborate case studies on such individual fire incidents, especially focusing on the indirect losses caused, are necessary future research directions to improve the estimation of the indirect losses and the economic impact of fire. Another essential consideration for future work is generating and publishing more data (with particular attention to the components with high uncertainty scores in Table 3.

From a macro perspective, future work may explore the deviance between expenditures and losses, which have been increasing over the years (as seen in Figure 5). This is underlined by the fact that expenditures constitute 1.9% of the U.S. GDP. It could be argued that a fair comparison of expenditures with losses happens when the latter is discounted, because the decreasing losses may be attributed, at least partly, to increasing successful fire interventions. However, the savings from fire service interventions are either unavailable or highly difficult to be calculated, thus making it difficult to estimate a discounting coefficient for the losses that factors in the savings. Calculating the savings that the fire service provide to the economy and considering those savings values in the comparison between expenditures and losses are two potential ideas for future research. This would enable fire departments to quantify and communicate their actual value to the public and to the policymakers, in the context of cost-cutting and resource scarcity. Another related advanced research direction is to calculate the effectiveness of expenditure in fire protection, which may differ between various regions in the U.S., due to inter-regional differences in the likelihood/vulnerability and consequences of fire. The various types of expenditure (such as personnel, building safety, and equipment) also may have different effectiveness levels. Policymakers could use this information to draft policies that allocate budget/resources based on effectiveness levels in addition to the conventional equity considerations.

Finally, the definitions for some of the components need to be revisited and rephrased to fit to the current fire protection context. In particular, the definitions of expenditures on fire grade products, fire maintenance, fire retardants, disaster planning, and preparing/maintaining standards, which together constitute 48.5% ($159.4 billion) of the total cost of fire ($328.5 billion), have been formed based on Meade (1991). These definitions and calculation methodology may need significant revisions to incorporate the current fire protection technology and practices. The fire safety cost in building construction, which is the largest individual component ($57.4 billion = 17.5% of the total cost), is also defined and calculated based on studies that may need significant updates (Apostolow et al., 1978; Meade, 1991). There would be clearly a need of future work for updating these definitions and estimates.

References

Andersson, H., N. Treich. 2011. The value of a statistical life. A. de Palma, E. Quinet R. Lindsey, R. Vickerman, eds., *A Handbook of Transport Economics*, chap. 17. Edward Elgar, Cheltenham, UK, 396–424.

Apostolow, J. J., D. L. Bowers, C. M. Sullivan, III. 1978. The nation's annual expenditure for the prevention and control of fire. Tech. rep., Worcester Polytechnic Institution, Worcester, MA.

AWWA. 2012. Rates for fire protection service. *Principles of Water Rates, Fees, and Charges — Manual of Water Supply Practices*, chap. IV.8. 141–153.

Baum, R. 2015. The revenue ups and downs of the water business. URL: http://efc.web.unc.edu/2015/08/19/water-utility-revenue/, accessed in October 2017.

Bureau of Economic Analysis. 2013. RIMS II. Tech. rep. URL: https://www.bea.gov/regional/pdf/rims/rimsii_user_guide.pdf, accessed in October 2017.

Bureau of Labor Statistics. 2017a. CPI inflation calculator. URL: https://www.bls.gov/data/inflation_calculator.htm, accessed in October 2017.

Bureau of Labor Statistics. 2017b. Occupational employment statistics data. URL: https://www.bls.gov/oes/tables.htm, accessed in October 2017.

Bureau of Labor Statistics. 2017c. Occupational outlook handbook, 2016-17 edition, Firefighters. URL: https://www.bls.gov/ooh/protective-service/firefighters.htm, accessed in October 2017.

Burkardt, J. 2014. The truncated normal distribution. Working paper, Florida State University. URL: https://people.sc.fsu.edu/ jburkardt/presentations/truncated_normal.pdf, accessed in October 2017.

City of Burlington Fire Department, Vermont. 2013. Fiscal Year 2013 Budget. URL: https://www.burlingtonvt.gov/node/701, accessed in October 2017.

CPSC. 2000. The Consumer Product Safety Commission's revised injury cost model. Tech. rep. URL: https://www.cpsc.gov/s3fs-public/pdfs/Revised-Injury-Cost-Model-120100.pdf, accessed in October 2017.

CPSC. 2009. 2004-2005 National sample survey of unreported residential fires. Tech. rep., Consumer Product Safety Commission. URL: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.591.8119&rep=rep1&type=pdf, accessed in October 2017.

Delorme, F., D. Waterhouse. 2017. Analysis of the economic impact of the Montréal Fire Safety Department's interventions for year 2015. Tech. rep.

Evans, A. 2017. The economic impact of successful commercial fire interventions. Tech. rep. URL: http://media2.abc15.com/html/pdf/ASU%20study.pdf, accessed in October 2017.

Federal Reserve Bank of St. Louis. 2017. Manufacturing sector: Real output. URL: https://fred.stlouisfed.org/series/OUTMS, accessed in October 2017.

Fire Engineering. 2011. Get battery donations through the Power Those Who Protect Us Program. URL: http://www.fireengineering.com/articles/2011/04/battery-donations.html, accessed in October 2017.

FireApparatusMagazine.com. 2011. Voters accept $245,000 in donations for Lincolnville (ME) Fire Department. URL: http://www.fireapparatusmagazine.com/articles/pt/2016/12/voters-accept-245-000-in-donations-for-lincolnville-me-fire-department.html, accessed in October 2017.

FireChief.com. 2016. NY fire department lands $500k donation for new fire station. URL: https://www.firechief.com/2016/05/25/ny-fire-department-lands-500k-donation-for-new-fire-station/, accessed in October 2017.

FSF. 2017. Equipment grants. URL: http://www.ffsupport.org/equipment-grants/, accessed in October 2017.

Griffin, S. C., T. L. Regan, P. Harber, E. A. Lutz, C. Hu, W. F. Peate, J. L. Burgess. 2016. Evaluation of a fitness intervention for new firefighters: injury reduction and economic benefits. *Injury prevention* **22**(3) 181–188.

Hall. Jr., J. R., B. Harwood. 1989. The national estimates approach to US fire statistics. *Fire Technology* **25**(2) 99–113.

Independent Sector. 2017. The value of volunteer time. URL: http://independentsector.org/resource/the-value-of-volunteer-time/, accessed in October 2017.

Meade, William P. 1991. A first pass at computing the cost of fire safety in a modern society. *Fire Technology* **27**(4) 341–345.

NAIC. 2015. NAIC report, 2015. URL: http://www.naic.org/state_report_cards/report_card_us.pdf, accessed in October 2017.

New Hampshire Department of Safety. 2017. Special operations, fire incident reporting resources. URL: https://www.nh.gov/safety/divisions/firesafety/special-operations/incident/NHFIRSResources.html, accessed in October 2017.

NFPA. 2012. Sprinkler impact on fire injury. Tech. rep. URL: http://www.nfpa.org/news-and-research/fire-statistics-and-reports/research-reports/suppression/sprinkler-impact-on-fire-injury, accessed in October 2017.

NFPA. 2014a. Characteristics of home fire victims. Tech. rep. URL: http://www.nfpa.org/news-and-research/fire-statistics-and-reports/fire-statistics/demographics-and-victim-patterns/characteristics-of-home-fire-victims, accessed in October 2017.

NFPA. 2014b. The total cost of fire in the United States. Tech. rep. URL: http://www.nfpa.org/news-and-research/fire-statistics-and-reports/fire-statistics/fires-in-the-us/overall-fire-problem/total-cost-of-fire, accessed in October 2017.

NFPA. 2016a. Fire loss in the United States. Tech. rep. URL: http://www.nfpa.org/news-and-research/fire-statistics-and-reports/fire-statistics/fires-in-the-us/overall-fire-problem/fire-loss-in-the-united-states, accessed in October 2017.

NFPA. 2016b. Large-loss fires in the United States. Tech. rep. URL: http://www.nfpa.org/news-and-research/fire-statistics-and-reports/fire-statistics/fires-in-the-us/large-property-loss/large-loss-fires-in-the-united-states, accessed in October 2017.

NFPA. 2016c. Patterns of firefighter fireground injuries. Tech. rep. URL: http://www.nfpa.org/news-and-research/fire-statistics-and-reports/fire-statistics/the-fire-service/fatalities-and-injuries/patterns-of-firefighter-fireground-injuries, accessed in October 2017.

NFPA. 2016d. U.S. Fire Department Profile. Tech. rep. URL: http://www.nfpa.org/news-and-research/fire-statistics-and-reports/fire-statistics/the-fire-service/administration/us-fire-department-profile, accessed in October 2017.

NFPA. 2017a. Fire department calls. URL: http://www.nfpa.org/News-and-Research/Fire-statistics-and-reports/Fire-statistics/The-fire-service/Fire-department-calls/Fire-department-calls, accessed in October 2017.

NFPA. 2017b. Firefighter fatalities in the United States. Tech. rep. URL: http://www.nfpa.org/News-and-Research/Fire-statistics-and-reports/Fire-statistics/The-fire-service/Fatalities-and-injuries/Firefighter-fatalities-in-the-United-States, accessed in October 2017.

NFPA. 2017. Fires by occupancy or property type. Tech. rep. URL: http://www.nfpa.org/news-and-research/fire-statistics-and-reports/fire-statistics/fires-in-the-us/overall-fire-problem/fires-by-occupancy-or-property-type, accessed in October 2017.

NIST. 2005. The economic consequences of firefighter injuries and their prevention. Final report. Tech. rep. URL: http://fire.nist.gov/bfrlpubs/fire05/art025.html, accessed in October 2017.

Oregon Office of State Fire Marshal. 2017. Standardized fire loss reporting best practice guideline. URL: http://www.oregon.gov/osp/SFM/docs/DataServices/FireLossReportingBestPractice.pdf, accessed in October 2017.

Pilsworth, J. E. 1993. Volunteer fire organizations and volunteer firefighters: An economic perspective and valuation for the State of Montana. M.A. Thesis, The University of Montana.

Ramachandran, G. 2002. *The Economics of Fire Protection*. Routledge, London, UK.

Regional Economic Models, Inc. 2017. Policy Insight. URL: http://www.remi.com/products/pi, accessed in October 2017.

San Diego Fire Department. 2012. Fiscal Year 2012 Adopted Budget. URL: https://www.sandiego.gov/fm/annual/fy12, accessed in October 2017.

Seattle Fire Department. 2016. Proposed Budget 2016. URL: http://www.seattle.gov/financedepartment/16proposedbudget/documents/SFD.pdf, accessed in October 2017.

Simmons, K. M., J. Czajkowski, J. M. Done. 2017. Economic effectiveness of implementing a statewide building code: The case of Florida. Tech. rep. Working paper, University of Pennsylvania. URL: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2963244, accessed in October 2017.

State of Wyoming. 2005. The economic impact of fire damage on Wyoming's economy from a business perspective. URL: http://eadiv.state.wy.us/SpecialReports/REMI_Fire_1.pdf, accessed in October 2017.

TACIR. 2013. Fire service in Tennessee. Tech. rep., The Tennessee Advisory Commission on Intergovernmental Relations. URL: https://tn.gov/assets/entities/tacir/attachments/Tab7_Fire.pdf, accessed in October 2017.

Tiger, M. 2012. American idol for water utility finance: The results show. URL: http://efc.web.unc.edu/2012/06/21/american-idol-for-water-utility-finance-the-results-show/, accessed in October 2017.

U.S. Census Bureau. 2017a. Construction spending: Historical value put in place. URL: https://www.census.gov/construction/c30/historical_data.html, accessed in October 2017.

U.S. Census Bureau. 2017b. Construction spending: Value of construction put in place at a glance. URL: https://www.census.gov/construction/c30/c30index.html, accessed in October 2017.

U.S. Census Bureau. 2017c. State & local government finance. URL: https://www.census.gov/govs/local/index.html, accessed in October 2017.

U.S. Census Bureau. 2017d. State & local government finance: Historial data. URL: https://www.census.gov//govs/local/historical_data.html, accessed in October 2017.

U.S. Census Bureau. 2017e. Statistical abstracts series. URL: https://www.census.gov/library/publications/time-series/statistical_abstracts.html, accessed in October 2017.

U.S. Department of Transportation. 2017. Revised departmental guidance on valuation of a statistical life in economic analysis. URL: https://www.transportation.gov/office-policy/transportation-policy/revised-departmental-guidance-on-valuation-of-a-statistical-life-in-economic-analysis, accessed in October 2017.

USFA. 2017a. Fire department overall run profile as reported to the National Fire Incident Reporting System (2014). Tech. rep. URL: https://www.usfa.fema.gov/downloads/pdf/statistics/v17i8.pdf, accessed in October 2017.

USFA. 2017b. National estimates methodology for building fires and losses. Tech. rep. URL: https://www.usfa.fema.gov/downloads/pdf/statistics/national_estimate_methodology.pdf, accessed in October 2017.

USFA. 2017c. NFIRSGram: Calculating fire loss. URL: https://www.usfa.fema.gov/data/nfirs/support/nfirsgrams/nfirsgram_calculating_fireloss.html, accessed in October 2017.

HIGH-RISE RETROFIT STUDY

CONTRACTOR BID AND RETROFIT PACKAGE

2025

FIRE SPRINKLERS BUY TIME TIME BUYS LIFE
NATIONAL FIRE SPRINKLER ASSOCIATION

@NFSAorg

NFSA.org

National Fire Sprinkler Association

#fastestwater

Fire is fast.
Fire sprinklers are faster.

NFSA
NATIONAL FIRE SPRINKLER ASSOCIATION
The Voice of the Fire Sprinkler Industry

514 Progress Drive, Suite A
Linthicum Heights, MD 21090 • nfsa.org

NFSA
NATIONAL FIRE SPRINKLER ASSOCIATION
The Voice of the Fire Sprinkler Industry

NFSA High-Rise Retrofit Study
2025

Contents

Project Summary....2
Building Overview....3
Existing Fire Protection Systems....4
Bid Items and Retrofit Scope....6
Appendix A – 2024 Internation Fire Code Reference....10
Appendix B – 1975 BOCA Reference....19
Appendix C – 1976 UBC Reference....26
Appendix D – Opinion of Probable Cost....31
Appendix E – Case Study Example Floorplans....32

Project Contact

Jeffrey M. Hugo, CBO – hugo@nfsa.org – 845-519-5963
NFSA Vice President of Codes and Standards

Project Summary

This project focuses on retrofitting with fire sprinklers a 12-story, 125-foot residential high-rise, originally built to the 1975 BOCA (Building Officials and Code Administrators) and/or the 1976 UBC (Uniform Building Code) code, to meet modern fire protection standards in accordance with the 2024 model codes (NFPA 1 *Fire Code*, Section 13.3.2.24.2; International Fire Code, Section 1103.5.4) and the 2022 edition of NFPA 13 (Standard for Installation of Fire Sprinklers). The building consists of R-2 occupancy apartments ranging from 900 to 1,200 sq. ft., with each floor containing 8,400 sq. ft. of dwelling space within a 10,000 sq. ft. footprint. The scope includes the installation of a wet-pipe sprinkler system throughout the dwelling units, public areas, and mechanical spaces, with exclusions for small bathrooms and exterior spaces, as permitted. Fire alarm and smoke detection systems will be upgraded to meet NFPA 72 standards, enhancing occupant safety and emergency response capabilities. Existing standpipes and a 750-gpm fire pump will remain in use, while necessary repairs, asbestos remediation, and aesthetic restorations will follow the system installation. This project will also provide a comprehensive cost analysis of the retrofits, including materials, labor, occupant disruption, and regulatory compliance, with scalability to calculate per-story costs for potential future expansions. Cost estimates will be tailored to major U.S. markets, including Seattle, Chicago, Philadelphia, Washington DC/Baltimore, St. Louis, and Miami. The results will support efforts to advocate for the retrofitting of fire sprinklers and other essential life-safety systems in existing high-rise buildings.

Building Overview

- **Original Construction**: Built to the 1975 BOCA and/or the 1976 UBC code, Type IA construction (steel frame, masonry walls, concrete plank floors).
- **Building Specifications**:
    - **Height**: 12 stories, 125 feet. 1 level below grade
    - **Use Group**:
        - Basement (1 level): S-1 (storage, mechanical, limited parking)
        - Floor 1: B (offices, mailroom) A-3 (day rooms, fitness) R-2 (apartments/condominiums)
        - Floors 2-12: R-2 (apartments/condominiums)
    - **Dwelling Units**:
        - Size: 900–1,200 sq. ft.
        - Layout: 4 one-bedroom (900 sq. ft.) and 4 two-bedroom (1,200 sq. ft.) units per floor.
    - **Ceilings**:
        - 9 ft in living rooms, bedrooms, hallways, and closets.
        - Dropped 8 ft ceilings in kitchens, bathrooms, and corridors with a 1 ft-7 in plenum.
    - **Total Floor Area**:
        - Basement: 10,000 sq. ft.
        - Floor 1: 10,000 sq. ft
        - Floors 2-12: 10,000 per floor, with 8,400 sq. ft. for dwelling units.
        - Dimensions: (approximately) 80 ft x 125 ft per floor
    - **Vertical Access:**
        - Two exit stair enclosures
        - Two elevators (one passenger, one freight)

Existing Fire Protection Systems

- **Standpipe System**:
    - Existing, installed per 1975 BOCA 1211.2.3 (1976 UBC Sec. 3804 (b)).
    - 6-inch riser, wet Class III (2-1/2" and 1-1/2" outlets) in each stairwell, serving all floor levels (retrofits are not required to be upgraded to automatic if originally manual)
    - Includes 100 ft of 1-1/2" hose, 500 gpm over two outlets, and 65 psi at the highest outlet. (1976 UBC Sec. 3804 (4) – The wet standpipes system shall deliver not less than 35 gallons of water per minute at not less than 25 pounds per square inch residual pressure from each of any two outlets flowing simultaneously for 30 minutes.)
    - Pre-existing and well-maintained 750 gpm electric fire pump.
        - Emergency/back-up power provided to fire pump and fire alarm system (BOCA 431.5.2) (UBC 1807 (j))
        - Structure is not beyond local fire department pumping capacity

- **Fire Sprinklers**:
    - Basement: Sprinklered to OH 1 (0.17/1500) per windowless story (BOCA 1202.16) to the 1974 NFPA 13
    - Floors 1-12: Not required or installed per 1975 BOCA, Section 431 (1976 UBC, Section 1807).

- **Fire safety features required by BOCA/UBC in a high rise without fire sprinklers**
  See Appendix B & C for code references. Existing buildings built under these adopted codes will also be protected with the following requirements:

    - **Areas of Refuge (‘75 BOCA-431.2.1) / Compartmentation (‘76 UBC-1807 [b]):**
        - Horizontal exits with fire separation walls on each floor, or
        - Smoke barrier compartments every 5 floors.
    - **Exterior Wall Openings (‘75 BOCA-431.2.2) (‘76 UBC-1807[b]):**
        - 1-hour spandrels (3 ft in height) when openings are vertically aligned.

- **Fire Alarm System (‘75 BOCA-431.2.4) / Fire Alarms (‘76 UBC-1807 [c]):**
  - Activates the voice alarm system (per BOCA 1216.0).
- **Smoke Alarms (‘75 BOCA-431.2.3) / Fire Detection (‘76 UBC-1807 [d]):**
  - Smoke detection activates voice alarm system in boiler/furnace rooms, return air ducts serving other floors, and elevator lobbies.
- **Voice Alarm System (‘75 BOCA-431.2.5) (‘76 UBC-1807 [e]):**
  - Pre-recorded messages triggered by smoke or fire alarms.
- **Voice Communication System (‘75 BOCA-431.2.6) (‘76 UBC-1807 [f]):**
  - Two-way communication for fire department in elevators, lobbies, corridors, and stairs.
  - One-way occupant voice alarm.
- **Smoke Control System (‘75 BOCA-431.2.7) (‘76 UBC-1807 [d]):**
  - Natural or mechanical smoke control system.
- **Elevators (‘75 BOCA-431.2.8) (‘76 UBC-1807 [d]):**
  - At least one elevator designated for fire department emergency use.

Bid Items and Retrofit Scope

This document outlines the bid requirements for contractors to retrofit a high-rise residential building with fire sprinkler and alarm systems in compliance with modern codes. It details the phased construction approach, system specifications, and additional considerations to ensure occupant safety and minimal disruption during the project.

- **Phased Construction**: Work will be conducted in phases to minimize occupant disruption. Only one floor will be affected at a time, and public areas will remain accessible. Construction hours are limited to 8:00 AM to 5:00 PM, during which occupants will be temporarily relocated to designated day rooms.
- **Security**: Provide site security during nonworking hours and dedicated security for dwelling unit floors during working hours.

Retrofit Scope

1. **Fire Sprinkler System**:
    - **Design and Installation**:
        - Install a wet-pipe sprinkler system in compliance with the 2024 model codes and the 2022 edition of NFPA 13.
        - Connect to the pre-existing 6-inch standpipe system on each floor.
        - Use CPVC piping with a surface-mounted soffit system for floors 1-12.
        - Install Schedule 40 steel piping in the basement/garage/mechanical rooms.
        - Garage is conditioned, wet pipe system.
        - Provide floor control valves on each floor, with two wet zones in the basement (one dedicated for the garage and one for the other half)
        - Incorporate a 3-inch express drain for high-rise water drainage.
    - **Coverage**:
        - Basement: Ordinary Hazard Group 2 (10,000 sq. ft.).
        - Floor 1: Light Hazard (~8,000 sq. ft.) and Ordinary Hazard Group 1 (~2,000 sq. ft.).

        - Floors 2-12: Light Hazard (9,300 sq. ft. per floor for dwelling units and public areas) and Ordinary Hazard Group 1 (700 sq. ft. per floor for mechanical and laundry rooms).
        - Dwelling unit closets: A single sprinkler installed in closets under 400 cubic feet.
        - Sprinklers are required in bathrooms opening directly onto public corridors or exitways on the first floor.
    - **NFPA 13 (2022) Design Methods**
        - Density/Area (19.2.3.2), or
        - Room Design (19.2.3.3), or
        - Residential (19.3.1)
    - **Exemptions**:
        - No sprinklers required for balconies or exterior spaces.
        - Bathrooms under 55 sq. ft. in dwelling units.
2. **Fire Alarm System**:
    - Upgrade to meet NFPA 72 standards if the existing system cannot be modified to supervise the new sprinkler system or accommodate required additions.
    - Include flow and tamper switches for each zone valve assembly.
    - Install a new fire alarm panel if the existing one cannot be modified or approved by the Authority Having Jurisdiction (AHJ).
    - Upgrade to meet NFPA 72 requirements if and only if the existing fire alarm system is not previously approved throughout the building. Details to be determined based on updated codes and existing deficiencies identified by the AHJ.
    - The ability to supervise the sprinkler system may be a cause for a fire alarm panel upgrade if the existing system cannot be modified to accommodate the supervision requirements. If the existing system is approved by the fire official and can be modified to accommodate supervision of the sprinkler system, then no additional upgrades are required at the time of sprinkler installation.
    - Document the cost and scope of these systems if they were not originally installed per the 1975 BOCA and/or 1976 UBC (see Appendix B).
3. **Fire Safety Features (1975 BOCA and 1976 UBC)**:

- Document the cost and scope of these systems if they were not originally installed per the 1975 BOCA and/or 1976 UBC (see Appendix B).

4. **Existing Standpipe and Fire Pump**:
    - Utilize the pre-existing 750-gpm fire pump and standpipe system installed per the 1975 BOCA and 1976 UBC codes.
    - No upgrades required.
5. **Aesthetic Restoration**:
    - Repair and restore walls, ceilings, and finishes affected by the installation of the sprinkler system.
    - Include asbestos remediation for mechanical room penetrations.
6. **Jobsite Housekeeping**:
    - Conduct daily cleanups to allow occupants to return to their units by evening.
    - Provide designated waste disposal areas in fire-sprinklered sections.
    - Restrict material storage to daily onsite use. Use the freight elevator from 7:30 AM to 5:00 PM for transportation.
    - Provide compensation or temporary relocation for disruptions to residents or operations, as necessary.
7. **Permits and Testing**:
    - Include costs for permits, system testing, inspections, and construction management.
    - Cover tap fees and underground service line installations if required.

Additional Notes on Retroactive Requirements

In addition to the fire sprinkler and fire alarm system, current building codes indicate a variety of additional retroactive upgrades required by the 2024 IFC (see Appendix A) and/or the 2022 NFPA 1 for high-rise R-2 occupancies. The building owner is responsible for meeting the retroactive requirements. However, in a well-maintained and previously approved building that meets the existing building codes at the time of construction, only any existing deficiencies or impairments may trigger an immediate system upgrade. The introduction of a sprinkler system into a previously unsprinklered building does not trigger a complete retroactive upgrade of all systems if they are well maintained and approved, rather it may spark a conversation to determine an agreeable timeline to make any additional system upgrades that require retroactive improvements. If identified by the code official, building owners shall file a

compliance schedule with the fire code official not later than 365 days after receipt of a written notice. The compliance schedule shall not exceed 12 years for completion of the retrofit.

Market Locations for Cost Analysis

- Seattle, Chicago, Washington, Philadelphia, DC/Baltimore, St. Louis, and Miami.

Key Deliverables

- Provide detailed cost estimates for retrofitting the NFPA 13 and NFPA 72 systems.
- Ensure scalability, allowing the cost per story to be easily calculated as additional stories are added.
- Include all associated costs for materials, labor, restoration, occupant disruption, and compliance with local regulations.

Appendix A – 2024 IFC Reference

2024 International Fire Code

1101.4 Owner Notification

When a building is found to be in noncompliance with this chapter, the fire code official shall duly notify the owner of the building. Upon receipt of such notice, the owner shall, subject to the following time limits, take necessary actions to comply with the provisions of this chapter.

1101.4.1 Construction Documents

Construction documents necessary to comply with this chapter shall be completed and submitted within a time schedule approved by the fire code official.

1101.4.2 Completion of Work

Work necessary to comply with this chapter shall be completed within a time schedule approved by the fire code official.

1101.4.3 Extension of Time

The fire code official is authorized to grant necessary extensions of time where it can be shown that the specified time periods are not physically practical or pose an undue hardship. The granting of an extension of time for compliance shall be based on the showing of good cause and subject to the filing of an acceptable systematic plan of correction with the fire code official.

1103.1.1 Historic Buildings

Facilities designated as historic buildings shall develop a fire protection plan in accordance with NFPA 914. The fire protection plans shall comply with the maintenance and availability provisions in Sections 404.3 and 404.4.

Table 1103.1 Occupancy and Use Requirements

(Bolded highlights applicable sections for Case Study)

High-rise R-2 occupancies require **1103.2**, **1103.3**, *1103.4.1 (HR groups I2 & 3 occupancies)*, *1103.4.2 (3-5 stories)* ,**1103.4.3**,*1103.4.6 (R-2 – escalators), 1103.4.7 (R-2 – escalators),* **1103.4.8**,*1103.4.9 (HR – I-2 occupancy linen chutes)*, *1103.4.10 (R-2 flue-fed incinerators),* 1103.5.5 (R-2 Pyroxylin Plastics), **1103.6.1**, *1103.6.2 (helistops/heliports),* **1103.7.6 (R-2)**, **1103.8 (R-2), 1103.9**, 1104

**Applicable sections shown below*

1103.2 Emergency Responder Communications Enhancement in Existing Buildings

Existing buildings other than Group R-3 that do not have approved in-building emergency response communications enhancement for emergency responders in the building based on existing coverage levels of the public safety communication systems, shall be equipped with such coverage according to one of the following:

1. Where an existing wired communication systems cannot be repaired or is being replaced, or where not approved in accordance with Section 510.1, Exception 1.
2. Within a time frame established by the adopting authority.

Exception: Where it is determined by the fire code official that the in-building emergency responder communications enhancement system is not needed.

1103.3 Existing Elevators

In other than Group R-3, existing elevators, escalators and moving walks shall comply with the requirements of Sections 1103.3.1 and 1103.3.2 .

1103.3.1 – Only applies to Group I-2, Condition2 and ambulatory care facilities.

1103.3.2 Elevator Emergency Operation

Existing elevators with a travel distance of 25 feet or more above or below the main floor or other level of a building and intended to serve the needs of emergency personnel for firefighting or rescue purposes shall be provided with emergency operation in accordance with ASME A17.3.

Exceptions:

1. Buildings without occupied floors located more than 55 feet above or 25 feet below the lowest level of fire department vehicle access where protected at the elevator shaft openings with additional fire doors in accordance with Section 716 of the International Building Code and where all of the following conditions are met:
    1. The doors shall be provided with vision panels of approved fire-protection-rated glazing so located as to furnish clear vision of the approach to the elevator. Such glazing shall not exceed 100 square inches in area.
    2. The doors shall be held open but be automatic -closing by activation of a fire alarm initiating device installed in accordance with the requirements of NFPA 72 as for Phase I Emergency Recall Operation, and shall be located at each floor served by the elevator; in the associated elevator machine room, control space, or control room; and in the elevator hoistway, where sprinklers are located in those hoistways.
    3. The doors, when closed, shall have signs visible from the approach area stating: "WHEN THESE DOORS ARE CLOSED OR IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT."

2. Buildings without occupied floors located more than 55 feet above or 25 feet below the lowest level of fire department vehicle access where provided with automatic sprinkler systems installed in accordance with Section 903.3.1.1 or 903.3.1.2.
3. Freight elevators in buildings provided with both automatic sprinkler systems installed in accordance with Section 903.3.1.1 or 903.3.1.2 and not less than one ASME 17.3-compliant elevator serving the same floors.

Elimination of previously installed Phase I emergency recall or Phase II emergency in-car systems shall not be permitted.

1103.4.3 More Than Five Stories

In other than Group I-2 and I-3 occupancies, interior vertical openings connecting more than five stories shall be protected by 1-hour fire-resistance rated construction.

Exceptions:

1. Vertical opening protection is not required for Group R-3 occupancies.
2. Vertical opening protection is not required for open parking garages.
3. Vertical opening protection for escalators shall be in accordance with Section 1103.4.5, 1103.4.6 or 1103.4.7. (these sections refer to escalators)
4. Exit access stairways and ramps shall be in accordance with Section 1103.4.8.

1103.4.8 Occupancies Other Than Groups I-2 and I-3

In other than Group I-2 and I-3 occupancies, floor openings containing exit access stairways and ramps that do not comply with one of the conditions listed in this section shall be protected by 1-hour fire-resistance rated - construction.

1. Exit access stairways and ramps that serve, or atmospherically communicate between, only two stories. Such interconnected stories shall not be open to other stories.
2. In Group R-1, R-2 or R-3 occupancies, exit access stairways and ramps connecting four stories or less serving and contained within an individual dwelling unit or sleeping unit or live/work unit.
3. Exit access stairways and ramps in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, where the area of the vertical opening between stories does not exceed twice the horizontal projected area of the stairway or ramp, and the opening is protected by a draft curtain and closely spaced sprinklers in accordance with NFPA 13. In other than Group B and M occupancies, this provision is limited to openings that do not connect more than four stories.
4. Exit access stairways and ramps within an atrium complying with the provisions of Section 404 of the International Building Code.
5. Exit access stairways and ramps in open parking garages that serve only the parking garage.

6. Exit access stairways and ramps serving open-air seating complying with the exit access travel distance requirements of Section 1030.7 of the International Building Code.
7. Exit access stairways and ramps serving the balcony, gallery or press box and the main assembly floor in occupancies such as theaters, places of religious worship, auditoriums and sports facilities.

1103.5.4 High-Rise Buildings (not listed in Table 1103.1 for high-rise)
Where Appendix M has not been adopted, existing high-rise buildings that do not have a previously approved automatic sprinkler system shall be equipped with an automatic sprinkler system in accordance with Section 903.3.1.1 where any of the following conditions apply:

1. The high-rise building has an occupied floor located more than 120 feet above the lowest level of fire department vehicle access.
2. The high-rise building has occupied floors located more than 75 feet and not more than 120 feet above the lowest level of fire department vehicle access, and the building does not have at least two interior exit stairways complying with Section 1104.10 that are separated from the building interior by fire assemblies having a fire-resistance rating of not less than 2 hours with opening protection in accordance with Table 716.1(2)of the International Building Code.
3. The high-rise building has occupied floors located more than 75 feet and not more than 120 feet above the lowest level of fire department vehicle access, and the building does not have a fire alarm system that includes smoke detection in mechanical equipment, electrical, transformer, telephone equipment and similar rooms; corridors; elevator lobbies; and at doors penetrating interior exit stairway enclosures.

Building owners shall file a compliance schedule with the fire code official not later than 365 days after receipt of a written notice. The compliance schedule shall not exceed 12 years for completion of the automatic sprinkler system retrofit.

1103.6 Standpipes
Existing structures shall be equipped with standpipes installed in accordance with Section 905 where required in Sections 1103.6.1 and 1103.6.2 . The fire code officials authorized to approve the installation of manual standpipe systems to achieve compliance with this section where the responding fire department is capable of providing the required hose flow at the highest standpipe outlet.

1103.6.1 Existing Multiple-Story Buildings
Existing buildings with occupied floors located more than 50 feet above the lowest level of fire department access or more than 50 feet below the highest level of fire department access shall be equipped with standpipes.

1103.7 Fire Alarm Systems

An approved fire alarm system shall be installed in existing buildings and structures in accordance with Sections 1103.7.1 through 1103.7.6 and provide occupant notification in accordance with Section 907.5 unless other requirements are provided by other sections of this code.

Exception: Occupancies with an existing, previously approved fire alarm system.

1103.7.6 Group R-2

A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in existing Group R-2 occupancies more than three stories in height or with more than 16 dwelling or sleeping units.

Exceptions:

1. Where each living unit is separated from other contiguous living units by fire barriers having a fire-resistance rating of not less than ¾ hour, and where each living unit has either its own independent exit or its own independent stairway or ramp discharging at grade.
2. A separate fire alarm system is not required in buildings that are equipped throughout with an approved supervised automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2 and having a local alarm to notify all occupants.
3. A fire alarm system is not required in buildings that do not have interior corridors serving dwelling units and are protected by an approved automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2, provided that dwelling units either have a means of egress door opening directly to an exterior exit access that leads directly to the exits or are served by open-ended corridors designed in accordance with Section 1027.6, Exception 3.
4. A fire alarm system is not required in buildings that do not have interior corridors serving dwelling units, do not exceed three stories in height and comply with both of the following:
    1. Each *dwelling unit* is separated from other contiguous *dwelling units* by fire barriers having a fire-resistance rating of not less than ¾ hour.
    2. Each dwelling unit is provided with smoke alarms complying with the requirements of Section 907.2.11.

1103.8 Single-And Multiple-Station Smoke Alarms

Single- and multiple-station smoke alarms shall be installed in existing Group I-1 and R occupancies in accordance with Sections 1103.8.1 through 1103.8.3.

1103.8.1 Where Required

Existing Group I-1 and R occupancies shall be provided with single-station smoke alarms in accordance with Section 907.2.11. Interconnection and power sources shall be in accordance with Sections 1103.8.2 and 1103.8.3, respectively.

Exceptions:

1. Where the code that was in effect at the time of construction required smoke alarms and smoke alarms complying with those requirements are already provided.
2. Where smoke alarms have been installed in occupancies and dwellings that were not required to have them at the time of construction, additional smoke alarms shall not be required, provided that the existing smoke alarms comply with requirements that were in effect at the time of installation.
3. Where smoke detectors connected to a fire alarm system have been installed as a substitute for smoke alarms.

1103.8.2 Interconnection

Where more than one smoke alarm is required to be installed within an individual dwelling or sleeping unit, the smoke alarms shall be interconnected in such a manner that the activation of one alarm will activate all of the alarms in the individual unit. Physical interconnection of smoke alarms shall not be required where listed wireless alarms are installed, and all alarms sound upon activation of one alarm. The alarm shall be clearly audible in all bedrooms over background noise levels with all intervening doors closed.

Exceptions:

1. Interconnection is not required in buildings that are not undergoing alterations, repairs or construction of any kind.
2. Smoke alarms in existing areas are not required to be interconnected where alterations or repairs do not result in the removal of interior wall or ceiling finishes exposing the structure, unless there is an attic, crawl space or basement available that could provide access for interconnection without the removal of interior finishes.

1103.8.3 Power Source

Single-station smoke alarms shall receive their primary power from the building wiring provided that such wiring is served from a commercial source and shall be equipped with a battery backup. Smoke alarms with integral strobes that are not equipped with battery backup shall be connected to an emergency electrical system. Smoke alarms shall emit a signal when the batteries are low. Wiring shall be permanent and without a disconnecting switch other than as required for overcurrent protection.

Exceptions:

1. Smoke alarms are permitted to be solely battery-operated in existing buildings where construction is not taking place.
2. Smoke alarms are permitted to be solely battery-operated in buildings that are not served from a commercial power source.
3. Smoke alarms are permitted to be solely battery operated in existing areas of buildings undergoing alterations or repairs that do not result in the removal of interior walls or ceiling finishes exposing the structure unless there is an attic, crawl space or basement available that could provide access for building wiring without the removal of interior finishes.

1103.9 Carbon Monoxide Detection

Carbon monoxide detection shall be installed in existing buildings where any of the conditions identified in Section 915.1.1 exist. Carbon monoxide alarms shall be installed in the locations specified in Section 915.2 and the installation shall be in accordance with Section 915.4.

Exceptions:

1. Carbon monoxide alarms are permitted to be solely battery operated where the code that was in effect at the time of construction did not require carbon monoxide detectors to be provided.
2. Carbon monoxide alarms are permitted to be solely battery-operated in dwelling units that are not served from a commercial power source.
3. A carbon monoxide detection system in accordance with Section 915.5 shall be an acceptable alternative to carbon monoxide alarms.

1104.1 General

Means of egress in existing buildings shall comply with the minimum egress requirements where specified in Table 1103.1as further enumerated in Sections 1104.2 through 1104.25, and the building code that applied at the time of construction. Where the provisions of this chapter conflict with the building code that applied at the time of construction, the most restrictive provision shall apply. Existing buildings that were not required to comply with a building code at the time of construction shall comply with the minimum egress requirements where specified in Table 1103.1 as further enumerated in Sections 1104.2 through 1104.25.

1104.2 Elevators, Escalators and Moving Walks

Elevators, escalators and moving walks shall not be used as a component of a required means of egress .

Exceptions:

1. Elevators used as an accessible means of egress where allowed by Section 1009.4.
2. Previously approved elevators, escalators and moving walks in existing buildings.

1104.3 Exit Sign Illumination

Exit signs shall be internally or externally illuminated. The face of an exit sign illuminated from an external source shall have an intensity of not less than 5 footcandles (54 lux). Internally illuminated signs shall provide equivalent luminance and be listed for the purpose.

Exception: Approved self-luminous signs that provide evenly illuminated letters shall have a minimum luminance of 0.06 foot-lamberts (0.21 cd/m^2).

1104.4 Power Source

Where emergency illumination is required in Section 1104.5, exit signs shall be visible under emergency illumination conditions.

Exception: Approved signs that provide continuous illumination independent of external power sources are not required to be connected to an emergency electrical system.

1104.5 Illumination Emergency Power

Where means of egress illumination is provided, the power supply for means of egress illumination shall normally be provided by the premises' electrical supply. In the event of power supply failure, illumination shall be automatically provided from an emergency system for the following occupancies where such occupancies require two or more means of egress:

1. Group A having 50 or more occupants.

   Exception: Assembly occupancies used exclusively as a place of worship and having an occupant load of less than 300.
2. Group B buildings three or more stories in height, buildings with 100 or more occupants above or below a level of exit discharge serving the occupants or buildings with 1,000 or more total occupants.
3. Group E in interior exit access and exit stairways and ramps, corridors, windowless areas with student occupancy, shops and laboratories.
4. Group F having more than 100 occupants.

   Exception: Buildings used only during daylight hours and that are provided with windows for natural light in accordance with the International Building Code.
5. Group I.
6. Group M.

   Exception: Buildings less than 3,000 square feet in gross sales area on one story only, excluding mezzanines.
7. Groups R-1 and R-2.

   Exception: Where each dwelling unit or sleeping unit has direct access to the outside of the building at grade.

1104.5.1 Emergency Power Duration and Installation

Emergency power for means of egress illumination shall be provided in accordance with Section 1203. In other than Group I-2, emergency power shall be provided for not less than 60 minutes for systems requiring emergency power.

Appendix B – 1975 BOCA Reference

1975 Building Officials and Code Administrators

Section 431.0 HIGH RISE BUILDINGS

431.1 Applicability: The provisions of this section shall apply to all buildings of the following use groups when such buildings are more than six (6) stories or seventy-five (75) feet in height:

1. use group B (business),
2. use group R-1 (residential, hotel), and
3. use group R-2 (residential, multi-family)

431.2 Compartmentation option: Buildings designed in accordance with the early fire control option as set forth in Section 431.3 are not subject to the provisions of this section. Buildings more than twelve (12) stories or one hundred fifty (150) feet in height shall be designed in accordance with this code and the mechanical code listed in Appendix B.

431.2.1 Areas of refuge: Compartmentation shall be provided in every building to provide areas of refuge for the building occupants. This shall be provided by one (1) of the following methods described below.

1. Installation of a fire separation wall with horizontal exits therein, dividing each story into two (2) or more areas of approximately the same size but not exceeding thirty thousand (30,000) square feet per area; or
2. Sub-dividing the building into five (5) story compartments by interrupting the interior exitway stairways with smoke barriers every fifth floor, or by providing smokeproof enclosures for all exitway stairways, or by any approved method which will protect against the movement of smoke from one compartment to another.

Horizontal exit walls used for compartmenting a building shall not have openings which would permit transfer of smoke from one compartment to the other, except for required exits.

431.2.2 Exterior wall openings: Openings located vertically above one another shall be separated by a one (1) hour fireresistance rated non-combustible spandrel or flame barrier. The minimum height of spandrels shall be three (3) feet. The flame barriers (eyebrows) shall extend thirty (30) inches beyond the exterior wall in the plane of the floor.

431.2.3 Fire-smoke detectors: An approved, automatic products-of- combustion (other than heat) detection system shall be installed in the following locations described below.

1. Boiler rooms and furnace rooms.

2. Return air ducts and plenums of heating, ventilating and air conditioning systems serving floors other than the floor on which the HVAC equipment is located. The detectors shall be located at each opening into the vertical return air duct or shaft.
3. Elevator lobby areas (see Section 1613.4).

The detection system shall be designed to activate the voice alarm system on a selective basis dependent upon the compartmentation design. The indicator panels shall be located in the central control station.

431.2.4 Fire alarm: An approved fire alarm system shall be installed as required by Section 1216.0 and shall be designed to activate the voice alarm system only, on a selective basis dependent upon the compartmentation design. The zoning indicator panels and controls shall be located in the central control station.

431.2.5 Voice alarm system: Both the fire detection system and the fire alarm system shall automatically activate a voice alarm system only, on a predetermined selective basis dependent upon the compartmentation design.
The central control station shall contain controls for the voice alarm system so that a selective or general voice alarm may be manually initiated.
Upon activation of the voice alarm system a pre-recorded message shall be automatically transmitted via one (1) of the voice communication systems.

431.2.6 Voice communication system: There shall be two (2) approved, electrically supervised communication systems as described below.

1. A two (2) way fire department communication system. The system shall provide two (2) way communication capabilities between the central control station and the following terminal areas: elevators, elevator lobbies, exitway access corridors and exitway stairways.
2. A one (1) way (address) communication system for transmission of the voice alarm system message to the building occupants. The system shall provide one (1) way communication capabilities between the central control station and throughout the following terminal areas: elevators, elevator lobbies, exitway access corridors and exitway stairways; office areas exceeding on thousand (1,000) square feet in area; dwelling units; and hotel guest rooms or suites.

The two (2) way fire department communication system may be combined with the one (1) way (address) communication system.

431.2.7 Smoke control: Natural or mechanical ventilation for the removal of products-of-combustion shall be provided in every story and shall consist of one (1) or more of the following.

1. Panels or windows, in the exterior wall, which can be opened from an approved location other than the fire floor. Such venting facilities shall be provided at the rate of twenty (20) square feet per fifty (50) lineal feet of exterior wall in each story, and distributed around the perimeter at not more than fifty (50) foot intervals. Such panels shall be clearly identified as department.
2. Approved tempered glass may be used in lieu of the openable panels described above.
3. A continuous shaft through which smoke and heat can be mechanically vented to the outdoors. The size of the shaft shall be uniform throughout and of such dimensions as to provide one (1) air change per minute in the largest compartment served anywhere in the building. Openings into the shaft shall be protected with an automatic single piece shutter located as one thousand (1,000) square high in the room as and designed to vent the entire compartment.
4. Any other approved design (see Section 108.5) which will produce equivalent results.

431.2.8 Elevators: At least one (1) elevator shall be provided for fire department emergency access to all floors. The elevator shall be located in a smokeproof enclosure; or shall open into a lobby (which may serve additional elevators), separated from the remainder of the building by one (1) hour fireresistance rated construction. Elevator operation shall be in accordance with Appendix E of the Safety Code for Elevators listed in Appendix B, said elevator cab shall be of such size as to accommodate an ambulance cot in its horizontal open position.

431.3 Early fire control option: Buildings designed in accordance with the compartmentation option as set forth in Section 431.2 and 431.3 not subject to the provisions of this section, except buildings more than twelve (12) stories or one hundred fifty (150) feet in height, shall be designed in accordance with this code and the mechanical code listed in Appendix B.

431.3.1 Fire suppression system: An approved fire suppression system shall be provided throughout every building. The system shall be hydraulically designed using the parameters set forth in the applicable standards listed in Appendix I and the following.

1. Valves and waterflow devices: Shut-off valves and water flow devices shall be provided at the riser connection on each floor. In addition to actuating a voice alarm on the floor where water flow is detected, the valves and waterflow devices shall be supervised by a continuously manned central control station or by a central station.
2. Standpipes: Each floor shall be supplied by two (2) or more combination (suppression system and standpipe) risers. In seismic zones 2 and 3, at each point of connection of the

suppression system to a riser, an approved check valve or anti-backflow device shall be installed so that one (1) riser can remain operational if a break occurs in the other riser.

3. Secondary water supply: In seismic zones 2 and 3 an on-site supply of water equal to a twenty (20) minute demand, or fifteen thousand (15,000) gallons on a combined suppression-standpipe system (whichever is smaller) shall be provided. This supply shall be automatically available if the principal supply fails. At least two (2) independently driven five hundred (500) gpm fire pumps shall be provided.
4. Piping may be copper or steel without minimum size of pipe re-quired. Solder connections may be used if composed of ninety-five (95) per cent tin and five (5) per cent antimony.

431.3.2 Voice alarm system: All fire detection devices and suppression system waterflow devices shall automatically activate a voice alarm system only, on a predetermined selective basis dependent upon the locations of the detectors and waterflow devices. The central control station shall contain controls for the voice alarm system so that a selective or general voice alarm may be manually initiated. Upon activation of the voice alarm system a pre-recorded message shall be automatically transmitted via one (1) of the voice communication systems.

431.3.3 Voice communication system: There shall be two (2) approved, electrically supervised communication systems as described below.

1. A two (2) way fire department communication system. The system shall provide two (2) way communication capabilities between the central control station and the following terminal areas: elevators, elevator lobbies, exitway access corridors and exitway stairways.
2. A one (1) way (address) communication system for transmission of the voice alarm system message to the building occupants. The system shall provide one (1) way communication capabilities between the central control station and throughout the following terminal areas: elevators, elevator lobbies, exitway access corridors and exitway stairways; office areas exceeding one thousand (1.00) square feet in area; dwelling units; and hotel guest rooms or suites.

The two (2) way fire department communication system may be combined with the one (1) way (address) communication system.

431.3.4 Smoke control: Natural or mechanical ventilation for the removal of products-of-combustion shall be provided in every story by one (1) or more of the following methods.

1. Mechanical air handling equipment designed to direct return and exhaust air directly to the outdoors under fire conditions.

2. Panels or windows, in the exterior wall, which can be opened from an approved location other than the fire floor. Such venting facilities shall be provided at the rate of twenty (20) square feet per fifty (50) lineal feet of exterior wall in each story, and distributed around the perimeter at not more than fifty (50) foot intervals. Such panels shall be clearly identified as required by the fire department.
3. Approved tempered glass may be used in lieu of the openable panels described above.
4. A continuous shaft through which smoke and heat can be mechanically vented to the outdoors. The size of the shaft shall be uniform throughout and of such dimensions as to provide one (1) air change per minute in the largest compartment served anywhere in the building. Openings into the shaft shall be protected with an automatic single piece shutter located as high in the room as possible and designed to vent the entire compartment.
5. Any other approved design (see Section 108.5) which will produce equivalent results.

431.3.5 Elevators: At least one (1) elevator shall be provided for fire department emergency access to all floors. Elevator operation shall be in accordance with Appendix E of the Safety Code for Elevators listed in Appendix B; said elevator cab shall be or such size as to accommodate an ambulance cot in its horizontal open position.

431.3.6 Modifications: When a fire suppression system is installed, modifications to this code are permitted as described below.

1. The type of construction required by this code may be modified as follows:

Type of construction set forth in Table 214	Modified type of construction permitted hereunder
1A	1B
1B	2A
2A	2B

2. The fireresistance rating of exitway access hallways and vertical separation of tenant spaces may be reduced by:
    a. one (1) hour in use group B (business) buildings;
    b. one-half (1/2) hour in use group R-1 (residential, hotel) and R-2 (residential, multi-family) buildings; and
    c. the wall or partitions may be terminated at the lowest portion of the fireresistance rated floor-ceiling assembly above.
3. The fireresistance rating of shafts, other than exitway stairways and hoistway enclosure shafts, may be reduced by one (1) hour in use group R-1 (residential, hotel) and R-2 (residential, multi-family) buildings.

4. The exitway access and common hallway doors need not meet the requirements of Section 610.4 except they shall be self-closing.
5. The one and one-half (1-1/2) inch hose line, nozzle, rack and cabinet may be omitted as set forth in Section 1211.5.1.
6. The exitway access travel distance set forth in Table 607 may be increased to three hundred (300) feet.
7. Smokeproof enclosures as set forth in Section 618.0 may be omitted, but required stairways shall be pressurized to fifteen-hundredths (0.15) inches of water column in the manner described in Section 618.9.3.
8. Fire dampers as set forth in Section 1808.0 and the standards listed in Appendix B may be omitted except where ducts penetrate fire-walls, horizontal exits and vertical shaft walls.
9. Automatic fire alarm systems as set forth in Section 1216.0 may be omitted, but a manual fire alarm system conforming to Section 1217.0 is required.

431.4 Central control station: A central control station for fire department operations shall be provided in a location approved by the fire department. It shall contain the following listed facilities when they are required by this section:

1. voice alarm system apparatus,
2. voice communication system panel and apparatus,
3. fire detection system panel,
4. fire alarm system panel,
5. status indicator and controls for elevators,
6. status indicator and controls for air handling systems,
7. sprinkler valve and waterflow detector indicators,
8. fire department telephone,
9. standby power controls,
10. public telephone, and
11. exitway stairway door unlocking system.

431.5 Standby power and light

431.5.1 Standby power system: A permanently installed standby power generation system conforming to the requirements of Article 15 of this code shall be provided. The system shall be equipped with approved means for automatically starting the generator, set upon failure of the normal electrical service and for automatic transfer and operation of all functions, required by this section, at full power within sixty (60) seconds of such normal service failure. System supervision devices with manual start and transfer features, shall be provided at the central control station.

431.5.2 Power requirements: The power requirement shall be determined so as to provide service to the following listed facilities when they are required by this section:

1. voice alarm system,
2. voice communicating system,
3. fire department elevator,
4. mechanical air handling system,
5. fire alarm system,
6. fire detection system,
7. fire protection equipment and devices,
8. exitway and other emergency lighting, and
9. exitway stairway door unlocking system.

431.5.3 Fuel supply: An on-premise fuel supply adequate for two (2) hours full demand operation of the system shall be provided.

431.6 Exitway stairways

431.6.1 Doors: All exitway stairway doors which are to be locked from the stairway side shall have approved locksets with the capability of being unlocked remotely upon a manual signal from the central control station.

431.6.2 Emergency telephones: Emergency telephones shall be provided at not less than every fifth floor in each required exitway stairway.

431.7 Seismic considerations: In seismic zones 2 and 3 the anchorage of the following mechanical and electrical equipment required by this section shall be designed in accordance with Appendix K-11 for a lateral force based on a "Cp" value of zero-point-five (0.5) unless data substantiating a lesser value is furnished:

1. elevator drive and suspension systems,
2. standby power and lighting facilities, and
3. fire pumps and other fire protection equipment.

Appendix C – 1976 UBC Reference

1976 Uniform Building Code

Special Provisions for Group B, Division 2 Office Buildings and Group R, Division 1 Occupancies

Sec. 1807.

(a) Scope. These requirements apply to buildings housing Group B, Division 2 Occupancies used primarily as offices and to Group R, Division I Occupancies.

Such buildings having floors used for human occupancy located more than 75 feet above the lowest level of Fire Department vehicle access shall conform to the requirements of this Section in addition to other applicable requirements of this Code.

(b) Compartmentation. Compartmentation shall be provided in every building to provide areas of refuge for the building occupants. This may be provided by either of the following:

1. Horizontal exits dividing a story into two or more areas of approximately the same size not exceeding 30,000 square feet; or

2. Subdividing the building into five-story compartments by interrupting the stair shaft with smoke barriers every fifth floor or through the use of smokeproof enclosures for all stairways or any other method which will protect against the movement of smoke from one compartment to another.

Openings in exterior walls, located vertically above one another, shall be protected by approved flame barriers extending 30 inches beyond the exterior wall in the plane of the floor or by vertical panels not less than 3 feet in height.

Horizontal exit walls used for compartmenting a building shall not have openings therein which would permit transfer of smoke from one compartment to the other except for required exits. For sprinkler alternate see Section 1807 (m).

(c) Fire Alarm. A manual fire alarm box shall be located adjacent to exit doors into stairway shafts and in every elevator lobby. The box shall be connected to the Central Control Station and to the voice communication system as required by Section 1807 (f) and (g). The system shall be designed in accordance with U.B.C. Standard No. 18-1.

(d) Fire Detectors. An approved system which will provide for automatic detection of products of combustion other than heat shall be installed in every mechanical equipment room and in the return air portion of every air conditioning and mechanical ventilation system that serves floors other than the floor on which the equipment is located. The detectors shall be set to operate within the limitations of U.B.C. Standard No. 43-6 and shall be located at each opening into the vertical shaft.

(e) Voice Alarm System. Both the detection system and the fire alarm system shall activate a voice alarm system capable of being operated from the Central Control Station on a general as well as a selective basis dependent upon the compartmentation involved. The alarm shall be designed to be heard by all occupants within the building or designated portions thereof as specified for the voice communication system. The elevator lobby detector required by Chapter 51 shall be connected to the system.

(f) Voice Communication System. There shall be two separate approved continuously electrically supervised voice communication systems; one for Fire Department communication system and the other a public voice communication (address) system between the central control station and the following areas:

1. Elevators, elevator lobbies, corridors and stairways.
2. Every office area exceeding 1000 square feet in area.
3. Each dwelling unit and hotel guest room.

When approved, the Fire Department system may be combined with the public voice communication system and voice alarm system.

(g) Central Control Station. A central control station for Fire Department operations shall be provided in a location approved by the Fire Department. It shall contain the voice communication systems panel; fire detection and alarm system panels; status indicators and controls for elevators and air handling systems; controls for unlocking stairway doors; a public telephone; sprinkler valve and water flow detectors; and standby power controls.

(h) Smoke Control. Natural or mechanical ventilation for the removal of the products of combustion shall be provided in every story and shall consist of one or more of the following:

1. Panels or windows in the exterior wall which can be opened from an approved location other than the fire floor. Such venting facilities shall be provided at the rate of at least 20 square feet per 50 lineal feet of exterior wall in each story, and distributed

around the perimeter at not more than 50-foot intervals. Such panels shall be clearly identified as required by the Fire Department.

2. Approved tempered glass may be used in lieu of openable panels.
3. When fire sprinklers are installed in compliance with Section 1807 (m), the mechanical air handling equipment may be designed to assist smoke removal. Under fire conditions, the return and exhaust air shall be taken directly to the outside without recirculation to other sections of the building.
4. A shaft through which smoke and heat can be mechanically vented to the outdoors. The size of the shaft shall be uniform throughout and of such dimensions as to provide not less than 60 air changes per hour in the largest compartment served anywhere in the building. Openings into the shaft shall be protected with an automatic single piece shutter located as high in the room as possible and designed to vent the entire compartment.
5. Any other design which will produce equivalent results.

(i) Elevators. There shall be provided at least one elevator in each bank available for Fire Department access to any floor. The elevator shall open into a lobby, which may serve other elevators, and shall be separated from the remainder of the building by construction as required for corridors. The elevator may be located within a smokeproof enclosure. See Chapter 51 for additional requirements.

(j) Standby Power and Light. An approved permanently installed standby power generating system shall be provided. The system shall be equipped with suitable means for automatically starting the generator set upon failure of the normal electrical service and for automatic transfer and operation of all the required electrical functions at full power within 60 seconds of such normal service failure. System supervision with manual start and transfer features, shall be provided at the Central Control Station.

An on-premise fuel supply sufficient for not less than two hours full demand operation of the system shall be provided. All power, lighting, signal, and communication facilities provided under the requirements of this Section shall be transferable to the standby power system.

The power requirement shall be determined so as to provide service to, but not limited to the following:

1. Fire alarm system.
2. Exit and other emergency lighting.
3. Fire protection equipment.

4. Mechanical ventilation required by this Section.
5. Fire Department elevator.
6. Voice communication system.

(k) Seismic Considerations. In Seismic Zones No. 2, No. 3 and No. 4 the anchorage of the following mechanical and electrical equipment required by the Section shall be designed in accordance with Section 2312 and Table No. 23-J, Item 4-d:

4. Elevator drive and suspension systems.
5. Standby power and lighting facilities.
6. Fire pumps and other fire protection equipment.

(l) Exits. All stairway doors which are to be locked from the stairway side shall have the capability of being unlocked without unlatching upon a signal from the Central Control Station.

Emergency telephones available to the public shall be provided at not less than every fifth floor in each required stairway.

(m) Fire Sprinkler Alternative. Sprinkler protection conforming to the following may be provided as an alternate to compartmentation:

1. The sprinkler system is hydraulically designed using the parameters set forth in U.B.C. Standard No. 38-1 and the following:
   (i) Shutoff valves and waterflow devices shall be provided on each floor. In addition to actuating a local alarm on the floor upon which the water flow is detected, such valves shall be supervised by a continuously staffed control station or by a central station.
   (ii) The sprinkler system shall be looped between standpipe risers at the bottom, top and mid-height of all buildings with a maximum of 20 stories served by any loop. The installation of check valves shall be approved by the Building Official.
   (iii) Piping may be copper or steel with no minimum size of pipe required. Solder used in connections shall contain not less than 95 per-cent tin and 5 percent antimony.
   (iv) Pitching of lines is not required.
   (v) A minimum of two fire pumps independently driven shall be provided and sized for the sprinkler demand and for a minimum 500 gallons per minute Fire Department standpipe operations.

(vi) An on-site supply of water equal to a 20-minute demand or 15,000 gallons on a combined sprinkler and standpipe, whichever is the smaller, shall be provided. This supply shall be available automatically if the principal supply fails.

(vii) Operation of the sprinkler system shall activate the voice communication system.

2. When the automatic sprinkler system described above is installed, the following reductions from the requirements of this Code are permitted:

(i) The fire-resistive time periods set forth in Table No. 17-A may be reduced by one hour for interior bearing walls, exterior bearing and nonbearing walls, roofs and the beams supporting roofs, provided they do not frame into columns. All office building partitions required to be of one-hour fire-resistive construction by Table No. 17-A and Section 3304 (g) may be of noncombustible construction without a fire-resistive time period. Openings in corridor walls shall be protected by tight-fitting, self-closing doors that need not have a fire-resistive time period. In Group R, Division I Occupancies, corridor and dwelling unit or guest room separation may be reduced to one-half hour.

(ii) The 1 ½ -inch hose lines and nozzles may be omitted.

(iii) Travel distance to a horizontal exit or to an enclosed stairway may be 300 feet.

(iv) Smokeproof enclosures may be eliminated if each required stairway is pressurized as provided in Section 3309 (h) to .15 inch of water column.

(v) Spandrel protection required by Section 1807 (b) may be omitted.

Appendix D – Opinion of Probable Cost

* Costs shown are for sprinkler retrofit and fire alarm panel replacement to accommodate the new sprinkler system. Additional costs associated with additional retroactive high-rise system upgrades are not shown. Opinion of cost for sprinkler addition to case study example is to illustrate the associated geographic cost range and allowance for open shops and union shops.

The following items were included for the cost opinion:

Sprinkler System:

- CPVC in sizes 3", 2", 1.5", 1" for Floors 1-12
- Schedule 40 black steel piping in sizes 3", 2", 1.5", 1" for Basement
- New zone control valve assemblies
- Express riser for zone valve assemblies
- Taps to existing riser
- Soffit system for exposed piping (estimated)
- Paint and patching for drywall repair (estimated)
- Phased installation per floor (estimated)
- K5.6 sprinklers as a consistent placeholder for cost

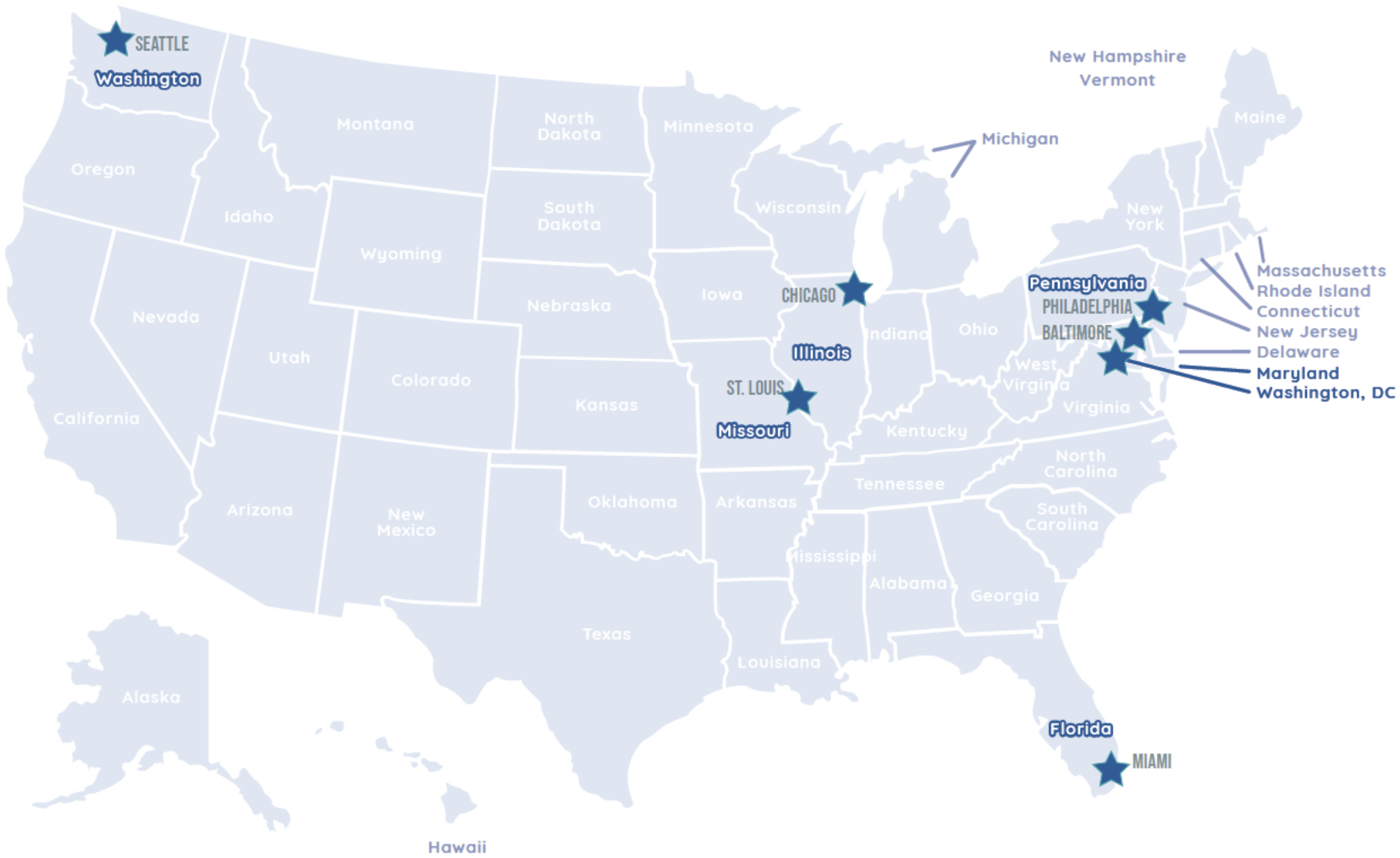
Fire Alarm System:

- New fire alarm panel (replacement)
- Conduit and wiring to new zone valve assemblies tamper/flow switches

Variables:

- Phased construction may vary cost on specific projects based on availability of units and number of active crews to complete work within a normal daytime shift.
- Asbestos abatement may vary on specific projects.
- Existing infrastructure and layout may vary on specific projects.

OPINION OF PROBABLE COST



SEATTLE
RANGE
$1,074,025 - $1,553,572

ST. LOUIS
RANGE
$956,188 - $1,382,136

CHICAGO
RANGE
$1,147,9765 - $1,693,572

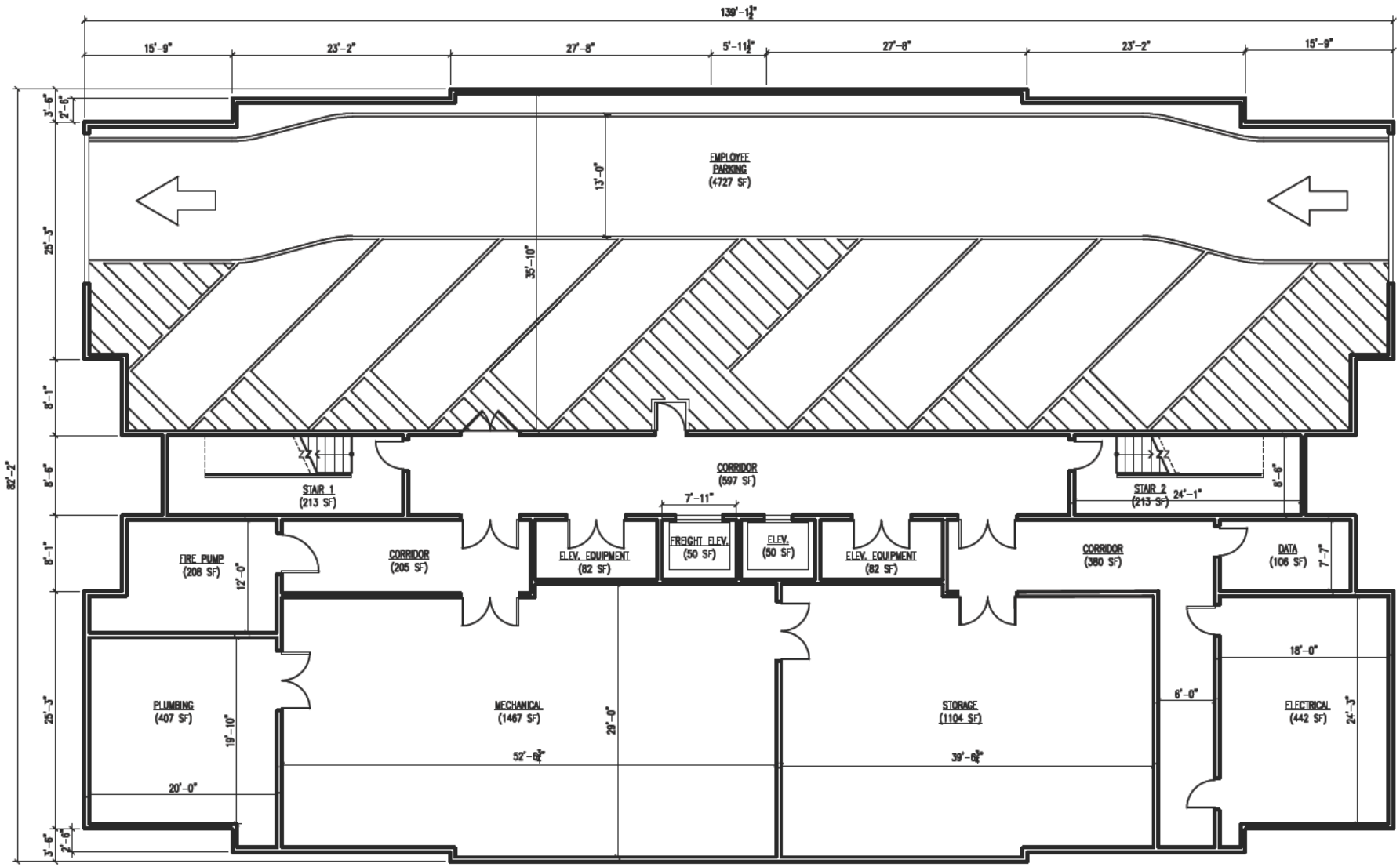
BALTIMORE
RANGE
$853,550 - $1,216,863

PHILADELPHIA
RANGE
$1,155,410 - $1,703,142

WASH. DC.
RANGE
$889,750 - $1,216,863

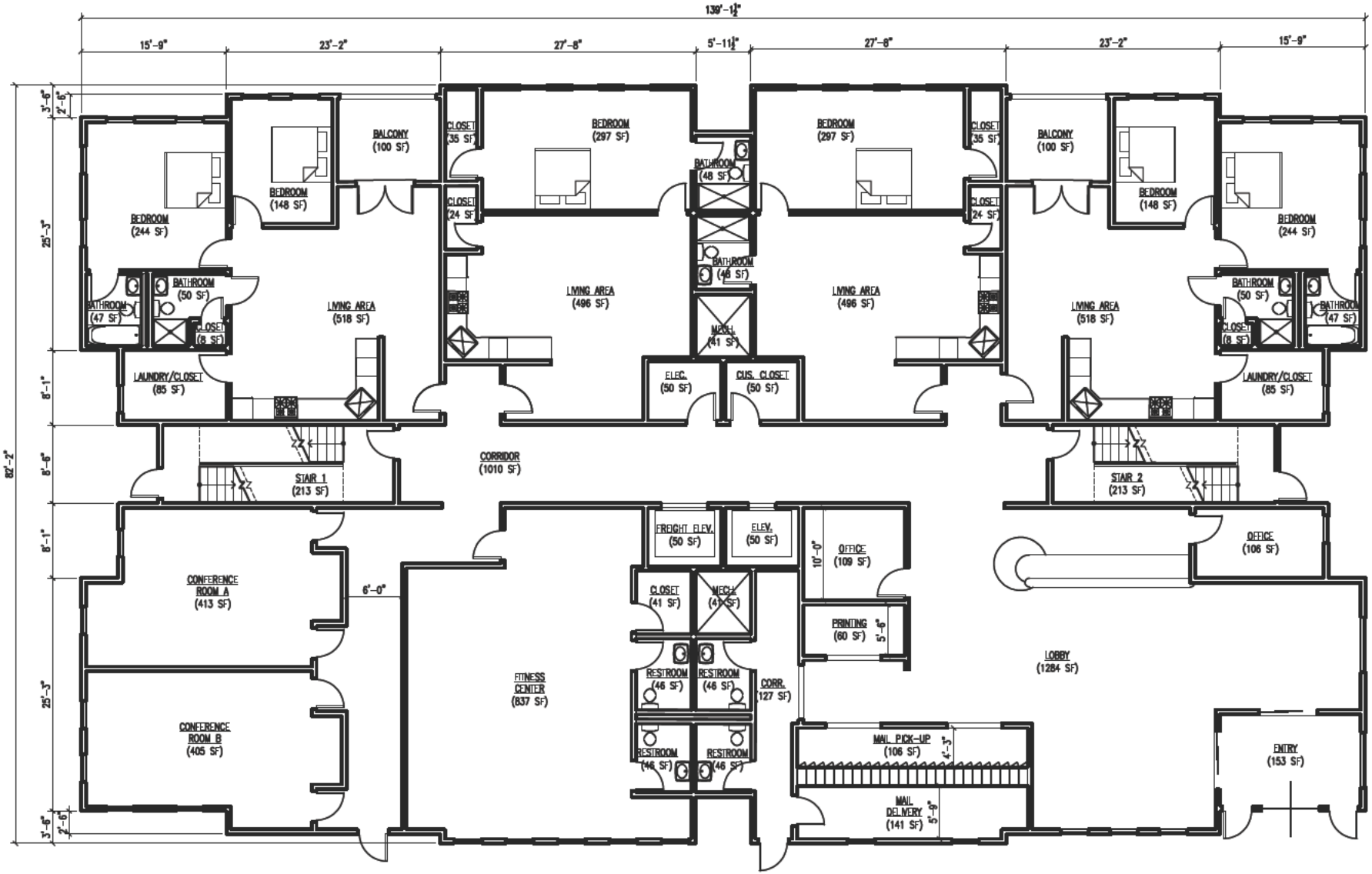
MIAMI
RANGE
$721,876 - $1,007,762

Appendix E – Case Study Example Floorplans



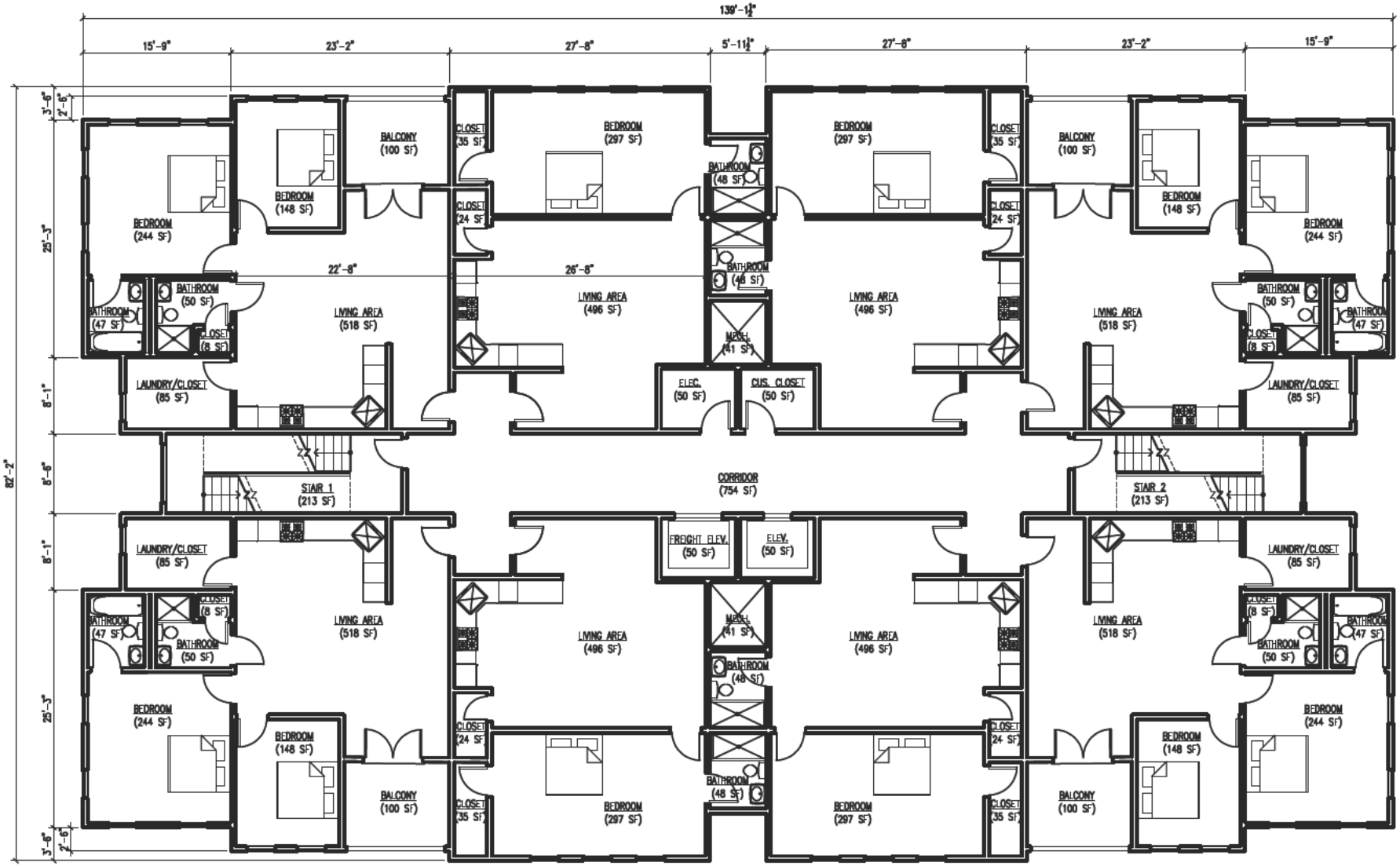
BASEMENT

SCALE: $\frac{1}{16}$"=1'



LEVEL 1

SCALE: $\frac{1}{16}$"=1'



LEVELS 2-12

SCALE: $\frac{1}{16}$"=1'

TRANSMITTAL

Date:	**May 8, 2023**
USC Job #:	**5461.001**
Client Job #:	
Shipping Method:	**E-Mail**
To:	**The Willoughby** **4515 Willard Avenue** **Chevy Chase** **Maryland 20815**
Attention:	**Meny Mulugeta**
Project Name:	**Fire Protection Upgrade Project**
Location:	**Chevy Chase MD**
Design Submission:	**Rough Order of Magnitude**
Copies (Bound):	**N/A**
Copies (Unbound):	**N/A**
Electronic Copy:	**1**
Revision No:	
Copies Sent To:	**File**
Comments:	

Signed: *K H Kwong*

Albert Kwong

Rough Order of Magnitude Cost Estimate

Owner:

The Willoughby

Fire Protection Upgrade Project

Chevy Chase MD

Prepared For:

The Willoughby
4515 Willard Avenue
Chevy Chase
Maryland 20815

Prepared By:

May 8, 2023

TABLE OF CONTENTS

I Executive Summary

II Basis of Estimate

III Total Cost Summary Report

IV Direct Cost Detail Report

I. Executive Summary

I. Executive Summary

was tasked with providing a Rough Order of Magnitude cost estimate, utilizing the Concept Study Report as a guide that was prepared by the Applied Fire Protection Engineering for the Willoughby

The purpose of this work is to upgrade Fire Protection System at Willoughby. The scope of woks includes upgrading fire suppression and fire alarm systems, replacing exhaust fans, interface between fire alarm and building energy management system, and asbestos containing material abatement.

It is anticipated that this work will be performed during normal work hours. This estimate also includes productivity factors considerations for workers travel through elevators to tower floors. This estimate does not include any considerations of overtime and weekend works.

The estimate assumes the project will be constructed and managed by a Prime Contractor utilizing subcontractors.

Executive Cost Summary

	Executive Cost Summary (continued)			
			Concept 1	**Concept 2**
	Project start date 3/1/2024	**Start date**	**Project Cost**	**Project Cost**
	Fire alarm system	3/1/2024	$10,170,518	$8,547,709
	Fire Suppression System	3/1/2025	$17,023,551	$16,557,987
	Fire alarm system + Fire Suppression System	3/1/2024	$23,041,833	$20,172,061
	Project start date 3/1/2026	**Start date**	**Project Cost**	**Project Cost**
	Fire alarm system	3/1/2026	$10,947,420	$9,200,648
	Fire Suppression System	3/1/2027	$17,605,840	$17,124,352
	Fire alarm system + Fire Suppression System	3/1/2026	$24,801,944	$21,712,956
	Project start date 3/1/2028	**Start date**	**Project Cost**	**Project Cost**
	Fire alarm system	3/1/2028	$11,321,804	$9,515,296
	Fire Suppression System	3/1/2029	$18,875,764	$18,359,546
	Fire alarm system + Fire Suppression System	3/1/2028	$25,650,131	$22,455,505

II. Basis of Estimate

II. Basis of Estimate

PROJECT INFORMATION

Client	**The Willoughby**
Estimator	**xxx**
Owner	**The Willoughby**
Project Name	**Fire Protection Upgrade Project**
Project Location	**Chevy Chase MD**
Date of Estimate Report	**May 8, 2023**
Project Number	**5461.001**
Estimate Submission	**Rough Order of Magnitude**
Project Type	**Fire Protection System Upgrade**
Building Utilization	**Condominium**

ESTIMATING TEAM

Estimating Team Lead/Project Manager
Architectural Estimator
Structural Estimator
Civil Estimator
Mechanical Estimator
Electrical Estimator

COST BASIS

The Basis of the Rough Order of Magnitude Estimate was established as follows:

A quantity survey was performed as detailed as possible relative to the levels of design and documentation available. Where quantities are not available, assumptions and or allowances for cost or scope have been made based on the historical information from similar type or other projects recently estimated by xxx.

The basis of the pricing used reflects the probable construction costs which can be obtained in the Montgomrty County, MD area for the project as understood by the estimators. This estimate assumes an competitive bid procurement method, and is an opinion of probable costs based on fair market value, and is not a prediction of the anticipated low bid. xxxxx has no control over the cost of labor and materials, the prime contractor's or any subcontractor's method of determining price or competitive bidding and market conditions. This opinion of probable costs of construction is made on the basis of the experience, qualifications and best judgment of the Cost Estimator. xxxx cannot and does not guarantee that proposals, bid or actual construction costs will not vary from this or subsequent estimates xxxhas prepared this estimate in accordance with generally accepted cost estimating and practices and standards.

II. Basis of Estimate

Processing Software	**Success**
Work Breakdown Structure (WBS)	**Uniformat II**
Basis of Pricing	**RS Means / USC Historical Data; Estimator Judgment**
Method of Measurement	**Imperial (US Standard)**
Currency	**United States Dollar**
General Conditions/Onsite Field Personnel	**See Summary**
Prime Contractor Home Office Overhead	**0.00%** included in above
Bonds & Insurance	**2.00%**
Prime Contractor's Risk/Profit	**6.50%**
Prime Contractor's QA/QC	Included in above
Sub-Contractor Markups	**20.00%**
Anticipated Project Award	**Please see details**
Estimated Start of Construction	**Please see details**
Estimated Construction Duration	**Please see details**
Estimated Midpoint	**Please see details**
Escalation Rate	**Please see details**
Sales Tax	**6.00%**
Basis for Labor Rates	**Davis Bacon MD 20230044**

Labor Burdens - Included with Labor Rates

PT&I	Fringe	WCI
15.87%	Varies by Trade	7.06 % to 33.35%

Project start date 3/1/2024	Start date	Duration
Fire alarm system	3/1/2024	730 (2 years)
Fire Suppression System	3/1/2025	730 (2 years)
Fire alarm system + Fire Suppression System	3/1/2024	730 (2 years)

Project start date 3/1/2026	Start date	Duration
Fire alarm system	3/1/2026	730 (2 years)
Fire Suppression System	3/1/2027	730 (2 years)
Fire alarm system + Fire Suppression System	3/1/2026	730 (2 years)

Project start date 3/1/2028	Start date	Duration
Fire alarm system	3/1/2028	730 (2 years)
Fire Suppression System	3/1/2029	730 (2 years)
Fire alarm system + Fire Suppression System	3/1/2028	730 (2 years)

II. Basis of Estimate

Contracting Methodology	**Competitive Bid**
Drawings Used to Prepare Estimate	**Project Info received 4/20/2023**
Design Analysis Used to Prepare Estimate	**Project Info received 4/17/2023**

Market Conditions Survey

An assessment of local market conditions affecting the cost of construction was performed as part of the estimating process for this submission. This included a review of labor, material, equipment and an attempt to quantify risk factors that may affect project costs and delivery at the time of bid. For this project the local prevailing labor rates were used, as well as an appraisal of overall labor availability. The large dollar value material and equipment items were verified with local suppliers for price and availability with adjustments made to the estimate as necessary. The general competitiveness of bids on public sector projects and contractor backlog in this local market, as well as the impact of weather events on supply and delivery were investigated. All the above constitute adjustments that were made to the estimate in order to capture the impact of the local market on the overall cost of construction for this project.

Additional Markups

The project includes 20% Design / Estimate Contingency. This markup has been included on as a direct cost markup on every line item in the cost estimate. This should be considered a Project Cost that is to be re-evaluated with each subsequent design submittal. Typically, estimates prepared at the this Level of design will include 10%-15% Contingency to cover minor design changes, unknown project requirements and unknown existing conditions, estimating omissions and other unknowns.

As the project moves through the design process and more information is available, the amount of contingency should be reevaluated and typically reduced. In most cases, the estimated cost of the project rises with each design submittal and the contingency applied is reduced, keeping the total project cost within budget.

Allowances

None

II. Basis of Estimate

Assumptions

HVAC System

1. Replace garage exhaust fans. (quantity assumed to be seven)
2. Replace stairwell and elevator shaft pressurization fans. (quantity assumed to be seven)
3. New fan controls and tied-into existing
4. Included an allowance for interface between fire alarm control and existing building energy management system.

Fire Sprinkler System

1. Dry Sprinkler system in the garage will be replaced
2. Wet Sprinkler system in the back of house, public, administration / leasing office will be replaced.
3. Wet sprinkler system in mechanical rooms will be replaced
4. Provide wet sprinkler system at all tenant units. There are two concepts. Concept 1 is to have one single fire main run along the center of corridor. Concept 2 is to have two fire mains run along both side of the corridor.

5. In the tenant tower, fire piping size equal or less than 2" will be CPVC, fire piping size equal or larger than 2-1/2" will be black steel A53 schedule 10 grooved piping
6. In all other areas, fire piping size equal or less than 2" will be blacksteel A54 schedule 40 threaded,. fire piping size equal or larger than 2-1/2" will be black steel A53 schedule 10 grooved piping
7. Fire pumps and pump room piping will be replaced.

Electrical

1. Lighting fixtures in corridors will be replaced in concept 1. Raceways & wires are considered ETR. New light fixture with a fixture whip considered every 8LF. Occupancy sensors and control panels are considered at each floor.
2. Existing 200kW generator will be replaced with a new 350kW generator considered with the fire suppression system replacement.
3. New feeder and connection to the fire pump considered with the fire suppression system replacement.

Fire Alarm

1. Fire alarm in the garage will be replaced. Cables in galvanized rigid steel conduits.
2. Fire alarm in BOH, public & administration areas, mechnical & electrical rooms will be replaced. Fire alarm cables in EMT conduits
3. Fire alarm in tenant areas will be replaced . Wired alarms will replaced in existing location, wireless alarms and sounders in new locations. No raceways will be installed inside tenant space.
4. Fire alarm in corridors will be replaced. Surface metal raceway similar to wiremold is considered if the fire alarm system is replaced by itself prior to the fire sprinkler system. Fire alarm cables will be run with the fire sprinklers if the two systems are being replaced concurrently.

Architectural

Popcorn ceiling in the lobbies contain hazardous material and will be abated and replaced with new ceiling
For option 1 new drop ceiling will be added in the hallways and new soffit will be added in the units
For option 2 new soffits will be added in the units and hallways

II. Basis of Estimate

Exclusions

Furniture Relocation/Staff Relocation or Temp Swing Space
Staff Relocation Costs
Owner's Reserve
Construction Contingency
Temporary Utility Consumption Charges
Permits and Owners Testing
Design Fees
Change Order Contingency
FF&E
Police for traffic control

Market Conditions Adjustment Calculation

Schedule Reference: N/A
Estimate Date: May 8, 2023
Estimated Start of Construction: March 1, 2024
Estimated Construction Duration: 730 Days
Estimated Midpoint: March 1, 2025

Item	Adjustment Period			Duration	Unit	% per YEAR	% per MONTH	% Total/year	% Compounding Cumulative
1	May-23	to	Dec-23	8	MONTH	7.00%	**0.583%**	**4.608%**	**4.608%**
2	Jan-24	to	Dec-24	12	MONTH	6.00%	**0.500%**	**6.083%**	**10.972%**
3	Jan-25	to	Mar-25	2	MONTH	4.00%	**0.333%**	**0.656%**	**11.699%**

TOTAL MONTHS	22	MONTH
AVG. MONTHLY PERCENTAGE	0.472%	
CALCULATED TOTAL MARKET ADJUSTMENT	11.70%	

Market Conditions Adjustment Calculation

Schedule Reference: N/A
Estimate Date: May 8, 2023
Estimated Start of Construction: March 1, 2025
Estimated Construction Duration: 730 Days
Estimated Midpoint: March 1, 2026

Item	Adjustment Period			Duration	Unit	% per YEAR	% per MONTH	% Total/year	% Compounding Cumulative
1	May-23	to	Dec-23	8	MONTH	7.00%	**0.583%**	**4.608%**	**4.608%**
2	Jan-24	to	Dec-24	12	MONTH	6.00%	**0.500%**	**6.083%**	**10.972%**
3	Jan-25	to	Dec-25	12	MONTH	4.00%	**0.333%**	**4.044%**	**15.460%**
4	Jan-26	to	Mar-26	2	MONTH	3.50%	**0.292%**	**0.574%**	**16.123%**

TOTAL MONTHS	34	MONTH
AVG. MONTHLY PERCENTAGE	0.427%	
CALCULATED TOTAL MARKET ADJUSTMENT	16.12%	

Market Conditions Adjustment Calculation

Schedule Reference: N/A
Estimate Date: May 8, 2023
Estimated Start of Construction: March 1, 2026
Estimated Construction Duration: 730 Days
Estimated Midpoint: March 1, 2027

Item	Adjustment Period			Duration	Unit	% per YEAR	% per MONTH	% Total/year	% Compounding Cumulative
1	May-23	to	Dec-23	8	MONTH	7.00%	**0.583%**	**4.608%**	**4.608%**
2	Jan-24	to	Dec-24	12	MONTH	6.00%	**0.500%**	**6.083%**	**10.972%**
3	Jan-25	to	Dec-25	12	MONTH	4.00%	**0.333%**	**4.044%**	**15.460%**
4	Jan-26	to	Dec-26	12	MONTH	3.50%	**0.292%**	**3.539%**	**19.546%**
4	Jan-27	to	Mar-27	2	MONTH	3.50%	**0.292%**	**0.574%**	**20.232%**

TOTAL MONTHS	46	MONTH
AVG. MONTHLY PERCENTAGE	0.400%	
CALCULATED TOTAL MARKET ADJUSTMENT	20.23%	

Market Conditions Adjustment Calculation

Schedule Reference: N/A
Estimate Date: May 8, 2023
Estimated Start of Construction: March 1, 2026
Estimated Construction Duration: 730 Days
Estimated Midpoint: March 1, 2027

Item	Adjustment Period			Duration	Unit	% per YEAR	% per MONTH	% Total/year	% Compounding Cumulative
1	May-23	to	Dec-23	8	MONTH	7.00%	**0.583%**	**4.608%**	**4.608%**
2	Jan-24	to	Dec-24	12	MONTH	6.00%	**0.500%**	**6.083%**	**10.972%**
3	Jan-25	to	Dec-25	12	MONTH	4.00%	**0.333%**	**4.044%**	**15.460%**
4	Jan-26	to	Dec-26	12	MONTH	3.50%	**0.292%**	**3.539%**	**19.546%**
5	Jan-27	to	Dec-27	12	MONTH	3.50%	**0.292%**	**3.539%**	**23.777%**
6	Jan-28	to	Mar-27	-10	MONTH	3.50%	**0.292%**	**-2.975%**	**20.094%**

TOTAL MONTHS	46	MONTH
AVG. MONTHLY PERCENTAGE	0.382%	
CALCULATED TOTAL MARKET ADJUSTMENT	20.09%	

Market Conditions Adjustment Calculation

Schedule Reference: N/A
Estimate Date: May 8, 2023
Estimated Start of Construction: March 1, 2027
Estimated Construction Duration: 730 Days
Estimated Midpoint: February 29, 2028

Item	Adjustment Period			Duration	Unit	% per YEAR	% per MONTH	% Total/year	% Compounding Cumulative
1	May-23	to	Dec-23	8	MONTH	7.00%	**0.583%**	**4.608%**	**4.608%**
2	Jan-24	to	Dec-24	12	MONTH	6.00%	**0.500%**	**6.083%**	**10.972%**
3	Jan-25	to	Dec-25	12	MONTH	4.00%	**0.333%**	**4.044%**	**15.460%**
4	Jan-26	to	Dec-26	12	MONTH	3.50%	**0.292%**	**3.539%**	**19.546%**
5	Jan-27	to	Dec-27	12	MONTH	3.50%	**0.292%**	**3.539%**	**23.777%**
6	Jan-28	to	Dec-28	12	MONTH	3.50%	**0.292%**	**3.549%**	**28.169%**
7	Jan-29	to	Feb-28	-10	MONTH	3.50%	**0.292%**	**-2.985%**	**24.344%**

TOTAL MONTHS	58	MONTH
AVG. MONTHLY PERCENTAGE	0.382%	
CALCULATED TOTAL MARKET ADJUSTMENT	24.34%	

Market Conditions Adjustment Calculation

Schedule Reference: N/A
Estimate Date: May 8, 2023
Estimated Start of Construction: March 1, 2028
Estimated Construction Duration: 730 Days
Estimated Midpoint: March 1, 2029

Item	Adjustment Period			Duration	Unit	% per YEAR	% per MONTH	% Total/year	% Compounding Cumulative
1	May-23	to	Dec-23	8	MONTH	7.00%	**0.583%**	**4.608%**	**4.608%**
2	Jan-24	to	Dec-24	12	MONTH	6.00%	**0.500%**	**6.083%**	**10.972%**
3	Jan-25	to	Dec-25	12	MONTH	4.00%	**0.333%**	**4.044%**	**15.460%**
4	Jan-26	to	Dec-26	12	MONTH	3.50%	**0.292%**	**3.539%**	**19.546%**
5	Jan-27	to	Dec-27	12	MONTH	3.50%	**0.292%**	**3.539%**	**23.777%**
6	Jan-28	to	Dec-28	12	MONTH	3.50%	**0.292%**	**3.549%**	**28.169%**
7	Jan-29	to	Dec-29	12	MONTH	3.50%	**0.292%**	**3.539%**	**32.705%**
8	Jan-30	to	Mar-29	-10	MONTH	3.50%	**0.292%**	**-2.975%**	**28.757%**

TOTAL MONTHS	71	MONTH
AVG. MONTHLY PERCENTAGE	0.382%	
CALCULATED TOTAL MARKET ADJUSTMENT	28.76%	

III. Total Cost Summary Report

Fire Protection Upgrade Project

Fire Alarm Cost Summary - Project Start Date March 2024

			Option 1	Option 2
Direct Trade Construction Cost				
A10	FOUNDATIONS			
A20	BASEMENT CONSTRUCTION			
B10	SUPERSTRUCTURE			
B20	EXTERIOR CLOSURE			
B30	ROOFING			
C10	INTERIOR CONSTRUCTION		$ 2,378,995	2,577,544
D10	CONVEYANCE SYSTEM			
D20	PLUMBING			
D30	HVAC			
D40	FIRE PROTECTION SYSTEM			
D50	ELLECTRICAL (FIRE ALARM & LIGHTING)		$ 3,516,682	2,203,620
E10	EQUIPMENT			
E20	FURNISHINGS			
F10	SPECIAL CONSTRUCTION			
F20	SELECTIVE BUILDING DEMOLITION		$ 597,917	597,917
G10	SITEWORK - SITE PREPARATION			
G20	SITEWORK - SITE IMPROVEMENTS			
G30	SITEWORK - UTILITIES			
G40	SITEWORK - SITE ELECTRICAL			
G90	SITEWORK - OTHER			
	SUB-TOTAL, DIRECT COST		**$ 6,493,594**	**5,379,081**
I90	Design / Estimate Allowance	20.00%	$ 1,298,719	1,075,816
1	**SUB-TOTAL, DIRECT COST, ADJUSTED (LINES A THRU I)**		**$ 7,792,313**	**$ 6,454,897**
FIELD REQUIREMENTS OVERHEAD & PROFIT				
X10A	FIELD OVERHEAD	7.57% 9.13%	$ 589,580	$ 589,580
X10B	BONDS. PERMITS, FEES, AND INSURANCE	2.00%	$ 167,638	$ 140,890
X20A	HOME OFFICE OVERHEAD	Included in Field OH 0.00%	$ -	$ -
X20C			$ -	$ -
X20B	PROFIT	6.50%	$ 555,719	$ 467,049
2	**SUB-TOTAL, FIELD REQUIREMENTS OH & PROFIT (LINES X10 - X20)**		**$ 1,312,937**	**1,197,518**
3	**SUB-TOTAL, CURRENT ESTIMATED CONSTRUCTION COST (LINES 1 + 2)**		**$ 9,105,250**	**7,652,416**
4	Escalation to the Midpoint Phase 0	11.70%	**1,065,268**	**895,294**
	TOTAL ESTIMATED CONSTRUCTION COST AT AWARD (ECCA)		***$ 10,170,518***	***$ 8,547,709***
	Cost per SF			
	GSF			-

Fire Protection Upgrade Project

Fire Alarm Cost Summary - Project Start Date March 2026

				Option 1	Option 2
Direct Trade Construction Cost					
A10	FOUNDATIONS				
A20	BASEMENT CONSTRUCTION				
B10	SUPERSTRUCTURE				
B20	EXTERIOR CLOSURE				
B30	ROOFING				
C10	INTERIOR CONSTRUCTION			$ 2,378,995	2,577,544
D10	CONVEYANCE SYSTEM				
D20	PLUMBING				
D30	HVAC				
D40	FIRE PROTECTION SYSTEM				
D50	ELLECTRICAL (FIRE ALARM & LIGHTING)			$ 3,516,682	2,203,620
E10	EQUIPMENT				
E20	FURNISHINGS				
F10	SPECIAL CONSTRUCTION				
F20	SELECTIVE BUILDING DEMOLITION			$ 597,917	597,917
G10	SITEWORK - SITE PREPARATION				
G20	SITEWORK - SITE IMPROVEMENTS				
G30	SITEWORK - UTILITIES				
G40	SITEWORK - SITE ELECTRICAL				
G90	SITEWORK - OTHER				
	SUB-TOTAL, DIRECT COST			**$ 6,493,594**	**5,379,081**
I90	Design / Estimate Allowance		20.00%	$ 1,298,719	1,075,816
1	**SUB-TOTAL, DIRECT COST, ADJUSTED (LINES A THRU I)**			**$ 7,792,313**	**$ 6,454,897**
FIELD REQUIREMENTS OVERHEAD & PROFIT					
X10A	FIELD OVERHEAD	7.57%	9.13%	$ 589,580	$ 589,580
X10B	BONDS. PERMITS, FEES, AND INSURANCE		2.00%	$ 167,638	$ 140,890
X20A	HOME OFFICE OVERHEAD	Included in Field OH	0.00%	$ -	$ -
X20C				$ -	$ -
X20B	PROFIT		6.50%	$ 555,719	$ 467,049
2	**SUB-TOTAL, FIELD REQUIREMENTS OH & PROFIT (LINES X10 - X20)**			**$ 1,312,937**	**1,197,518**
3	**SUB-TOTAL, CURRENT ESTIMATED CONSTRUCTION COST (LINES 1 + 2)**			**$ 9,105,250**	**7,652,416**
4	Escalation to the Midpoint Phase 0		20.23%	**1,842,169**	**1,548,233**
	TOTAL ESTIMATED CONSTRUCTION COST AT AWARD (ECCA)			***$ 10,947,420***	***$ 9,200,648***
	Cost per SF				
	GSF				-

Fire Protection Upgrade Project

Fire Alarm Cost Summary - Project Start Date March 2028

				Option 1	Option 2
Direct Trade Construction Cost					
A10	FOUNDATIONS				
A20	BASEMENT CONSTRUCTION				
B10	SUPERSTRUCTURE				
B20	EXTERIOR CLOSURE				
B30	ROOFING				
C10	INTERIOR CONSTRUCTION			$ 2,378,995	2,577,544
D10	CONVEYANCE SYSTEM				
D20	PLUMBING				
D30	HVAC				
D40	FIRE PROTECTION SYSTEM				
D50	ELLECTRICAL (FIRE ALARM & LIGHTING)			$ 3,516,682	2,203,620
E10	EQUIPMENT				
E20	FURNISHINGS				
F10	SPECIAL CONSTRUCTION				
F20	SELECTIVE BUILDING DEMOLITION			$ 597,917	597,917
G10	SITEWORK - SITE PREPARATION				
G20	SITEWORK - SITE IMPROVEMENTS				
G30	SITEWORK - UTILITIES				
G40	SITEWORK - SITE ELECTRICAL				
G90	SITEWORK - OTHER				
	SUB-TOTAL, DIRECT COST			**$ 6,493,594**	**5,379,081**
I90	Design / Estimate Allowance		20.00%	$ 1,298,719	1,075,816
1	**SUB-TOTAL, DIRECT COST, ADJUSTED (LINES A THRU I)**			**$ 7,792,313**	**$ 6,454,897**
FIELD REQUIREMENTS OVERHEAD & PROFIT					
X10A	FIELD OVERHEAD	7.57%	9.13%	$ 589,580	$ 589,580
X10B	BONDS. PERMITS, FEES, AND INSURANCE		2.00%	$ 167,638	$ 140,890
X20A	HOME OFFICE OVERHEAD	Included in Field OH	0.00%	$ -	$ -
X20C				$ -	$ -
X20B	PROFIT		6.50%	$ 555,719	$ 467,049
2	**SUB-TOTAL, FIELD REQUIREMENTS OH & PROFIT (LINES X10 - X20)**			**$ 1,312,937**	**1,197,518**
3	**SUB-TOTAL, CURRENT ESTIMATED CONSTRUCTION COST (LINES 1 + 2)**			**$ 9,105,250**	**7,652,416**
4	Escalation to the Midpoint Phase 0		24.34%	**2,216,554**	**1,862,880**
	TOTAL ESTIMATED CONSTRUCTION COST AT AWARD (ECCA)			***$ 11,321,804***	***$ 9,515,296***
	Cost per SF				
	GSF				-

Fire Protection Upgrade Project

Fire Protection Cost Summary - Project Start Date March 2025

			Option 1	Option 2
Direct Trade Construction Cost				
A10	FOUNDATIONS			
A20	BASEMENT CONSTRUCTION			
B10	SUPERSTRUCTURE			
B20	EXTERIOR CLOSURE			
B30	ROOFING			
C10	INTERIOR CONSTRUCTION		$ 1,765,782	2,268,615
D10	CONVEYANCE SYSTEM			
D20	PLUMBING			
D30	HVAC		$ 500,656	500,656
D40	FIRE PROTECTION SYSTEM		$ 7,797,130	6,940,740
D50	ELLECTRICAL (GENSET & EQUIP CONNECTION)		$ 186,377	186,377
E10	EQUIPMENT			
E20	FURNISHINGS			
F10	SPECIAL CONSTRUCTION			
F20	SELECTIVE BUILDING DEMOLITION		$ 504,859	550,855
G10	SITEWORK - SITE PREPARATION			
G20	SITEWORK - SITE IMPROVEMENTS			
G30	SITEWORK - UTILITIES			
G40	SITEWORK - SITE ELECTRICAL			
G90	SITEWORK - OTHER			
	SUB-TOTAL, DIRECT COST		**$ 10,754,804**	**10,447,243**
I90	Design / Estimate Allowance	20.00%	$ 2,150,961	2,089,449
1	**SUB-TOTAL, DIRECT COST, ADJUSTED (LINES A THRU I)**		**$ 12,905,765**	**$ 12,536,692**
FIELD REQUIREMENTS OVERHEAD & PROFIT				
X10A	FIELD OVERHEAD	4.57% 4.70%	$ 589,580	$ 589,580
X10B	BONDS. PERMITS, FEES, AND INSURANCE	2.00%	$ 269,907	$ 262,525
X20A	HOME OFFICE OVERHEAD Included in Field OH	0.00%	$ -	$ -
X20C			$ -	$ -
X20B	PROFIT	6.50%	$ 894,741	$ 870,272
2	**SUB-TOTAL, FIELD REQUIREMENTS OH & PROFIT (LINES X10 - X20)**		**$ 1,754,228**	**1,722,377**
3	**SUB-TOTAL, CURRENT ESTIMATED CONSTRUCTION COST (LINES 1 + 2)**		**$ 14,659,993**	**14,259,069**
4	Escalation to the Midpoint Phase 0	16.12%	**2,363,557**	**2,298,918**
	TOTAL ESTIMATED CONSTRUCTION COST AT AWARD (ECCA)		***$ 17,023,551***	***$ 16,557,987***
	Cost per SF			

GSF		-

Fire Protection Upgrade Project

Fire Protection Cost Summary - Project Start Date March 2027

			Option 1	Option 2
Direct Trade Construction Cost				
A10	FOUNDATIONS			
A20	BASEMENT CONSTRUCTION			
B10	SUPERSTRUCTURE			
B20	EXTERIOR CLOSURE			
B30	ROOFING			
C10	INTERIOR CONSTRUCTION		$ 1,765,782	2,268,615
D10	CONVEYANCE SYSTEM			
D20	PLUMBING			
D30	HVAC		$ 500,656	500,656
D40	FIRE PROTECTION SYSTEM		$ 7,797,130	6,940,740
D50	ELLECTRICAL (GENSET & EQUIP CONNECTION)		$ 186,377	186,377
E10	EQUIPMENT			
E20	FURNISHINGS			
F10	SPECIAL CONSTRUCTION			
F20	SELECTIVE BUILDING DEMOLITION		$ 504,859	550,855
G10	SITEWORK - SITE PREPARATION			
G20	SITEWORK - SITE IMPROVEMENTS			
G30	SITEWORK - UTILITIES			
G40	SITEWORK - SITE ELECTRICAL			
G90	SITEWORK - OTHER			
	SUB-TOTAL, DIRECT COST		**$ 10,754,804**	**10,447,243**
I90	Design / Estimate Allowance	20.00%	$ 2,150,961	2,089,449
1	**SUB-TOTAL, DIRECT COST, ADJUSTED (LINES A THRU I)**		**$ 12,905,765**	**$ 12,536,692**
FIELD REQUIREMENTS OVERHEAD & PROFIT				
X10A	FIELD OVERHEAD	4.57% 4.70%	$ 589,580	$ 589,580
X10B	BONDS. PERMITS, FEES, AND INSURANCE	2.00%	$ 269,907	$ 262,525
X20A	HOME OFFICE OVERHEAD Included in Field OH	0.00%	$ -	$ -
X20C			$ -	$ -
X20B	PROFIT	6.50%	$ 894,741	$ 870,272
2	**SUB-TOTAL, FIELD REQUIREMENTS OH & PROFIT (LINES X10 - X20)**		**$ 1,754,228**	**1,722,377**
3	**SUB-TOTAL, CURRENT ESTIMATED CONSTRUCTION COST (LINES 1 + 2)**		**$ 14,659,993**	**14,259,069**
4	Escalation to the Midpoint Phase 0	20.09%	**2,945,847**	**2,865,283**
	TOTAL ESTIMATED CONSTRUCTION COST AT AWARD (ECCA)		***$ 17,605,840***	***$ 17,124,352***
	Cost per SF			

GSF		-

Fire Protection Upgrade Project

Fire Protection Cost Summary - Project Start Date March 2029

			Option 1	Option 2
Direct Trade Construction Cost				
A10	FOUNDATIONS			
A20	BASEMENT CONSTRUCTION			
B10	SUPERSTRUCTURE			
B20	EXTERIOR CLOSURE			
B30	ROOFING			
C10	INTERIOR CONSTRUCTION		$ 1,765,782	2,268,615
D10	CONVEYANCE SYSTEM			
D20	PLUMBING			
D30	HVAC		$ 500,656	500,656
D40	FIRE PROTECTION SYSTEM		$ 7,797,130	6,940,740
D50	ELLECTRICAL (GENSET & EQUIP CONNECTION)		$ 186,377	186,377
E10	EQUIPMENT			
E20	FURNISHINGS			
F10	SPECIAL CONSTRUCTION			
F20	SELECTIVE BUILDING DEMOLITION		$ 504,859	550,855
G10	SITEWORK - SITE PREPARATION			
G20	SITEWORK - SITE IMPROVEMENTS			
G30	SITEWORK - UTILITIES			
G40	SITEWORK - SITE ELECTRICAL			
G90	SITEWORK - OTHER			
	SUB-TOTAL, DIRECT COST		**$ 10,754,804**	**10,447,243**
I90	Design / Estimate Allowance	20.00%	$ 2,150,961	2,089,449
1	**SUB-TOTAL, DIRECT COST, ADJUSTED (LINES A THRU I)**		**$ 12,905,765**	**$ 12,536,692**
FIELD REQUIREMENTS OVERHEAD & PROFIT				
X10A	FIELD OVERHEAD	4.57% 4.70%	$ 589,580	$ 589,580
X10B	BONDS. PERMITS, FEES, AND INSURANCE	2.00%	$ 269,907	$ 262,525
X20A	HOME OFFICE OVERHEAD Included in Field OH	0.00%	$ -	$ -
X20C			$ -	$ -
X20B	PROFIT	6.50%	$ 894,741	$ 870,272
2	**SUB-TOTAL, FIELD REQUIREMENTS OH & PROFIT (LINES X10 - X20)**		**$ 1,754,228**	**1,722,377**
3	**SUB-TOTAL, CURRENT ESTIMATED CONSTRUCTION COST (LINES 1 + 2)**		**$ 14,659,993**	**14,259,069**
4	Escalation to the Midpoint Phase 0	28.76%	**4,215,771**	**4,100,477**
	TOTAL ESTIMATED CONSTRUCTION COST AT AWARD (ECCA)		***$ 18,875,764***	***$ 18,359,546***
	Cost per SF			

GSF		-

Fire Protection Upgrade Project

Fire Alarm & Fire Protection (Concurrent) Cost Summary - Project Start Date March 2024

			Option 1	Option 2
Direct Trade Construction Cost				
A10	FOUNDATIONS			
A20	BASEMENT CONSTRUCTION			
B10	SUPERSTRUCTURE			
B20	EXTERIOR CLOSURE			
B30	ROOFING			
C10	INTERIOR CONSTRUCTION		$ 2,378,995	2,577,544
D10	CONVEYANCE SYSTEM			
D20	PLUMBING			
D30	HVAC		$ 500,656	500,656
D40	FIRE PROTECTION SYSTEM		$ 7,797,130	6,940,740
D50	ELLECTRICAL (GENSET & EQUIP CONNECTION)		$ 3,454,881	2,141,819
E10	EQUIPMENT			
E20	FURNISHINGS			
F10	SPECIAL CONSTRUCTION			
F20	SELECTIVE BUILDING DEMOLITION		$ 1,001,697	1,001,697
G10	SITEWORK - SITE PREPARATION			
G20	SITEWORK - SITE IMPROVEMENTS			
G30	SITEWORK - UTILITIES			
G40	SITEWORK - SITE ELECTRICAL			
G90	SITEWORK - OTHER			
	SUB-TOTAL, DIRECT COST		**$ 15,133,359**	**13,162,456**
I90	Design / Estimate Allowance	20.00%	$ 3,026,672	2,632,491
1	**SUB-TOTAL, DIRECT COST, ADJUSTED (LINES A THRU I)**		**$ 18,160,031**	**$ 15,794,947**
FIELD REQUIREMENTS OVERHEAD & PROFIT				
X10A	FIELD OVERHEAD	4.57% 5.25%	$ 829,580	$ 829,580
X10B	BONDS. PERMITS, FEES, AND INSURANCE	2.00%	$ 379,792	$ 332,491
X20A	HOME OFFICE OVERHEAD Included in Field OH	0.00%	$ -	$ -
X20C			$ -	$ -
X20B	PROFIT	6.50%	$ 1,259,011	$ 1,102,206
2	**SUB-TOTAL, FIELD REQUIREMENTS OH & PROFIT (LINES X10 - X20)**		**$ 2,468,383**	**2,264,277**
3	**SUB-TOTAL, CURRENT ESTIMATED CONSTRUCTION COST (LINES 1 + 2)**		**$ 20,628,414**	**18,059,224**
4	Escalation to the Midpoint Phase 0	11.70%	**2,413,419**	**2,112,837**
	TOTAL ESTIMATED CONSTRUCTION COST AT AWARD (ECCA)		***$ 23,041,833***	***$ 20,172,061***
	Cost per SF			

GSF		-

Fire Protection Upgrade Project

Fire Alarm & Fire Protection (Concurrent) Cost Summary - Project Start Date March 2026

			Option 1	Option 2
Direct Trade Construction Cost				
A10	FOUNDATIONS			
A20	BASEMENT CONSTRUCTION			
B10	SUPERSTRUCTURE			
B20	EXTERIOR CLOSURE			
B30	ROOFING			
C10	INTERIOR CONSTRUCTION		$ 2,378,995	2,577,544
D10	CONVEYANCE SYSTEM			
D20	PLUMBING			
D30	HVAC		$ 500,656	500,656
D40	FIRE PROTECTION SYSTEM		$ 7,797,130	6,940,740
D50	ELLECTRICAL (GENSET & EQUIP CONNECTION)		$ 3,454,881	2,141,819
E10	EQUIPMENT			
E20	FURNISHINGS			
F10	SPECIAL CONSTRUCTION			
F20	SELECTIVE BUILDING DEMOLITION		$ 1,001,697	1,001,697
G10	SITEWORK - SITE PREPARATION			
G20	SITEWORK - SITE IMPROVEMENTS			
G30	SITEWORK - UTILITIES			
G40	SITEWORK - SITE ELECTRICAL			
G90	SITEWORK - OTHER			
	SUB-TOTAL, DIRECT COST		**$ 15,133,359**	**13,162,456**
I90	Design / Estimate Allowance	20.00%	$ 3,026,672	2,632,491
1	**SUB-TOTAL, DIRECT COST, ADJUSTED (LINES A THRU I)**		**$ 18,160,031**	**$ 15,794,947**
FIELD REQUIREMENTS OVERHEAD & PROFIT				
X10A	FIELD OVERHEAD	4.57% 5.25%	$ 829,580	$ 829,580
X10B	BONDS. PERMITS, FEES, AND INSURANCE	2.00%	$ 379,792	$ 332,491
X20A	HOME OFFICE OVERHEAD	Included in Field OH 0.00%	$ -	$ -
X20C			$ -	$ -
X20B	PROFIT	6.50%	$ 1,259,011	$ 1,102,206
2	**SUB-TOTAL, FIELD REQUIREMENTS OH & PROFIT (LINES X10 - X20)**		**$ 2,468,383**	**2,264,277**
3	**SUB-TOTAL, CURRENT ESTIMATED CONSTRUCTION COST (LINES 1 + 2)**		**$ 20,628,414**	**18,059,224**
4	Escalation to the Midpoint Phase 0	20.23%	**4,173,530**	**3,653,733**
	TOTAL ESTIMATED CONSTRUCTION COST AT AWARD (ECCA)		***$ 24,801,944***	***$ 21,712,956***
	Cost per SF			

GSF		-

Fire Protection Upgrade Project

Fire Alarm & Fire Protection (Concurrent) Cost Summary - Project Start Date March 2028

			Option 1	Option 2
Direct Trade Construction Cost				
A10	FOUNDATIONS			
A20	BASEMENT CONSTRUCTION			
B10	SUPERSTRUCTURE			
B20	EXTERIOR CLOSURE			
B30	ROOFING			
C10	INTERIOR CONSTRUCTION		$ 2,378,995	2,577,544
D10	CONVEYANCE SYSTEM			
D20	PLUMBING			
D30	HVAC		$ 500,656	500,656
D40	FIRE PROTECTION SYSTEM		$ 7,797,130	6,940,740
D50	ELLECTRICAL (GENSET & EQUIP CONNECTION)		$ 3,454,881	2,141,819
E10	EQUIPMENT			
E20	FURNISHINGS			
F10	SPECIAL CONSTRUCTION			
F20	SELECTIVE BUILDING DEMOLITION		$ 1,001,697	1,001,697
G10	SITEWORK - SITE PREPARATION			
G20	SITEWORK - SITE IMPROVEMENTS			
G30	SITEWORK - UTILITIES			
G40	SITEWORK - SITE ELECTRICAL			
G90	SITEWORK - OTHER			
	SUB-TOTAL, DIRECT COST		**$ 15,133,359**	**13,162,456**
I90	Design / Estimate Allowance	20.00%	$ 3,026,672	2,632,491
1	**SUB-TOTAL, DIRECT COST, ADJUSTED (LINES A THRU I)**		**$ 18,160,031**	**$ 15,794,947**
FIELD REQUIREMENTS OVERHEAD & PROFIT				
X10A	FIELD OVERHEAD	4.57% 5.25%	$ 829,580	$ 829,580
X10B	BONDS. PERMITS, FEES, AND INSURANCE	2.00%	$ 379,792	$ 332,491
X20A	HOME OFFICE OVERHEAD	Included in Field OH 0.00%	$ -	$ -
X20C			$ -	$ -
X20B	PROFIT	6.50%	$ 1,259,011	$ 1,102,206
2	**SUB-TOTAL, FIELD REQUIREMENTS OH & PROFIT (LINES X10 - X20)**		**$ 2,468,383**	**2,264,277**
3	**SUB-TOTAL, CURRENT ESTIMATED CONSTRUCTION COST (LINES 1 + 2)**		**$ 20,628,414**	**18,059,224**
4	Escalation to the Midpoint Phase 0	24.34%	**5,021,717**	**4,396,281**
	TOTAL ESTIMATED CONSTRUCTION COST AT AWARD (ECCA)		***$ 25,650,131***	***$ 22,455,505***
	Cost per SF			

GSF		-

IV. Direct Cost Detail Report

Rough Order Of Magnitude Estimate
FOR
The Willoughby
Chevy Chase, MD

SUMMARY REPORT No. 1

LEVEL DESCRIPTION	TOTAL	QUANTITY	UNIT	UNIT COST
- WILLOUGHBY CONDO FIRE PROTECTION CONCEPT SUBMISSIO	$61,370,536	1	JOB	$61,370,536.12
- FIRE ALARM - START 3/1/2024	$11,872,674	1,362,763	SF	$8.71
- CONCEPT 1	$6,493,593	1,362,763	SF	$4.77
- C INTERIORS	$2,378,995	1,362,763	SF	$1.75
+ C10 INTERIOR CONSTRUCTION	$1,580,684	1,362,763	SF	$1.16
+ C30 INTERIOR FINISHES	$798,311	1,362,763	SF	$0.59
- D SERVICES	$3,516,682	1,362,763	EA	$2.58
+ D50 ELECTRICAL	$3,516,682	1,362,763	SF	$2.58
+ F SPECIAL CONSTRUCTION & DEMOLITION	$597,917	1	LS	$597,916.70
- CONCEPT 2	$5,379,080	1,362,763	SF	$3.95
+ C INTERIORS	$2,577,544	1,362,763	SF	$1.89
- D SERVICES	$2,203,620	1,362,763	EA	$1.62
+ D50 ELECTRICAL	$2,203,620	1,362,763	SF	$1.62
- F SPECIAL CONSTRUCTION & DEMOLITION	$597,917	1	LS	$597,916.70
+ F20 SELECTIVE BUILDING DEMOLITION	$597,917	1	LS	$597,916.70
- FIRE SUPPRESSION - START 3/1/2025 (ONE YR AF	$21,202,048	1,362,763	SF	$15.56
- CONCEPT 1	$10,754,805	1,362,763	SF	$7.89
- C INTERIORS	$1,765,782	1,362,763	SF	$1.30
+ C10 INTERIOR CONSTRUCTION	$1,289,743	1,362,763	SF	$0.95
+ C30 INTERIOR FINISHES	$476,039	1,362,763	SF	$0.35
- D SERVICES	$8,484,163	1,362,763	SF	$6.23
+ D30 HVAC	$500,656	1	LS	$500,655.87
+ D40 FIRE PROTECTION	$7,797,130	1,362,763	SF	$5.72
+ D50 ELECTRICAL	$186,377	1,362,763	SF	$0.14
- F SPECIAL CONSTRUCTION & DEMOLITION	$504,859	1	LS	$504,859.26
+ F20 SELECTIVE BUILDING DEMOLITION	$504,859	1	LS	$504,859.26
- CONCEPT 2	$10,447,243	1,362,763	SF	$7.67
- C INTERIORS	$2,268,615	1,362,763	SF	$1.66
+ C10 INTERIOR CONSTRUCTION	$2,268,615	1,362,763	SF	$1.66
- D SERVICES	$7,627,773	1,362,763	SF	$5.60
+ D30 HVAC	$500,656	1	LS	$500,655.87

SUMMARY REPORT No. 1

LEVEL DESCRIPTION	TOTAL	QUANTITY	UNIT	UNIT COST
+ D40 FIRE PROTECTION	**$6,940,740**	1,362,763	SF	**$5.09**
+ D50 ELECTRICAL	**$186,377**	1,362,763	SF	**$0.14**
- F SPECIAL CONSTRUCTION & DEMOLITION	**$550,855**	1	LS	**$550,855.02**
+ F20 SELECTIVE BUILDING DEMOLITION	**$550,855**	1	LS	**$550,855.02**
- FIRE ALARM & FIRE SUPPRESSION - CONCURRENT S	**$28,295,815**	1,362,763	SF	**$20.76**
- CONCEPT 1	**$15,133,359**	1,362,763	SF	**$11.10**
- C INTERIORS	**$2,378,995**	1,362,763	SF	**$1.75**
+ C10 INTERIOR CONSTRUCTION	**$1,580,684**	1,362,763	SF	**$1.16**
+ C30 INTERIOR FINISHES	**$798,311**	1,362,763	SF	**$0.59**
- D SERVICES	**$11,752,667**	1,362,763	SF	**$8.62**
+ D30 HVAC	**$500,656**	1	LS	**$500,655.87**
+ D40 FIRE PROTECTION	**$7,797,130**	1,362,763	SF	**$5.72**
+ D50 ELECTRICAL	**$3,454,881**	1,362,763	SF	**$2.54**
- F SPECIAL CONSTRUCTION & DEMOLITION	**$1,001,697**	1	LS	**$1,001,696.99**
+ F20 SELECTIVE BUILDING DEMOLITION	**$1,001,697**	1	LS	**$1,001,696.99**
- CONCEPT 2	**$13,162,455**	1,362,763	SF	**$9.66**
- C INTERIORS	**$2,577,544**	1,362,763	SF	**$1.89**
+ C10 INTERIOR CONSTRUCTION	**$2,559,276**	1,362,763	SF	**$1.88**
+ C30 INTERIOR FINISHES	**$18,268**	1,362,763	SF	**$0.01**
- D SERVICES	**$9,583,215**	1,362,763	SF	**$7.03**
+ D30 HVAC	**$500,656**	1	LS	**$500,655.87**
+ D40 FIRE PROTECTION	**$6,940,740**	1,362,763	SF	**$5.09**
+ D50 ELECTRICAL	**$2,141,819**	1,362,763	SF	**$1.57**
- F SPECIAL CONSTRUCTION & DEMOLITION	**$1,001,697**	1	LS	**$1,001,696.99**
+ F20 SELECTIVE BUILDING DEMOLITION	**$1,001,697**	1	LS	**$1,001,696.99**

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$6,493,593 CONCEPT 1											
$2,378,995 C INTERIORS											
$1,580,684 C10 INTERIOR CONSTRUCTION											
$279,926 C1010 PARTITIONS											
C1010145A PARTITION W1											
1 **Firestopping, construction joints, floor slab to drywall partition**	**84** L.F.	8	$452	$1,243	$0	$0	$75	$1,770	$572	$0	**$2,342**
		0.098	5.38	14.80			0.89	21.07	6.81		27.88
2 **Gypsum wallboard, on walls, fire resistant, 5/8" thick, finish excluded**	**218** S.F.	2	$117	$89	$0	$0	$5	$212	$69	$0	**$281**
		0.01	0.54	0.41			0.03	0.97	0.31		1.29
3 **Sound attenuation blanket, 3" thick**	**109** S.F.	1	$66	$82	$0	$0	$5	$153	$49	$0	**$202**
		0.011	0.61	0.75			0.04	1.40	0.45		1.85
4 **Metal stud partition, non-load bearing, galvanized, 3-5/8" wide, 20 gauge, 16" OC, includes top & bottom track**	**109** S.F.	3	$154	$146	$0	$0	$9	$309	$100	$0	**$409**
		0.026	1.41	1.34			0.08	2.83	0.92		3.75
5 **Channels, cold rolled, galvanized, 16 ga., 3/4" deep**	**10.90** C.L.		$0	$545	$0	$0	$33	$578	$187	$0	**$764**
				50.00			3.00	53.00	17.12		70.12
Subtotal			$790	$2,105	$0	$0	$126	$3,021	$976	$0	**$3,997**
Taxes			$0	$126	$0	$0					
Subcontractor Markups			$255	$721	$0	$0					
TOTAL C1010145A PARTITION W1	**14**		**$1,045**	**$2,953**	**$0**	**$0**	**$126**	**$3,021**	**$976**	**$0**	**$3,997**
109.00 SF	*Level Unit Cost-->*		*$9.58*	*$27.09*			*$1.16*	*$27.72*	*$8.95*		*$36.67*
Estimate Tree Structure Rollups											
$6,493,593 CONCEPT 1											
$2,378,995 C INTERIORS											
$1,580,684 C10 INTERIOR CONSTRUCTION											
$279,926 C1010 PARTITIONS											
C1010145B PARTITION W2											
6 **Firestopping, construction joints, floor slab to drywall partition**	**80** L.F.	8	$431	$1,184	$0	$0	$71	$1,686	$544	$0	**$2,230**
		0.098	5.38	14.80			0.89	21.07	6.81		27.88
7 **Gypsum wallboard, on walls, fire resistant, 5/8" thick, finish excluded**	**198** S.F.	2	$107	$81	$0	$0	$5	$193	$62	$0	**$255**
		0.01	0.54	0.41			0.03	0.97	0.31		1.29

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$6,493,593 CONCEPT 1												
$2,378,995 C INTERIORS												
$1,580,684 C10 INTERIOR CONSTRUCTION												
$279,926 C1010 PARTITIONS												
C1010145B PARTITION W2												
8 **Sound attenuation blanket, 3" thick**	**99**	S.F.	1	$60	$74	$0	$0	$4	$139	$45	$0	**$183**
			0.011	0.61	0.75			0.04	1.40	0.45		1.85
9 **Metal stud partition, non-load bearing, galvanized, 3-5/8" wide, 20 gauge, 16" OC, includes top & bottom track**	**99**	S.F.	3	$140	$133	$0	$0	$8	$281	$91	$0	**$371**
			0.026	1.41	1.34			0.08	2.83	0.92		3.75
10 **Channels, cold rolled, galvanized, 16 ga., 3/4" deep**	**9.90**	C.L.		$0	$495	$0	$0	$30	$525	$169	$0	**$694**
					50.00			3.00	53.00	17.12		70.12
Subtotal				$737	$1,967	$0	$0	$118	$2,822	$912	$0	$3,734
Taxes				$0	$118	$0	$0					
Subcontractor Markups				$238	$673	$0	$0					
TOTAL C1010145B PARTITION W2	**13**			**$975**	**$2,759**	**$0**	**$0**	**$118**	**$2,822**	**$912**	**$0**	$3,734
99.00 SF			*Level Unit Cost-->*	*$9.85*	*$27.86*			*$1.19*	*$28.51*	*$9.21*		*$37.72*
Estimate Tree Structure Rollups												
$6,493,593 CONCEPT 1												
$2,378,995 C INTERIORS												
$1,580,684 C10 INTERIOR CONSTRUCTION												
$279,926 C1010 PARTITIONS												
C1010145C PILASTER												
11 **U-Shield 6"h x 12"w x 6"h (00" Perimeter) @ 10' ht, 20 Gauge material**	**572**	EA	1,055	$74,176	$113,771	$0	$0	$6,826	$194,773	$62,912	$0	**$257,685**
			1.845	129.68	198.90			11.93	340.51	109.99		450.50
12 **Laser Cut holes for installation of electrical boxes**	**919.73**	EA		$0	$10,347	$0	$0	$621	$10,968	$3,543	$0	**$14,510**
					11.25			0.68	11.93	3.85		15.78
Subtotal				$74,176	$124,118	$0	$0	$7,447	$205,741	$66,454	$0	$272,195
Taxes				$0	$7,447	$0	$0					
Subcontractor Markups				$23,959	$42,495	$0	$0					
TOTAL C1010145C PILASTER	**1,055**			**$98,135**	**$174,060**	**$0**	**$0**	**$7,447**	**$205,741**	**$66,454**	**$0**	$272,195
572.00 EA			*Level Unit Cost-->*	*$171.56*	*$304.30*			*$13.02*	*$359.69*	*$116.18*		*$475.87*

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$6,493,593 CONCEPT 1											
$2,378,995 C INTERIORS											
$1,580,684 C10 INTERIOR CONSTRUCTION											
$3,873 C1020 INTERIOR DOORS											
C1020300 INTERIOR DOORS AND FRAMES											
13 **Doors, fire, flush, "B" label, 90 minutes, composite, 20 ga., 3'-0" x 7'-0"**	**1** Ea.	1	$67	$1,025	$0	$0	$62	$1,154	$373	$0	**$1,526**
		1.23	67.29	1,025.00			61.50	1,153.79	372.68		1,526.46
14 **Frames, steel, knock down, hollow metal, single, 90 minutes, 14 ga., up to 3-7/8" deep, 3'-0" x 7'-0"**	**1** Ea.	1	$67	$465	$0	$0	$28	$560	$181	$0	**$741**
		1.23	67.29	465.00			27.90	560.19	180.94		741.13
15 **Paints & coatings, interior latex, zero voc, doors, panel, both sides, roll & brush, primer + 2 coats, incl. frame & trim**	**1** Ea.	4	$181	$30	$0	$0	$2	$212	$69	$0	**$281**
		3.936	181.16	29.50			1.77	212.43	68.61		281.05
Subtotal			$316	$1,520	$0	$0	$91	$1,926	$622	$0	**$2,549**
Taxes			$0	$91	$0	$0					
Subcontractor Markups			$102	$520	$0	$0					
TOTAL C1020300 INTERIOR DOORS AND FRAMES	**6**		**$418**	**$2,131**	**$0**	**$0**	**$91**	**$1,926**	**$622**	**$0**	**$2,549**
1.00 EA											
Estimate Tree Structure Rollups											
$6,493,593 CONCEPT 1											
$2,378,995 C INTERIORS											
$1,580,684 C10 INTERIOR CONSTRUCTION											
$3,873 C1020 INTERIOR DOORS											
C1020400 DOOR HARDWARE											
16 **Door hardware, single, interior, regular use, incl. lever handle**	**1** Door	3	$179	$775	$0	$0	$47	$1,001	$323	$0	**$1,324**
		3.28	179.47	775.00			46.50	1,000.97	323.31		1,324.28
Subtotal			$179	$775	$0	$0	$47	$1,001	$323	$0	**$1,324**
Taxes			$0	$47	$0	$0					
Subcontractor Markups			$58	$265	$0	$0					
TOTAL C1020400 DOOR HARDWARE	**3**		**$237**	**$1,087**	**$0**	**$0**	**$47**	**$1,001**	**$323**	**$0**	**$1,324**
1.00 EA											

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$6,493,593 CONCEPT 1											
$2,378,995 C INTERIORS											
$1,580,684 C10 INTERIOR CONSTRUCTION											
$1,296,885 C1030 SPECIALTIES											
C1030A IDENTIFYING DEVICES											
17 **Signs, flexible door sign, adhesive back, w/Braille, 5/8" letters, 8" x 4"**	**2** Ea.	1	$20	$126	$0	$0	$8	$153	$0	$0	**$153**
		0.308	9.76	63.00			3.78	76.54			76.54
Taxes			$0	$8	$0	$0					
TOTAL C1030A IDENTIFYING DEVICES	**1**		**$20**	**$134**	**$0**	**$0**	**$8**	**$153**	**$0**	**$0**	**$153**
2.00 EA	*Level Unit Cost-->*		*$9.76*	*$66.78*			*$3.78*	*$76.54*			*$76.54*
Estimate Tree Structure Rollups											
$6,493,593 CONCEPT 1											
$2,378,995 C INTERIORS											
$1,580,684 C10 INTERIOR CONSTRUCTION											
$1,296,885 C1030 SPECIALTIES											
C1030B RAILING											
18 **Railing, pipe, aluminum, 2 rails, 3'-6" high, posts @ 4' OC, 1-1/2" diameter, shop fabricated**	**54** L.F.	13	$940	$3,942	$59	$0	$240	$5,181	$1,674	$0	**$6,855**
		0.246	17.41	73.00	1.09		4.45	95.95	30.99		126.94
19 **Prime railingwith Rustoleum Primer**	**54** L.F.	1	$37	$3	$0	$0	$0	$40	$13	$0	**$52**
		0.015	0.68	0.05				0.73	0.24		0.97
20 **Paints & coatings, pipe railing, paint 2 coats, spray**	**54** S.F.	1	$40	$21	$0	$0	$1	$62	$20	$0	**$82**
		0.016	0.74	0.39			0.02	1.15	0.37		1.52
Subtotal			$1,017	$3,966	$59	$0	$241	$5,283	$1,706	$0	$6,989
Taxes			$0	$238	$4	$0					
Subcontractor Markups			$328	$1,358	$20	$0					
TOTAL C1030B RAILING	**15**		**$1,345**	**$5,562**	**$83**	**$0**	**$241**	**$5,283**	**$1,706**	**$0**	**$6,989**
54.00 LF	*Level Unit Cost-->*		*$24.91*	*$102.99*	*$1.53*		*$4.47*	*$97.83*	*$31.60*		*$129.43*

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$6,493,593 CONCEPT 1											
$2,378,995 C INTERIORS											
$1,580,684 C10 INTERIOR CONSTRUCTION											
$1,296,885 C1030 SPECIALTIES											
C1030C INTERIOR SOFFIT											
21 Add soffit in the unit	**32,004** L.F.	7,873	$430,717	$513,344	$0	$0	$30,801	$974,862	$314,880	$0	**$1,289,743**
		0.246	13.46	16.04			0.96	30.46	9.84		40.30
Subtotal			$430,717	$513,344	$0	$0	$30,801	$974,862	$314,880	$0	**$1,289,743**
Taxes			$0	$30,801	$0	$0					
Subcontractor Markups			$139,122	$175,759	$0	$0					
TOTAL C1030C INTERIOR SOFFIT		**7,873**	**$569,839**	**$719,904**	**$0**	**$0**	**$30,801**	**$974,862**	**$314,880**	**$0**	**$1,289,743**
32,004.00 LF	*Level Unit Cost-->*		*$17.81*	*$22.49*			*$0.96*	*$30.46*	*$9.84*		*$40.30*
Estimate Tree Structure Rollups											
$11,872,674 FIRE ALARM - START 3/1/2024											
$6,493,593 CONCEPT 1											
$2,378,995 C INTERIORS											
$798,311 C30 INTERIOR FINISHES											
C3010 WALL FINISHES											
22 Painting walls, complete, on drywall or plaster, primer and 2 finish coats, with roller, including surface preparation	**4,493** S.F.	135	$6,204	$1,977	$0	$0	$119	$8,300	$2,681	$0	**$10,980**
		0.03	1.38	0.44			0.03	1.85	0.60		2.44
Subtotal			$6,204	$1,977	$0	$0	$119	$8,300	$2,681	$0	**$10,980**
Taxes			$0	$119	$0	$0					
Subcontractor Markups			$2,004	$677	$0	$0					
TOTAL C3010 WALL FINISHES		**135**	**$8,208**	**$2,772**	**$0**	**$0**	**$119**	**$8,300**	**$2,681**	**$0**	**$10,980**
4,493.00 SF	*Level Unit Cost-->*		*$1.83*	*$0.62*			*$0.03*	*$1.85*	*$0.60*		*$2.44*
Estimate Tree Structure Rollups											
$11,872,674 FIRE ALARM - START 3/1/2024											
$6,493,593 CONCEPT 1											
$2,378,995 C INTERIORS											
$798,311 C30 INTERIOR FINISHES											
C3030 CEILING FINISHES											
23 Patch & Repair existing ceiling near wall demo	**30** S.F.	4	$202	$120	$0	$0	$7	$329	$106	$0	**$435**
		0.123	6.73	4.00			0.24	10.97	3.54		14.51

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$11,872,674 *FIRE ALARM - START 3/1/2024*											
$6,493,593 *CONCEPT 1*											
$2,378,995 *C INTERIORS*											
$798,311 *C30 INTERIOR FINISHES*											
C3030 CEILING FINISHES											
24 **Surface preparation, interior, ceiling, Patch & Prep for new finish**	**1,412** S.F.	52 0.037	$2,398 1.70	$635 0.45	$0	$0	$38 0.03	$3,072 2.17	$992 0.70	$0	**$4,064** 2.88
25 **Paints & coatings, walls & ceilings, interior, concrete, drywall or plaster, zero voc latex, 3 coats, smooth finish, spray**	**1,412** S.F.	35 0.025	$1,599 1.13	$480 0.34	$0	$0	$29 0.02	$2,108 1.49	$681 0.48	$0	**$2,788** 1.98
26 **Suspended ceiling system, 2" carriers, 24" OC with 1-5/8" channels, 24" OC, incl. carriers**	**77,700** S.F.	2,797 0.036	$162,876 2.10	$52,836 0.68	$0	$0	$3,170 0.04	$218,882 2.82	$0	$0	**$218,882** 2.82
27 **Gypsum wallboard, on ceilings, fire resistant, taped & finished (level 4 finish), 1/2" thick**	**77,700** S.F.	1,632 0.021	$89,267 1.15	$39,627 0.51	$0	$0	$2,378 0.03	$131,272 1.69	$0	$0	**$131,272** 1.69
28 **Paints & coatings, walls & ceilings, interior, concrete, drywall or plaster, zero voc latex, 2 coats, sand finish, brushwork**	**77,700** S.F.	1,242 0.016	$57,185 0.74	$10,101 0.13	$0	$0	$606 0.01	$67,892 0.87	$0	$0	**$67,892** 0.87
29 **Temporary protection, flooring, taped seams, 1/8" tempered hardboard**	**77,700** S.F.	1,051 0.014	$57,514 0.74	$35,742 0.46	$0	$0	$2,145 0.03	$95,400 1.23	$30,814 0.40	$0	**$126,215** 1.62
30 **Temporary protect existing walls in the hallways during ceilign demo work**	**242,900** S.F.	2,091 0.009	$162,769 0.67	$14,574 0.06	$0	$0	$874	$178,218 0.73	$57,564 0.24	$0	**$235,782** 0.97
Subtotal			$533,811	$154,115	$0	$0	$9,247	$697,173	$90,158	$0	**$787,331**
Taxes			$0	$9,247	$0	$0					
Subcontractor Markups			$72,508	$17,650	$0	$0					
TOTAL C3030 CEILING FINISHES	**8,905**		**$606,318**	**$181,013**	**$0**	**$0**	**$9,247**	**$697,173**	**$90,158**	**$0**	**$787,331**
79,142.00 SF	*Level Unit Cost-->*		*$7.66*	*$2.29*			*$0.12*	*$8.81*	*$1.14*		*$9.95*

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$6,493,593 CONCEPT 1												
$3,516,682 D SERVICES												
$3,516,682 D50 ELECTRICAL												
$1,313,062 D5020 LIGHTING & BRANCH WIRING												
D502002 LIGHTING EQUIPMENT												
31 **Fluorescent fixtures, interior, electrical demolition, remove, recessed drop-in, to 10' high, including supports & whips**	**2,100**	Ea.	1,377 0.656	$117,759 56.08	$0	$0	$0	$0	$117,759 56.08	$27,650 13.17	$0	**$145,409** 69.24
32 **Interior LED fixtures, troffer, recess mounted, 2' x 2', 4,000K**	**2,100**	Ea.	2,431 1.157	$207,902 99.00	$344,400 164.00	$0	$0	$20,664 9.84	$572,966 272.84	$134,532 64.06	$0	**$707,498** 336.90
33 **Fixture whips, 3/8" greenfield, 2 connectors, THHN wire, three #12, 6' long**	**2,100**	Ea.	646 0.308	$55,234 26.30	$25,830 12.30	$0	$0	$1,550 0.74	$82,614 39.34	$19,398 9.24	$0	**$102,012** 48.58
34 **Lighting devices, occupancy sensors, dual technology, ceiling mounted**	**340**	Ea.	515 1.514	$44,034 129.51	$37,740 111.00	$0	$0	$2,264 6.66	$84,038 247.17	$19,732 58.04	$0	**$103,770** 305.21
35 **Outlet boxes, pressed steel, 4" square**	**2,440**	Ea.	1,200 0.492	$102,683 42.08	$5,026 2.06	$0	$0	$302 0.12	$108,011 44.27	$25,361 10.39	$0	**$133,372** 54.66
36 **Outlet boxes, pressed steel, covers, blank, 4" square**	**2,440**	Ea.	375 0.154	$32,088 13.15	$3,465 1.42	$0	$0	$208 0.09	$35,761 14.66	$8,397 3.44	$0	**$44,158** 18.10
37 **Lighting control relay panel, 16 relay, with timeclock**	**20**	Ea.	109 5.466	$9,351 467.55	$28,000 1,400.00	$0	$0	$1,680 84.00	$39,031 1,951.55	$9,164 458.22	$0	**$48,195** 2,409.77
38 **Unshielded twisted pair (UTP) cable, solid, plenum, #24, 4 pair, category 6**	**170**	C.L.	239 1.406	$20,443 120.25	$2,601 15.30	$0	$0	$156 0.92	$23,200 136.47	$5,447 32.04	$0	**$28,647** 168.51
Subtotal				$589,494	$447,062	$0	$0	$26,824	$1,063,380	$249,682	$0	**$1,313,062**
Taxes				$0	$26,824	$0	$0					
Subcontractor Markups				$138,413	$111,268	$0	$0					
TOTAL D502002 LIGHTING EQUIPMENT	**6,892**			**$727,908**	**$585,154**	**$0**	**$0**	**$26,824**	**$1,063,380**	**$249,682**	**$0**	**$1,313,062**
2,100.00 EA			*Level Unit Cost-->*	*$346.62*	*$278.64*			*$12.77*	*$506.37*	*$118.90*		*$625.27*

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$3,516,682 D SERVICES												
$3,516,682 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
TENANT TOWER												
39 **Detection system, break glass station, addressable, excluding wires & conduits**	**145**	Ea.	197	$16,826	$24,070	$0	$0	$1,444	$42,341	$9,942	$0	**$52,282**
			1.357	116.04	166.00			9.96	292.00	68.56		360.57
40 **Detection system, strobe & horn, ADA type, excluding wires & conduits**	**308**	Ea.	572	$48,898	$40,656	$0	$0	$2,439	$91,993	$21,600	$0	**$113,593**
			1.856	158.76	132.00			7.92	298.68	70.13		368.81
41 **Detection system, visual alarm, ADA type, excluding wires & conduits**	**61**	Ea.	90	$7,663	$7,076	$0	$0	$425	$15,163	$3,560	$0	**$18,724**
			1.469	125.62	116.00			6.96	248.58	58.37		306.94
42 **Detection system, smoke detector, addressable type, excl. wires & conduit**	**526**	Ea.	862	$73,767	$126,766	$0	$0	$7,606	$208,139	$48,871	$0	**$257,011**
			1.64	140.24	241.00			14.46	395.70	92.91		488.61
43 **'MM' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**4**	Ea.	5	$464	$234	$0	$0	$14	$713	$167	$0	**$880**
			1.357	116.05	58.60			3.52	178.16	41.83		219.99
Memo: https://thefirealarmsupplier.us/products/fmm-1-												
44 **'REL/CR' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**2**	Ea.	3	$232	$292	$0	$0	$18	$541	$127	$0	**$668**
			1.357	116.05	145.83			8.75	270.63	63.54		334.17
Memo: https://thefirealarmsupplier.us/products/mix-m500rap-												
45 **Door closer, electric automatic operators, surface mounted, universal heavy duty, regular arm**	**2**	Ea.	3	$179	$700	$0	$0	$42	$921	$216	$0	**$1,138**
			1.64	89.70	350.00			21.00	460.70	108.17		568.87
46 **Detection system, strobe, weatherproof, excluding wires & conduits**	**1**	Ea.	1	$126	$149	$0	$0	$9	$283	$67	$0	**$350**
			1.469	125.62	148.74			8.92	283.28	66.52		349.80
Memo: https://thefirealarmsupplier.us/products/simplex-49av-												
47 **Smoke alarm photoelectric - battery powered**	**1,087**	Ea.	445	$38,082	$52,176	$0	$0	$3,131	$93,389	$21,928	$0	**$115,317**
			0.41	35.03	48.00			2.88	85.91	20.17		106.09

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$3,516,682 D SERVICES												
$3,516,682 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
TENANT TOWER												
48 Smoke alarm photoelectric -120V wired	**785**	Ea.	643	$55,004	$50,570	$0	$0	$3,034	$108,608	$25,501	$0	**$134,109**
			0.819	70.07	64.42			3.87	138.35	32.48		170.84
Memo: https://www.gsaadvantage.gov/advantage/ws/catalog/prod												
49 Speaker - battery powered	**1,442**	Ea.	591	$50,519	$69,216	$0	$0	$4,153	$123,888	$29,089	$0	**$152,977**
			0.41	35.03	48.00			2.88	85.91	20.17		106.09
50 Surface raceway, metal, straight section, no. 1000	**17,000**	L.F.	1,861	$159,180	$39,440	$0	$0	$2,366	$200,986	$47,192	$0	**$248,178**
			0.109	9.36	2.32			0.14	11.82	2.78		14.60
51 Outlet boxes, pressed steel, 4" octagon	**470**	Ea.	231	$19,779	$620	$0	$0	$37	$20,437	$4,799	$0	**$25,235**
			0.492	42.08	1.32			0.08	43.48	10.21		53.69
52 Outlet boxes, pressed steel, 4" square	**521**	Ea.	256	$21,925	$1,073	$0	$0	$64	$23,063	$5,415	$0	**$28,478**
			0.492	42.08	2.06			0.12	44.27	10.39		54.66
53 Outlet boxes, pressed steel, plaster rings, 4" square, concealed	**497**	Ea.	76	$6,536	$850	$0	$0	$51	$7,437	$1,746	$0	**$9,183**
			0.154	13.15	1.71			0.10	14.96	3.51		18.48
54 Outlet boxes, pressed steel, covers, blank, 4" square	**6**	Ea.	1	$79	$9	$0	$0	$1	$88	$21	$0	**$109**
			0.154	13.15	1.42			0.09	14.66	3.44		18.10
55 Fire alarm cable,#18, 1 pair	**204.93**	C.L.	252	$21,560	$6,966	$0	$0	$418	$28,944	$6,796	$0	**$35,740**
			1.23	105.21	33.99			2.04	141.24	33.16		174.40
Memo: https://www.showmecables.com/1-pair-18-awg-solid-												
56 Fire alarm cable,#14, 1 pair	**223.74**	C.L.	339	$28,977	$10,874	$0	$0	$652	$40,503	$9,510	$0	**$50,013**
			1.514	129.51	48.60			2.92	181.03	42.51		223.53
Memo: https://www.showmecables.com/fire-alarm-cable-2-												

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$3,516,682 D SERVICES												
$3,516,682 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
TENANT TOWER												
57 **Testing & Commissioning**	**1,049**		774	$66,218	$0	$0	$0	$0	$66,218	$15,548	$0	**$81,766**
			0.738	63.13					63.13	14.82		77.95
Subtotal				$616,015	$431,736	$0	$0	$25,904	$1,073,655	$252,094	$0	**$1,325,750**
Taxes				$0	$25,904	$0	$0					
Subcontractor Markups				$144,640	$107,454	$0	$0					
TOTAL TENANT TOWER	**7,203**			**$760,656**	**$565,094**	**$0**	**$0**	**$25,904**	**$1,073,655**	**$252,094**	**$0**	**$1,325,750**
969,696.00 SF			*Level Unit Cost–>*	*$0.78*	*$0.58*			*$0.03*	*$1.11*	*$0.26*		*$1.37*
Estimate Tree Structure Rollups												
$3,516,682 D SERVICES												
$3,516,682 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
BOH, PUBLIC & ADMINISTRATION AREAS												
58 **Detection system, break glass station, addressable, excluding wires & conduits**	**21**	Ea.	28	$2,437	$3,486	$0	$0	$209	$6,132	$1,440	$0	**$7,572**
			1.357	116.04	166.00			9.96	292.00	68.56		360.57
59 **Detection system, strobe & horn, ADA type, excluding wires & conduits**	**72**	Ea.	134	$11,431	$9,504	$0	$0	$570	$21,505	$5,049	$0	**$26,554**
			1.856	158.76	132.00			7.92	298.68	70.13		368.81
60 **Detection system, visual alarm, ADA type, excluding wires & conduits**	**52**	Ea.	76	$6,532	$6,032	$0	$0	$362	$12,926	$3,035	$0	**$15,961**
			1.469	125.62	116.00			6.96	248.58	58.37		306.94
61 **Detection system, smoke detector, addressable type, excl. wires & conduit**	**29**	Ea.	48	$4,067	$6,989	$0	$0	$419	$11,475	$2,694	$0	**$14,170**
			1.64	140.24	241.00			14.46	395.70	92.91		488.61
62 **'MM' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**1**	Ea.	1	$116	$59	$0	$0	$4	$178	$42	$0	**$220**
			1.357	116.04	58.60			3.52	178.16	41.83		219.99

Memo: https://thefirealarmsupplier.us/products/fmm-1-

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$3,516,682 D SERVICES												
$3,516,682 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
BOH, PUBLIC & ADMINISTRATION AREAS												
63 **'REL/CR' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**9**	Ea.	12	$1,044	$1,312	$0	$0	$79	$2,436	$572	$0	**$3,008**
			1.357	116.04	145.83			8.75	270.62	63.54		334.17
Memo: https://thefirealarmsupplier.us/products/mix-m500rap-												
64 **Detection system, strobe, weatherproof, excluding wires & conduits**	**1**	Ea.	1	$126	$149	$0	$0	$9	$283	$67	$0	**$350**
			1.469	125.62	148.74			8.92	283.28	66.52		349.80
Memo: https://thefirealarmsupplier.us/products/simplex-49av-												
65 **Notification Appliance Power Extender Panel**	**1**	Ea.	7	$623	$963	$0	$0	$58	$1,645	$386	$0	**$2,031**
			7.289	623.46	963.28			57.80	1,644.54	386.14		2,030.68
Memo: https://thefirealarmsupplier.us/products/hpff8-												
66 **Detection system, smoke detector, duct type, addressable, excl. wires & conduit**	**16**	Ea.	49	$4,208	$3,232	$0	$0	$194	$7,634	$1,793	$0	**$9,427**
			3.075	263.02	202.00			12.12	477.14	112.03		589.17
67 **LCD Textual Sign**	**4**	Ea.	7	$635	$1,391	$0	$0	$83	$2,109	$495	$0	**$2,605**
			1.856	158.76	347.74			20.86	527.37	123.83		651.19
Memo: https://www.gsaadvantage.gov/advantage/ws/catalog/proc												
68 **Outlet boxes, pressed steel, 4" octagon**	**10**	Ea.	5	$421	$13	$0	$0	$1	$435	$102	$0	**$537**
			0.492	42.08	1.32			0.08	43.48	10.21		53.69
69 **Outlet boxes, pressed steel, 4" square**	**180**	Ea.	89	$7,575	$371	$0	$0	$22	$7,968	$1,871	$0	**$9,839**
			0.492	42.08	2.06			0.12	44.27	10.39		54.66
70 **Outlet boxes, pressed steel, plaster rings, 4" square, concealed**	**21**	Ea.	3	$276	$36	$0	$0	$2	$314	$74	$0	**$388**
			0.154	13.15	1.71			0.10	14.96	3.51		18.48
71 **Outlet boxes, pressed steel, covers, blank, 4" square**	**18**	Ea.	3	$237	$26	$0	$0	$2	$264	$62	$0	**$326**
			0.154	13.15	1.42			0.09	14.66	3.44		18.10

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$3,516,682 D SERVICES											
$3,516,682 D50 ELECTRICAL											
$2,203,620 D5030 COMMUNICATIONS & SECURITY											
$2,203,620 D503001 FIRE ALARM SYSTEMS											
BOH, PUBLIC & ADMINISTRATION AREAS											
72 **Electric metallic tubing (EMT), 3/4" diameter, to 10' high, incl 2 terminations, 2 field bend elbows, 11 beam clamps, and 11 couplings per 100 LF**	**5,580** L.F.	426	$36,398	$10,825	$0	$0	$650	$47,872	$11,240	$0	**$59,113**
		0.076	6.52	1.94			0.12	8.58	2.01		10.59
73 **EMT boxes connectors, compression, steel, 3/4" diameter, to 15' H**	**380** Ea.	34	$2,918	$186	$0	$0	$11	$3,116	$732	$0	**$3,847**
		0.09	7.68	0.49			0.03	8.20	1.93		10.13
74 **Fire alarm cable,#18, 1 pair**	**21.45** C.L.	26	$2,257	$729	$0	$0	$44	$3,030	$711	$0	**$3,741**
		1.23	105.21	33.99			2.04	141.24	33.16		174.40
Memo: https://www.showmecables.com/1-pair-18-awg-solid-											
75 **Fire alarm cable,#14, 1 pair**	**65.34** C.L.	99	$8,462	$3,175	$0	$0	$191	$11,828	$2,777	$0	**$14,606**
		1.514	129.51	48.60			2.92	181.03	42.51		223.53
Memo: https://www.showmecables.com/fire-alarm-cable-2-											
76 **Testing & Commissioning**	**206**	152	$13,004	$0	$0	$0	$0	$13,004	$3,053	$0	**$16,057**
		0.738	63.13					63.13	14.82		77.95
Subtotal			$102,767	$48,478	$0	$0	$2,909	$154,154	$36,195	$0	$190,350
Taxes			$0	$2,909	$0	$0					
Subcontractor Markups			$24,130	$12,066	$0	$0					
TOTAL BOH, PUBLIC & ADMINISTRATION AREAS	**1,201**		**$126,897**	**$63,453**	**$0**	**$0**	**$2,909**	**$154,154**	**$36,195**	**$0**	**$190,350**
65,117.00 SF	*Level Unit Cost-->*		*$1.95*	*$0.97*			*$0.04*	*$2.37*	*$0.56*		*$2.92*
Estimate Tree Structure Rollups											
$3,516,682 D SERVICES											
$3,516,682 D50 ELECTRICAL											
$2,203,620 D5030 COMMUNICATIONS & SECURITY											
$2,203,620 D503001 FIRE ALARM SYSTEMS											
GARAGE											
77 **Detection system, break glass station, addressable, excluding wires & conduits**	**8** Ea.	11	$928	$1,328	$0	$0	$80	$2,336	$549	$0	**$2,885**
		1.357	116.05	166.00			9.96	292.01	68.56		360.57

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$3,516,682 D SERVICES												
$3,516,682 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
GARAGE												
78 Detection system, strobe & horn, ADA type, excluding wires & conduits	**10**	Ea.	19	$1,588	$1,320	$0	$0	$79	$2,987	$701	$0	**$3,688**
			1.856	158.76	132.00			7.92	298.68	70.13		368.81
79 Detection system, visual alarm, ADA type, excluding wires & conduits	**7**	Ea.	10	$879	$812	$0	$0	$49	$1,740	$409	$0	**$2,149**
			1.469	125.62	116.00			6.96	248.58	58.37		306.94
80 Detection system, smoke detector, addressable type, excl. wires & conduit	**2**	Ea.	3	$280	$482	$0	$0	$29	$791	$186	$0	**$977**
			1.64	140.24	241.00			14.46	395.70	92.91		488.61
81 'MM' Detection system, fire alarm control panel,relay module, excluding wires & conduits	**6**	Ea.	8	$696	$352	$0	$0	$21	$1,069	$251	$0	**$1,320**
			1.357	116.05	58.60			3.52	178.16	41.83		219.99
Memo: https://thefirealarmsupplier.us/products/fmm-1-												
82 'REL/CR' Detection system, fire alarm control panel,relay module, excluding wires & conduits	**2**	Ea.	3	$232	$292	$0	$0	$18	$541	$127	$0	**$668**
			1.357	116.05	145.83			8.75	270.63	63.54		334.17
Memo: https://thefirealarmsupplier.us/products/mix-m500rap-												
83 Notification Appliance Power Extender Panel	**2**	Ea.	15	$1,247	$1,927	$0	$0	$116	$3,289	$772	$0	**$4,061**
			7.289	623.47	963.28			57.80	1,644.54	386.14		2,030.68
Memo: https://thefirealarmsupplier.us/products/hpff8-												
84 Detection system, fire alarm signal bell 10" red 20-24 V P	**6**	Ea.	7	$631	$1,230	$0	$0	$74	$1,935	$454	$0	**$2,389**
			1.23	105.21	205.00			12.30	322.51	75.72		398.23
85 Detection system, strobe, weatherproof, excluding wires & conduits	**50**	Ea.	73	$6,281	$7,437	$0	$0	$446	$14,164	$3,326	$0	**$17,490**
			1.469	125.62	148.74			8.92	283.28	66.52		349.80
Memo: https://thefirealarmsupplier.us/products/simplex-49av-												
86 Detection system, strobe & horn, weather proof, ADA type, excluding wires & conduits	**115**	Ea.	213	$18,257	$44,400	$0	$0	$2,664	$65,322	$15,338	$0	**$80,659**
			1.856	158.76	386.09			23.16	568.01	133.37		701.38
Memo: https://www.gordonelectricsupply.com/p/Edwards-												

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$3,516,682 D SERVICES												
$3,516,682 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
GARAGE												
87 Detection system, Manual pull station, weather proof, excluding wires & conduits	**27**	Ea.	37	$3,133	$3,901	$0	$0	$234	$7,269	$1,707	$0	**$8,975**
			1.357	116.04	144.49			8.67	269.20	63.21		332.41
Memo: https://www.gordonelectricsupply.com/p/Edwards-Mpsr1-												
88 Outlet boxes, pressed steel, 4" octagon	**1**	Ea.		$42	$1	$0	$0	$0	$43	$10	$0	**$54**
			0.492	42.08	1.32			0.08	43.48	10.21		53.69
89 Outlet boxes, pressed steel, 4" square	**225**	Ea.	111	$9,469	$464	$0	$0	$28	$9,960	$2,339	$0	**$12,299**
			0.492	42.08	2.06			0.12	44.27	10.39		54.66
90 Outlet boxes, pressed steel, plaster rings, 4" square, concealed	**47**	Ea.	7	$618	$80	$0	$0	$5	$703	$165	$0	**$868**
			0.154	13.15	1.71			0.10	14.96	3.51		18.48
91 Outlet boxes, pressed steel, covers, blank, 4" square	**8**	Ea.	1	$105	$11	$0	$0	$1	$117	$28	$0	**$145**
			0.154	13.15	1.42			0.09	14.66	3.44		18.10
92 Rigid galvanized steel conduit, 3/4" diameter, to 10' H, incl 2 terminations, 2elbows, 11 beam clamps, and 11 couplings per 100 LF	**13,920**	L.F.	1,712	$146,450	$67,373	$0	$0	$4,042	$217,865	$51,155	$0	**$269,019**
			0.123	10.52	4.84			0.29	15.65	3.67		19.33
93 Conduit fittings for rigid galvanized steel, standard, locknuts, 3/4" diameter	**936**	Ea.		$0	$534	$0	$0	$32	$566	$133	$0	**$698**
					0.57			0.03	0.60	0.14		0.75
94 Conduit fittings for rigid galvanized steel, bushings, plastic, 3/4" diameter	**468**	Ea.	144	$12,309	$112	$0	$0	$7	$12,428	$2,918	$0	**$15,347**
			0.308	26.30	0.24			0.01	26.56	6.24		32.79
95 Fire alarm cable,#18, 1 pair	**28.38**	C.L.	35	$2,986	$965	$0	$0	$58	$4,008	$941	$0	**$4,949**
			1.23	105.21	33.99			2.04	141.24	33.16		174.40
Memo: https://www.showmecables.com/1-pair-18-awg-solid-												
96 Fire alarm cable,#14, 1 pair	**207.24**	C.L.	314	$26,840	$10,072	$0	$0	$604	$37,516	$8,809	$0	**$46,325**
			1.514	129.51	48.60			2.92	181.03	42.51		223.53
Memo: https://www.showmecables.com/fire-alarm-cable-2-												

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$3,516,682 D SERVICES												
$3,516,682 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
GARAGE												
97 Testing & Commissioning	**235**		173	$14,834	$0	$0	$0	$0	$14,834	$3,483	$0	**$18,317**
			0.738	63.13					63.13	14.82		77.95
Subtotal				$247,807	$143,092	$0	$0	$8,586	$399,484	$93,799	$0	**$493,283**
Taxes				$0	$8,586	$0	$0					
Subcontractor Markups				$58,185	$35,614	$0	$0					
TOTAL GARAGE	**2,897**			**$305,992**	**$187,291**	**$0**	**$0**	**$8,586**	**$399,484**	**$93,799**	**$0**	**$493,283**
318,322.00 SF			*Level Unit Cost-->*	*$0.96*	*$0.59*			*$0.03*	*$1.25*	*$0.29*		*$1.55*
Estimate Tree Structure Rollups												
$3,516,682 D SERVICES												
$3,516,682 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
MECHANICAL ROOM SPACES												
98 Detection system, break glass station, addressable, excluding wires & conduits	**6**	Ea.	8	$696	$996	$0	$0	$60	$1,752	$411	$0	**$2,163**
			1.357	116.05	166.00			9.96	292.01	68.56		360.57
99 Detection system, strobe & horn, ADA type, excluding wires & conduits	**18**	Ea.	33	$2,858	$2,376	$0	$0	$143	$5,376	$1,262	$0	**$6,639**
			1.856	158.76	132.00			7.92	298.68	70.13		368.81
100 Detection system, visual alarm, ADA type, excluding wires & conduits	**3**	Ea.	4	$377	$348	$0	$0	$21	$746	$175	$0	**$921**
			1.469	125.62	116.00			6.96	248.58	58.37		306.95
101 Detection system, smoke detector, addressable type, excl. wires & conduit	**6**	Ea.	10	$841	$1,446	$0	$0	$87	$2,374	$557	$0	**$2,932**
			1.64	140.24	241.00			14.46	395.70	92.91		488.61
102 'MM' Detection system, fire alarm control panel,relay module, excluding wires & conduits	**27**	Ea.	37	$3,133	$1,582	$0	$0	$95	$4,810	$1,129	$0	**$5,940**
			1.357	116.04	58.60			3.52	178.16	41.83		219.99

Memo: https://thefirealarmsupplier.us/products/fmm-1-

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$3,516,682 D SERVICES												
$3,516,682 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
MECHANICAL ROOM SPACES												
103 **'REL/CR' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**23**	Ea.	31	$2,669	$3,354	$0	$0	$201	$6,224	$1,461	$0	**$7,686**
			1.357	116.04	145.83			8.75	270.62	63.54		334.17
Memo: https://thefirealarmsupplier.us/products/mix-m500rap-												
104 **Detection system, smoke detector, duct type, addressable, excl. wires & conduit**	**2**	Ea.	6	$526	$404	$0	$0	$24	$954	$224	$0	**$1,178**
			3.075	263.02	202.00			12.12	477.14	112.03		589.17
105 **Notification Appliance Power Extender Panel**	**8**	Ea.	58	$4,988	$7,706	$0	$0	$462	$13,156	$3,089	$0	**$16,245**
			7.289	623.46	963.28			57.80	1,644.54	386.14		2,030.68
Memo: https://thefirealarmsupplier.us/products/hpff8-												
106 **Detection system, strobe & horn, weather proof, ADA type, excluding wires & conduits**	**5**	Ea.	9	$794	$1,930	$0	$0	$116	$2,840	$667	$0	**$3,507**
			1.856	158.76	386.09			23.16	568.01	133.37		701.38
Memo: https://www.gordonelectricsupply.com/p/Edwards-												
107 **'FACP' Detection system, fire alarm control panel, addressable with voice, up to 400 points, excluding wires & conduits**	**3**	Ea.	81	$6,946	$34,200	$0	$0	$2,052	$43,198	$10,143	$0	**$53,341**
			27.07	2,315.42	11,400.00			684.00	14,399.42	3,380.98		17,780.40
108 **Mass notification system, wireless command center, PC based, 10,000 devices database**	**1**	Ea.	15	$1,266	$3,175	$0	$0	$191	$4,631	$1,087	$0	**$5,719**
			14.797	1,265.65	3,175.00			190.50	4,631.15	1,087.39		5,718.54
109 **Mass notification system, transmitter, 100 watt**	**1**	Ea.	7	$633	$6,475	$0	$0	$389	$7,496	$1,760	$0	**$9,256**
			7.398	632.83	6,475.00			388.50	7,496.33	1,760.14		9,256.47
110 **Detection system, fire alarm control panel, battery & rack, automatic charger, excluding wires & conduits**	**3**	Ea.	4	$316	$1,770	$0	$0	$106	$2,192	$515	$0	**$2,706**
			1.23	105.21	590.00			35.40	730.61	171.55		902.15
111 **'FAAP' Detection system, annunciator panel**	**3**	Ea.	27	$2,296	$2,700	$0	$0	$162	$5,158	$1,211	$0	**$6,369**
			8.946	765.18	900.00			54.00	1,719.18	403.66		2,122.84
Memo: https://www.buyfirealarmparts.com/shop/lcd280.html												

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$3,516,682 D SERVICES												
$3,516,682 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
MECHANICAL ROOM SPACES												
112 Outlet boxes, pressed steel, 4" octagon	**3**	Ea.	1	$126	$4	$0	$0	$0	$130	$31	$0	**$161**
			0.492	42.08	1.32			0.08	43.48	10.21		53.69
113 Outlet boxes, pressed steel, 4" square	**84**	Ea.	41	$3,535	$173	$0	$0	$10	$3,718	$873	$0	**$4,591**
			0.492	42.08	2.06			0.12	44.27	10.39		54.66
114 Outlet boxes, pressed steel, plaster rings, 4" square, concealed	**25**	Ea.	4	$329	$43	$0	$0	$3	$374	$88	$0	**$462**
			0.154	13.15	1.71			0.10	14.96	3.51		18.48
115 Outlet boxes, pressed steel, covers, blank, 4" square	**35**	Ea.	5	$460	$50	$0	$0	$3	$513	$120	$0	**$633**
			0.154	13.15	1.42			0.09	14.66	3.44		18.10
116 Electric metallic tubing (EMT), 3/4" diameter, to 10' high, incl 2 terminations, 2 field bend elbows, 11 beam clamps, and 11 couplings per 100 LF	**2,610**	L.F.	199	$17,025	$5,063	$0	$0	$304	$22,392	$5,258	$0	**$27,650**
			0.076	6.52	1.94			0.12	8.58	2.01		10.59
117 EMT boxes connectors, compression, steel, 3/4" diameter, to 15' H	**174**	Ea.	16	$1,336	$85	$0	$0	$5	$1,427	$335	$0	**$1,762**
			0.09	7.68	0.49			0.03	8.20	1.93		10.13
118 Fire alarm cable,#18, 1 pair	**20.13**	C.L.	25	$2,118	$684	$0	$0	$41	$2,843	$668	$0	**$3,511**
			1.23	105.21	33.99			2.04	141.24	33.16		174.40
Memo: https://www.showmecables.com/1-pair-18-awg-solid-												
119 Fire alarm cable,#14, 1 pair	**16.17**	C.L.	24	$2,094	$786	$0	$0	$47	$2,927	$687	$0	**$3,614**
			1.514	129.51	48.60			2.92	181.03	42.51		223.53
Memo: https://www.showmecables.com/fire-alarm-cable-2-												

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$3,516,682 D SERVICES												
$3,516,682 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
MECHANICAL ROOM SPACES												
120 Testing & Commissioning	**98**		72	$6,186	$0	$0	$0	$0	$6,186	$1,453	$0	**$7,639**
			0.738	63.13					63.13	14.82		77.95
Subtotal				$61,548	$75,351	$0	$0	$4,521	$141,420	$33,205	$0	**$174,625**
Taxes				$0	$4,521	$0	$0					
Subcontractor Markups				$14,451	$18,754	$0	$0					
TOTAL MECHANICAL ROOM SPACES	**720**			**$75,999**	**$98,626**	**$0**	**$0**	**$4,521**	**$141,420**	**$33,205**	**$0**	**$174,625**
15,138.00 SF			*Level Unit Cost-->*	*$5.02*	*$6.52*			*$0.30*	*$9.34*	*$2.19*		*$11.54*
Estimate Tree Structure Rollups												
$3,516,682 D SERVICES												
$3,516,682 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
FIRE PUMPS & PUMP ROOM PIPING												
121 'MM' Detection system, fire alarm control panel,relay module, excluding wires & conduits	**21**	Ea.	28	$2,437	$1,231	$0	$0	$74	$3,741	$878	$0	**$4,620**
			1.357	116.04	58.60			3.52	178.16	41.83		219.99
Memo: https://thefirealarmsupplier.us/products/fmm-1-												
122 'REL/CR' Detection system, fire alarm control panel,relay module, excluding wires & conduits	**1**	Ea.	1	$116	$146	$0	$0	$9	$271	$64	$0	**$334**
			1.357	116.04	145.83			8.75	270.62	63.54		334.16
Memo: https://thefirealarmsupplier.us/products/mix-m500rap-												
123 Detection system, strobe & horn, weather proof, ADA type, excluding wires & conduits	**2**	Ea.	4	$318	$772	$0	$0	$46	$1,136	$267	$0	**$1,403**
			1.856	158.76	386.09			23.17	568.02	133.37		701.38
Memo: https://www.gordonelectricsupply.com/p/Edwards-												
124 Outlet boxes, pressed steel, 4" square	**24**	Ea.	12	$1,010	$49	$0	$0	$3	$1,062	$249	$0	**$1,312**
			0.492	42.08	2.06			0.12	44.27	10.39		54.66
125 Outlet boxes, pressed steel, covers, blank, 4" square	**22**	Ea.	3	$289	$31	$0	$0	$2	$322	$76	$0	**$398**
			0.154	13.15	1.42			0.09	14.66	3.44		18.10

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$3,516,682 D SERVICES											
$3,516,682 D50 ELECTRICAL											
$2,203,620 D5030 COMMUNICATIONS & SECURITY											
$2,203,620 D503001 FIRE ALARM SYSTEMS											
FIRE PUMPS & PUMP ROOM PIPING											
126 **Electric metallic tubing (EMT), 3/4" diameter, to 10' high, incl 2 terminations, 2 field bend elbows, 11 beam clamps, and 11 couplings per 100 LF**	**720** L.F.	55 0.076	$4,696 6.52	$1,397 1.94	$0	$0	$84 0.12	$6,177 8.58	$1,450 2.01	$0	**$7,627** 10.59
127 **EMT boxes connectors, compression, steel, 3/4" diameter, to 15' H**	**48** Ea.	4 0.09	$369 7.68	$24 0.49	$0	$0	$1 0.03	$394 8.20	$92 1.93	$0	**$486** 10.13
128 **Fire alarm cable,#18, 1 pair**	**7.26** C.L.	9 1.23	$764 105.21	$247 33.99	$0	$0	$15 2.04	$1,025 141.24	$241 33.16	$0	**$1,266** 174.40
Memo: https://www.showmecables.com/1-pair-18-awg-solid-											
129 **Fire alarm cable,#14, 1 pair**	**1.32** C.L.	2 1.514	$171 129.51	$64 48.60	$0	$0	$4 2.92	$239 181.02	$56 42.51	$0	**$295** 223.53
Memo: https://www.showmecables.com/fire-alarm-cable-2-											
130 **Testing & Commissioning**	**24**	18 0.738	$1,515 63.13	$0	$0	$0	$0	$1,515 63.13	$356 14.82	$0	**$1,871** 77.95
Subtotal			$11,685	$3,961	$0	$0	$238	$15,883	$3,729	$0	**$19,612**
Taxes			$0	$238	$0	$0					
Subcontractor Markups			$2,744	$986	$0	$0					
TOTAL FIRE PUMPS & PUMP ROOM PIPING **1.00 EA**	**137**		**$14,428**	**$5,184**	**$0**	**$0**	**$238**	**$15,883**	**$3,729**	**$0**	**$19,612**
Estimate Tree Structure Rollups											
$6,493,593 CONCEPT 1											
$597,917 F SPECIAL CONSTRUCTION & DEMOLITION											
$597,917 F20 SELECTIVE BUILDING DEMOLITION											
$78,434 F2010 BUILDING ELEMENTS DEMOLITION											
F201004 INTERIOR CONSTRUCTION & FINISHES											
131 **Walls and partitions demolition, metal or wood studs, finish two sides, plasterboard (gypsum wallboard)**	**96** S.F.	5 0.055	$172 1.79	$0	$0	$0	$0	$172 1.79	$55 0.58	$0	**$227** 2.37

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$6,493,593 CONCEPT 1												
$597,917 F SPECIAL CONSTRUCTION & DEMOLITION												
$597,917 F20 SELECTIVE BUILDING DEMOLITION												
$78,434 F2010 BUILDING ELEMENTS DEMOLITION												
F201004 INTERIOR CONSTRUCTION & FINISHES												
Subtotal				$172	$0	$0	$0	$0	$172	$55	$0	**$227**
Subcontractor Markups				$55	$0	$0	$0					
TOTAL F201004 INTERIOR CONSTRUCTION & FINISHES	**5**			**$227**	**$0**	**$0**	**$0**	**$0**	**$172**	**$55**	**$0**	**$227**
1.00 LS												
Estimate Tree Structure Rollups												
$6,493,593 CONCEPT 1												
$597,917 F SPECIAL CONSTRUCTION & DEMOLITION												
$597,917 F20 SELECTIVE BUILDING DEMOLITION												
$78,434 F2010 BUILDING ELEMENTS DEMOLITION												
F201007 ELECTRICAL SYSTEMS												
132 **Fire alarm control panel, 12 to 16 zone, electrical demolition, remove**	**3**	Ea.	22	$1,892	$0	$0	$0	$0	$1,892	$444	$0	**$2,336**
			7.371	630.51					630.51	148.04		778.56
133 **Fire alarm bell, electrical demolition, remove**	**207**	Ea.	127	$10,889	$0	$0	$0	$0	$10,889	$2,557	$0	**$13,446**
			0.615	52.60					52.60	12.35		64.95
134 **Fire alarm pull station, electrical demolition, remove**	**206**	Ea.	88	$7,542	$0	$0	$0	$0	$7,542	$1,771	$0	**$9,313**
			0.428	36.61					36.61	8.60		45.21
135 **Smoke detector, electrical demolition, remove**	**595**	Ea.	255	$21,784	$0	$0	$0	$0	$21,784	$5,115	$0	**$26,899**
			0.428	36.61					36.61	8.60		45.21
136 **Junction boxes, 4" square & octagon, electrical demolition, remove, including removal of supports and terminations**	**415**	Ea.	51	$4,366	$0	$0	$0	$0	$4,366	$1,025	$0	**$5,391**
			0.123	10.52					10.52	2.47		12.99
137 **Conduit, electric metallic tubing (EMT), 1/2" to 1" diameter, electrical demolition, remove conduit to 10' high, including fittings & hangers**	**960**	L.F.	24	$2,020	$0	$0	$0	$0	$2,020	$474	$0	**$2,494**
			0.025	2.10					2.10	0.49		2.60
138 **Conduit, rigid galvanized steel, 1/2" to 1" diameter, electrical demolition, remove conduit to 10' high, including fittings & hangers**	**3,030**	L.F.	123	$10,520	$0	$0	$0	$0	$10,520	$2,470	$0	**$12,990**
			0.041	3.47					3.47	0.81		4.29

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$6,493,593 CONCEPT 1												
$597,917 F SPECIAL CONSTRUCTION & DEMOLITION												
$597,917 F20 SELECTIVE BUILDING DEMOLITION												
$78,434 F2010 BUILDING ELEMENTS DEMOLITION												
F201007 ELECTRICAL SYSTEMS												
139 **Fire Alarm Cable, electrical demolition, remove**	**13,695**	L.F.	51	$4,322	$0	$0	$0	$0	$4,322	$1,015	$0	**$5,337**
			0.004	0.32					0.32	0.07		0.39
Subtotal				$63,335	$0	$0	$0	$0	$63,335	$14,871	$0	**$78,207**
Subcontractor Markups				$14,871	$0	$0	$0					
TOTAL F201007 ELECTRICAL SYSTEMS	**740**			**$78,207**	**$0**	**$0**	**$0**	**$0**	**$63,335**	**$14,871**	**$0**	**$78,207**
1.00 LS												
Estimate Tree Structure Rollups												
$11,872,674 FIRE ALARM - START 3/1/2024												
$6,493,593 CONCEPT 1												
$597,917 F SPECIAL CONSTRUCTION & DEMOLITION												
$597,917 F20 SELECTIVE BUILDING DEMOLITION												
F2020 HAZARDOUS COMPONENTS ABATEMENT												
140 **Asbestos abatement equipment, respirator, single use**	**88**	Ea.		$0	$176	$0	$0	$11	$187	$50	$0	**$237**
					2.00			0.12	2.12	0.57		2.69
Memo: 4 workers for 22 days												
141 **Asbestos abatement equipment, respirator, single use, cartridge**	**88**	Ea.		$0	$1,276	$0	$0	$77	$1,353	$362	$0	**$1,715**
					14.50			0.87	15.37	4.12		19.49
Memo: 4 workers for 20 days												
142 **Asbestos abatement equipment, worker protection, whole body, foot, head cover &gloves, plastic**	**176**	Ea.		$0	$1,866	$0	$0	$112	$1,978	$530	$0	**$2,507**
					10.60			0.64	11.24	3.01		14.25
Memo: 4 workers for 20 days x 2												
143 **Preparation of asbestos containment area, cover surfaces with polyethylene sheeting, floors, each layer, 4 mil, incl. glue & tape**	**35,918**	S.F.	309	$24,069	$2,155	$0	$0	$129	$26,353	$7,059	$0	**$33,413**
			0.009	0.67	0.06				0.73	0.20		0.93
144 **Preparation of asbestos containment area, cover surfaces with polyethylene sheeting, walls, each layer, 4 mil, incl. glue & tape**	**190,684**	S.F.	2,111	$164,287	$11,441	$0	$0	$686	$176,415	$47,257	$0	**$223,672**
			0.011	0.86	0.06				0.93	0.25		1.17

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$11,872,674 *FIRE ALARM - START 3/1/2024*											
$6,493,593 *CONCEPT 1*											
$597,917 *F SPECIAL CONSTRUCTION & DEMOLITION*											
$597,917 *F20 SELECTIVE BUILDING DEMOLITION*											
F2020 HAZARDOUS COMPONENTS ABATEMENT											
145 **Preparation of asbestos containment area, caulk seams with latex**	**24,153** L.F.	1,040 0.043	$56,885 2.36	$5,072 0.21	$0	$0	$304 0.01	$62,261 2.58	$16,678 0.69	$0	**$78,940** 3.27
Memo: =(680)/32=22*12=264*5=13200lf											
146 **Preparation of asbestos containment area, separation barrier, 2" x 4" @ 16", 1/2" plywood each side, 12' high**	**5,920** S.F.	364 0.062	$19,918 3.37	$28,712 4.85	$0	$0	$1,723 0.29	$50,353 8.51	$13,488 2.28	$0	**$63,841** 10.78
147 **Cover floor surface with tarpaulins, polyvinyl coated nylon, 14 oz. to 18 oz., min**	**2,824** S.F.	27 0.01	$2,110 0.75	$3,841 1.36	$0	$0	$230 0.08	$6,181 2.19	$1,656 0.59	$0	**$7,837** 2.77
Memo: 2 layer x floor area											
148 **Selective demolition, saw cutting, masonry walls, brick, per inch of depth, hydraulic saw**	**33** EA	14 0.435	$703 21.31	$12 0.36	$997 30.20	$0	$61 1.83	$1,772 53.70	$475 14.38	$0	**$2,247** 68.08
149 **Concrete core drilling, core, reinforced concrete slab, 1" diameter, up to 6" thick slab, includes bit cost, layout and set up time**	**565** Ea.	654 1.157	$31,376 55.53	$124 0.22	$4,749 8.41	$0	$292 0.52	$36,542 64.68	$9,789 17.32	$0	**$46,331** 82.00
150 **Concrete core drilling, core, reinforced concrete slab, 1" diameter, up to 6" thick slab, includes bit cost, layout and set up time, for each additional**	**1,130** Ea.	15 0.014	$734 0.65	$45 0.04	$111 0.10	$0	$9 0.01	$899 0.80	$241 0.21	$0	**$1,140** 1.01
151 **Demolition in asbestos contaminated area, popcorn ceiling**	**1,412** S.F.	108 0.077	$8,440 5.98	$282 0.20	$0	$0	$17 0.01	$8,739 6.19	$2,341 1.66	$0	**$11,080** 7.85
152 **Asbestos encapsulation with sealants, ceilings & walls, max**	**1,412** S.F.	15 0.011	$1,187 0.84	$734 0.52	$0	$0	$44 0.03	$1,965 1.39	$526 0.37	$0	**$2,492** 1.76
153 **Asbestos abate equip, disposable fiber drums, 55 Gal**	**210** Ea.		$0	$3,822 18.20	$0	$0	$229 1.09	$4,051 19.29	$1,085 5.17	$0	**$5,137** 24.46
154 **Asbestos abatement equipment, pressure sensitive caution labels, 3" x 5"**	**210** Ea.		$0	$685 3.26	$0	$0	$41 0.20	$726 3.46	$194 0.93	$0	**$920** 4.38

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$11,872,674 *FIRE ALARM - START 3/1/2024*												
$6,493,593 *CONCEPT 1*												
$597,917 *F SPECIAL CONSTRUCTION & DEMOLITION*												
$597,917 *F20 SELECTIVE BUILDING DEMOLITION*												
F2020 HAZARDOUS COMPONENTS ABATEMENT												
155 **Decontamination of asbestos containment area, bag polyethylene sheeting**	**260**	Ea.	51	$3,982	$369	$0	$0	$22	$4,374	$1,172	$0	**$5,545**
			0.197	15.32	1.42			0.09	16.82	4.51		21.33
Memo: Assume 3 bags per drum												
156 **Asbestos abatement equipment & supplies, buy, shower unit, incl. pump & filters**	**5**	Ea.		$0	$4,825	$0	$0	$290	$5,115	$1,370	$0	**$6,485**
					965.00			57.90	1,022.90	274.01		1,296.91
Memo: 1 shower unit to be move to different floors												
157 **Preparation of asbestos containment area, set up and remove portable shower unit**	**5**	Ea.	25	$1,913	$0	$0	$0	$0	$1,913	$512	$0	**$2,426**
			4.92	382.61					382.61	102.49		485.10
Memo: 1 shower unit to be move to different floors												
158 **Asbestos abatement equipment & supplies, buy, vacuum cleaner, HEPA, stainless steel, wet/dry, 16 gal.**	**4**	Ea.		$0	$5,800	$0	$0	$348	$6,148	$1,647	$0	**$7,795**
					1,450.00			87.00	1,537.00	411.72		1,948.72
Memo: Assuming 4 workers working in 4 locations at the same												
159 **Decontamination of asbestos containment area, spray exposed substrate with surfactant (bridging), flat surfaces**	**1,412**	S.F.	19	$1,451	$635	$0	$0	$38	$2,124	$569	$0	**$2,693**
			0.013	1.03	0.45			0.03	1.50	0.40		1.91
Memo: If assuming floor abatement use 100 sf area												
160 **Decontamination of asbestos containment area, final cleaning of protected surfaces**	**4,424**	S.F.	16	$1,241	$0	$0	$0	$0	$1,241	$332	$0	**$1,574**
			0.004	0.28					0.28	0.07		0.36
Memo: Includes abatement area and immediate area (wall or												
161 **Preparation of asbestos containment area, personnel decontamination chamber, 2"x 4" @ 16", 3/4" plywood each side**	**50**	S.F.	3	$187	$298	$0	$0	$18	$502	$135	$0	**$637**
			0.068	3.74	5.95			0.36	10.05	2.69		12.74

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$11,872,674 FIRE ALARM - START 3/1/2024											
$6,493,593 CONCEPT 1											
$597,917 F SPECIAL CONSTRUCTION & DEMOLITION											
$597,917 F20 SELECTIVE BUILDING DEMOLITION											
F2020 HAZARDOUS COMPONENTS ABATEMENT											
162 **Asbestos waste packaging, handling & disposal, disposal charges, excl. haul, min**	**132** C.Y		$0	$8,052	$0	$0	$483	$8,535	$2,286	$0	**$10,821**
				61.00			3.66	64.66	17.32		81.98
Subtotal			$318,483	$80,222	$5,857	$0	$5,165	$409,727	$109,756	$0	**$519,483**
Taxes			$0	$4,813	$351	$0					
Subcontractor Markups			$85,314	$22,779	$1,663	$0					
TOTAL F2020 HAZARDOUS COMPONENTS ABATEMENT	**4,772**		**$403,797**	**$107,814**	**$7,871**	**$0**	**$5,165**	**$409,727**	**$109,756**	**$0**	**$519,483**
1.00 LS											
Estimate Tree Structure Rollups											
$5,379,080 CONCEPT 2											
$2,577,544 C INTERIORS											
$2,559,276 C10 INTERIOR CONSTRUCTION											
$279,926 C1010 PARTITIONS											
C1010145A PARTITION W1											
163 **Firestopping, construction joints, floor slab to drywall partition**	**84** L.F.	8	$452	$1,243	$0	$0	$75	$1,770	$572	$0	**$2,342**
		0.098	5.38	14.80			0.89	21.07	6.81		27.88
164 **Gypsum wallboard, on walls, fire resistant, 5/8" thick, finish excluded**	**218** S.F.	2	$117	$89	$0	$0	$5	$212	$69	$0	**$281**
		0.01	0.54	0.41			0.03	0.97	0.31		1.29
165 **Sound attenuation blanket, 3" thick**	**109** S.F.	1	$66	$82	$0	$0	$5	$153	$49	$0	**$202**
		0.011	0.61	0.75			0.04	1.40	0.45		1.85
166 **Metal stud partition, non-load bearing, galvanized, 3-5/8" wide, 20 gauge, 16" OC, includes top & bottom track**	**109** S.F.	3	$154	$146	$0	$0	$9	$309	$100	$0	**$409**
		0.026	1.41	1.34			0.08	2.83	0.92		3.75

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$5,379,080 CONCEPT 2											
$2,577,544 C INTERIORS											
$2,559,276 C10 INTERIOR CONSTRUCTION											
$279,926 C1010 PARTITIONS											
C1010145A PARTITION W1											
167 **Channels, cold rolled, galvanized, 16 ga., 3/4" deep**	**10.90** C.L.		$0	$545	$0	$0	$33	$578	$187	$0	**$764**
				50.00			3.00	53.00	17.12		70.12
Subtotal			$790	$2,105	$0	$0	$126	$3,021	$976	$0	$3,997
Taxes			$0	$126	$0	$0					
Subcontractor Markups			$255	$721	$0	$0					
TOTAL C1010145A PARTITION W1	**14**		**$1,045**	**$2,953**	**$0**	**$0**	**$126**	**$3,021**	**$976**	**$0**	$3,997
109.00 SF	*Level Unit Cost-->*		*$9.58*	*$27.09*			*$1.16*	*$27.72*	*$8.95*		*$36.67*
Estimate Tree Structure Rollups											
$5,379,080 CONCEPT 2											
$2,577,544 C INTERIORS											
$2,559,276 C10 INTERIOR CONSTRUCTION											
$279,926 C1010 PARTITIONS											
C1010145B PARTITION W2											
168 **Firestopping, construction joints, floor slab to drywall partition**	**80** L.F.	8	$431	$1,184	$0	$0	$71	$1,686	$544	$0	**$2,230**
		0.098	5.38	14.80			0.89	21.07	6.81		27.88
169 **Gypsum wallboard, on walls, fire resistant, 5/8" thick, finish excluded**	**198** S.F.	2	$107	$81	$0	$0	$5	$193	$62	$0	**$255**
		0.01	0.54	0.41			0.03	0.97	0.31		1.29
170 **Sound attenuation blanket, 3" thick**	**99** S.F.	1	$60	$74	$0	$0	$4	$139	$45	$0	**$183**
		0.011	0.61	0.75			0.04	1.40	0.45		1.85
171 **Metal stud partition, non-load bearing, galvanized, 3-5/8" wide, 20 gauge, 16" OC, includes top & bottom track**	**99** S.F.	3	$140	$133	$0	$0	$8	$281	$91	$0	**$371**
		0.026	1.41	1.34			0.08	2.83	0.92		3.75

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$5,379,080 CONCEPT 2												
$2,577,544 C INTERIORS												
$2,559,276 C10 INTERIOR CONSTRUCTION												
$279,926 C1010 PARTITIONS												
C1010145B PARTITION W2												
172 **Channels, cold rolled, galvanized, 16 ga., 3/4" deep**	**9.90**	C.L.		$0	$495	$0	$0	$30	$525	$169	$0	**$694**
					50.00			3.00	53.00	17.12		70.12
Subtotal				$737	$1,967	$0	$0	$118	$2,822	$912	$0	$3,734
Taxes				$0	$118	$0	$0					
Subcontractor Markups				$238	$673	$0	$0					
TOTAL C1010145B PARTITION W2	**13**			**$975**	**$2,759**	**$0**	**$0**	**$118**	**$2,822**	**$912**	**$0**	$3,734
99.00 SF			*Level Unit Cost-->*	*$9.85*	*$27.86*			*$1.19*	*$28.51*	*$9.21*		*$37.72*
Estimate Tree Structure Rollups												
$5,379,080 CONCEPT 2												
$2,577,544 C INTERIORS												
$2,559,276 C10 INTERIOR CONSTRUCTION												
$279,926 C1010 PARTITIONS												
C1010145C PILASTER												
173 **U-Shield 6"h x 12"w x 6"h (00" Perimeter) @ 10' ht, 20 Gauge material**	**572**	EA	1,055	$74,176	$113,771	$0	$0	$6,826	$194,773	$62,912	$0	**$257,685**
			1.845	129.68	198.90			11.93	340.51	109.99		450.50
174 **Laser Cut holes for installation of electrical boxes**	**919.73**	EA		$0	$10,347	$0	$0	$621	$10,968	$3,543	$0	**$14,510**
					11.25			0.68	11.93	3.85		15.78
Subtotal				$74,176	$124,118	$0	$0	$7,447	$205,741	$66,454	$0	$272,195
Taxes				$0	$7,447	$0	$0					
Subcontractor Markups				$23,959	$42,495	$0	$0					
TOTAL C1010145C PILASTER	**1,055**			**$98,135**	**$174,060**	**$0**	**$0**	**$7,447**	**$205,741**	**$66,454**	**$0**	$272,195
572.00 EA			*Level Unit Cost-->*	*$171.56*	*$304.30*			*$13.02*	*$359.69*	*$116.18*		*$475.87*

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$5,379,080 CONCEPT 2												
$2,577,544 C INTERIORS												
$2,559,276 C10 INTERIOR CONSTRUCTION												
$3,592 C1020 INTERIOR DOORS												
C1020300 INTERIOR DOORS AND FRAMES												
175 **Doors, fire, flush, "B" label, 90 minutes, composite, 20 ga., 3'-0" x 7'-0"**	1	Ea.	1	$67	$1,025	$0	$0	$62	$1,154	$373	$0	**$1,526**
			1.23	67.29	1,025.00			61.50	1,153.79	372.68		1,526.46
176 **Frames, steel, knock down, hollow metal, single, 90 minutes, 14 ga., up to 3-7/8" deep, 3'-0" x 7'-0"**	1	Ea.	1	$67	$465	$0	$0	$28	$560	$181	$0	**$741**
			1.23	67.29	465.00			27.90	560.19	180.94		741.13
Subtotal				$135	$1,490	$0	$0	$89	$1,714	$554	$0	**$2,268**
Taxes				$0	$89	$0	$0					
Subcontractor Markups				$43	$510	$0	$0					
TOTAL C1020300 INTERIOR DOORS AND FRAMES	**2**			**$178**	**$2,090**	**$0**	**$0**	**$89**	**$1,714**	**$554**	**$0**	**$2,268**
1.00 EA												
Estimate Tree Structure Rollups												
$5,379,080 CONCEPT 2												
$2,577,544 C INTERIORS												
$2,559,276 C10 INTERIOR CONSTRUCTION												
$3,592 C1020 INTERIOR DOORS												
C1020400 DOOR HARDWARE												
177 **Door hardware, single, interior, regular use, incl. lever handle**	1	Door	3	$179	$775	$0	$0	$47	$1,001	$323	$0	**$1,324**
			3.28	179.47	775.00			46.50	1,000.97	323.31		1,324.28
Subtotal				$179	$775	$0	$0	$47	$1,001	$323	$0	**$1,324**
Taxes				$0	$47	$0	$0					
Subcontractor Markups				$58	$265	$0	$0					
TOTAL C1020400 DOOR HARDWARE	**3**			**$237**	**$1,087**	**$0**	**$0**	**$47**	**$1,001**	**$323**	**$0**	**$1,324**
1.00 EA												

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$5,379,080 CONCEPT 2											
$2,577,544 C INTERIORS											
$2,559,276 C10 INTERIOR CONSTRUCTION											
$2,275,758 C1030 SPECIALTIES											
C1030A IDENTIFYING DEVICES											
178 **Signs, flexible door sign, adhesive back, w/Braille, 5/8" letters, 8" x 4"**	**2** Ea.	1	$20	$126	$0	$0	$8	$153	$0	$0	**$153**
		0.308	9.76	63.00			3.78	76.54			76.54
Taxes			$0	$8	$0	$0					
TOTAL C1030A IDENTIFYING DEVICES	**1**		**$20**	**$134**	**$0**	**$0**	**$8**	**$153**	**$0**	**$0**	**$153**
2.00 EA	*Level Unit Cost-->*		*$9.76*	*$66.78*			*$3.78*	*$76.54*			*$76.54*
Estimate Tree Structure Rollups											
$5,379,080 CONCEPT 2											
$2,577,544 C INTERIORS											
$2,559,276 C10 INTERIOR CONSTRUCTION											
$2,275,758 C1030 SPECIALTIES											
C1030B RAILING											
179 **Railing, pipe, aluminum, 2 rails, 3'-6" high, posts @ 4' OC, 1-1/2" diameter, shop fabricated**	**54** L.F.	13	$940	$3,942	$59	$0	$240	$5,181	$1,674	$0	**$6,855**
		0.246	17.41	73.00	1.09		4.45	95.95	30.99		126.94
180 **Prime railingwith Rustoleum Primer**	**54** L.F.	1	$37	$3	$0	$0	$0	$40	$13	$0	**$52**
		0.015	0.68	0.05				0.73	0.24		0.97
181 **Paints & coatings, pipe railing, paint 2 coats, spray**	**54** S.F.	1	$40	$21	$0	$0	$1	$62	$20	$0	**$82**
		0.016	0.74	0.39			0.02	1.15	0.37		1.52
Subtotal			$1,017	$3,966	$59	$0	$241	$5,283	$1,706	$0	$6,989
Taxes			$0	$238	$4	$0					
Subcontractor Markups			$328	$1,358	$20	$0					
TOTAL C1030B RAILING	**15**		**$1,345**	**$5,562**	**$83**	**$0**	**$241**	**$5,283**	**$1,706**	**$0**	**$6,989**
54.00 LF	*Level Unit Cost-->*		*$24.91*	*$102.99*	*$1.53*		*$4.47*	*$97.83*	*$31.60*		*$129.43*

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$5,379,080 CONCEPT 2											
$2,577,544 C INTERIORS											
$2,559,276 C10 INTERIOR CONSTRUCTION											
$2,275,758 C1030 SPECIALTIES											
C1030C INTERIOR SOFFIT											
182 **Add soffit in the unit**	**32,004** L.F.	7,873	$430,717	$513,344	$0	$0	$30,801	$974,862	$314,880	$0	**$1,289,743**
		0.246	13.46	16.04			0.96	30.46	9.84		40.30
183 **Add soffit in the hallway**	**24,290** L.F.	5,975	$326,900	$389,612	$0	$0	$23,377	$739,889	$238,984	$0	**$978,873**
		0.246	13.46	16.04			0.96	30.46	9.84		40.30
Subtotal			$757,618	$902,956	$0	$0	$54,177	$1,714,751	$553,865	$0	**$2,268,615**
Taxes			$0	$54,177	$0	$0					
Subcontractor Markups			$244,711	$309,154	$0	$0					
TOTAL C1030C INTERIOR SOFFIT	**13,848**		**$1,002,328**	**$1,266,287**	**$0**	**$0**	**$54,177**	**$1,714,751**	**$553,865**	**$0**	**$2,268,615**
56,294.00 LF	*Level Unit Cost-->*		*$17.81*	*$22.49*			*$0.96*	*$30.46*	*$9.84*		*$40.30*
Estimate Tree Structure Rollups											
$11,872,674 FIRE ALARM - START 3/1/2024											
$5,379,080 CONCEPT 2											
$2,577,544 C INTERIORS											
$18,268 C30 INTERIOR FINISHES											
C3010 WALL FINISHES											
184 **Painting walls, complete, on drywall or plaster, primer and 2 finish coats, with roller, including surface preparation**	**4,493** S.F.	135	$6,204	$1,977	$0	$0	$119	$8,300	$2,681	$0	**$10,980**
		0.03	1.38	0.44			0.03	1.85	0.60		2.44
Subtotal			$6,204	$1,977	$0	$0	$119	$8,300	$2,681	$0	**$10,980**
Taxes			$0	$119	$0	$0					
Subcontractor Markups			$2,004	$677	$0	$0					
TOTAL C3010 WALL FINISHES	**135**		**$8,208**	**$2,772**	**$0**	**$0**	**$119**	**$8,300**	**$2,681**	**$0**	**$10,980**
4,493.00 SF	*Level Unit Cost-->*		*$1.83*	*$0.62*			*$0.03*	*$1.85*	*$0.60*		*$2.44*

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$11,872,674 *FIRE ALARM - START 3/1/2024*											
$5,379,080 *CONCEPT 2*											
$2,577,544 *C INTERIORS*											
$16,268 *C30 INTERIOR FINISHES*											
C3030 CEILING FINISHES											
185 **Patch & Repair existing ceiling nearwall demo**	**30** S.F.	4	$202	$120	$0	$0	$7	$329	$106	$0	**$435**
		0.123	6.73	4.00			0.24	10.97	3.54		14.51
186 **Surface preparation, interior, ceiling, Patch & Prep for new finish**	**1,412** S.F.	52	$2,398	$635	$0	$0	$38	$3,072	$992	$0	**$4,064**
		0.037	1.70	0.45			0.03	2.17	0.70		2.88
187 **Paints & coatings, walls & ceilings, interior, concrete, drywall or plaster, zero voc latex, 3 coats, smooth finish, spray**	**1,412** S.F.	35	$1,599	$480	$0	$0	$29	$2,108	$681	$0	**$2,788**
		0.025	1.13	0.34			0.02	1.49	0.48		1.98
Subtotal			$4,199	$1,235	$0	$0	$74	$5,508	$1,779	$0	**$7,288**
Taxes			$0	$74	$0	$0					
Subcontractor Markups			$1,356	$423	$0	$0					
TOTAL C3030 CEILING FINISHES	**91**		**$5,555**	**$1,733**	**$0**	**$0**	**$74**	**$5,508**	**$1,779**	**$0**	**$7,288**
1,442.00 SF *Level Unit Cost-->*			*$3.85*	*$1.20*			*$0.05*	*$3.82*	*$1.23*		*$5.05*
Estimate Tree Structure Rollups											
$2,203,620 *D SERVICES*											
$2,203,620 *D50 ELECTRICAL*											
$2,203,620 *D5030 COMMUNICATIONS & SECURITY*											
$2,203,620 *D503001 FIRE ALARM SYSTEMS*											
TENANT TOWER											
188 **Detection system, break glass station, addressable, excluding wires & conduits**	**145** Ea.	197	$16,826	$24,070	$0	$0	$1,444	$42,341	$9,942	$0	**$52,282**
		1.357	116.04	166.00			9.96	292.00	68.56		360.57
189 **Detection system, strobe & horn, ADA type, excluding wires & conduits**	**308** Ea.	572	$48,898	$40,656	$0	$0	$2,439	$91,993	$21,600	$0	**$113,593**
		1.856	158.76	132.00			7.92	298.68	70.13		368.81
190 **Detection system, visual alarm, ADA type, excluding wires & conduits**	**61** Ea.	90	$7,663	$7,076	$0	$0	$425	$15,163	$3,560	$0	**$18,724**
		1.469	125.62	116.00			6.96	248.58	58.37		306.94
191 **Detection system, smoke detector, addressable type, excl. wires & conduit**	**526** Ea.	862	$73,767	$126,766	$0	$0	$7,606	$208,139	$48,871	$0	**$257,011**
		1.64	140.24	241.00			14.46	395.70	92.91		488.61

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$2,203,620 D SERVICES												
$2,203,620 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
TENANT TOWER												
192 **'MM' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**4**	Ea.	5	$464	$234	$0	$0	$14	$713	$167	$0	**$880**
			1.357	116.05	58.60			3.52	178.16	41.83		219.99
Memo: https://thefirealarmsupplier.us/products/fmm-1-												
193 **'REL/CR' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**2**	Ea.	3	$232	$292	$0	$0	$18	$541	$127	$0	**$668**
			1.357	116.05	145.83			8.75	270.63	63.54		334.17
Memo: https://thefirealarmsupplier.us/products/mix-m500rap-												
194 **Door closer, electric automatic operators, surface mounted, universal heavy duty, regular arm**	**2**	Ea.	3	$179	$700	$0	$0	$42	$921	$216	$0	**$1,138**
			1.64	89.70	350.00			21.00	460.70	108.17		568.87
195 **Detection system, strobe, weatherproof, excluding wires & conduits**	**1**	Ea.	1	$126	$149	$0	$0	$9	$283	$67	$0	**$350**
			1.469	125.62	148.74			8.92	283.28	66.52		349.80
Memo: https://thefirealarmsupplier.us/products/simplex-49av-												
196 **Smoke alarm photoelectric - battery powered**	**1,087**	Ea.	445	$38,082	$52,176	$0	$0	$3,131	$93,389	$21,928	$0	**$115,317**
			0.41	35.03	48.00			2.88	85.91	20.17		106.09
197 **Smoke alarm photoelectric -120V wired**	**785**	Ea.	643	$55,004	$50,570	$0	$0	$3,034	$108,608	$25,501	$0	**$134,109**
			0.819	70.07	64.42			3.87	138.35	32.48		170.84
Memo: https://www.gsaadvantage.gov/advantage/ws/catalog/prod												
198 **Speaker - battery powered**	**1,442**	Ea.	591	$50,519	$69,216	$0	$0	$4,153	$123,888	$29,089	$0	**$152,977**
			0.41	35.03	48.00			2.88	85.91	20.17		106.09
199 **Surface raceway, metal, straight section, no. 1000**	**17,000**	L.F.	1,861	$159,180	$39,440	$0	$0	$2,366	$200,986	$47,192	$0	**$248,178**
			0.109	9.36	2.32			0.14	11.82	2.78		14.60
200 **Outlet boxes, pressed steel, 4" octagon**	**470**	Ea.	231	$19,779	$620	$0	$0	$37	$20,437	$4,799	$0	**$25,235**
			0.492	42.08	1.32			0.08	43.48	10.21		53.69

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$2,203,620 D SERVICES												
$2,203,620 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
TENANT TOWER												
201 **Outlet boxes, pressed steel, 4" square**	**521**	Ea.	256	$21,925	$1,073	$0	$0	$64	$23,063	$5,415	$0	**$28,478**
			0.492	42.08	2.06			0.12	44.27	10.39		54.66
202 **Outlet boxes, pressed steel, plaster rings, 4" square, concealed**	**497**	Ea.	76	$6,536	$850	$0	$0	$51	$7,437	$1,746	$0	**$9,183**
			0.154	13.15	1.71			0.10	14.96	3.51		18.48
203 **Outlet boxes, pressed steel, covers, blank, 4" square**	**6**	Ea.	1	$79	$9	$0	$0	$1	$88	$21	$0	**$109**
			0.154	13.15	1.42			0.09	14.66	3.44		18.10
204 **Fire alarm cable,#18, 1 pair**	**204.93**	C.L.	252	$21,560	$6,966	$0	$0	$418	$28,944	$6,796	$0	**$35,740**
			1.23	105.21	33.99			2.04	141.24	33.16		174.40
Memo: https://www.showmecables.com/1-pair-18-awg-solid-												
205 **Fire alarm cable,#14, 1 pair**	**223.74**	C.L.	339	$28,977	$10,874	$0	$0	$652	$40,503	$9,510	$0	**$50,013**
			1.514	129.51	48.60			2.92	181.03	42.51		223.53
Memo: https://www.showmecables.com/fire-alarm-cable-2-												
206 **Testing & Commisioning**	**1,049**		774	$66,218	$0	$0	$0	$0	$66,218	$15,548	$0	**$81,766**
			0.738	63.13					63.13	14.82		77.95
Subtotal				$616,015	$431,736	$0	$0	$25,904	$1,073,655	$252,094	$0	**$1,325,750**
Taxes				$0	$25,904	$0	$0					
Subcontractor Markups				$144,640	$107,454	$0	$0					
TOTAL TENANT TOWER	**7,203**			**$760,656**	**$565,094**	**$0**	**$0**	**$25,904**	**$1,073,655**	**$252,094**	**$0**	**$1,325,750**
969,696.00 SF			*Level Unit Cost-->*	*$0.78*	*$0.58*			*$0.03*	*$1.11*	*$0.26*		*$1.37*

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$2,203,620 D SERVICES												
$2,203,620 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
BOH, PUBLIC & ADMINISTRATION AREAS												
207 Detection system, break glass station, addressable, excluding wires & conduits	**21**	Ea.	28	$2,437	$3,486	$0	$0	$209	$6,132	$1,440	$0	**$7,572**
			1.357	116.04	166.00			9.96	292.00	68.56		360.57
208 Detection system, strobe & horn, ADA type, excluding wires & conduits	**72**	Ea.	134	$11,431	$9,504	$0	$0	$570	$21,505	$5,049	$0	**$26,554**
			1.856	158.76	132.00			7.92	298.68	70.13		368.81
209 Detection system, visual alarm, ADA type, excluding wires & conduits	**52**	Ea.	76	$6,532	$6,032	$0	$0	$362	$12,926	$3,035	$0	**$15,961**
			1.469	125.62	116.00			6.96	248.58	58.37		306.94
210 Detection system, smoke detector, addressable type, excl. wires & conduit	**29**	Ea.	48	$4,067	$6,989	$0	$0	$419	$11,475	$2,694	$0	**$14,170**
			1.64	140.24	241.00			14.46	395.70	92.91		488.61
211 'MM' Detection system, fire alarm control panel,relay module, excluding wires & conduits	**1**	Ea.	1	$116	$59	$0	$0	$4	$178	$42	$0	**$220**
			1.357	116.04	58.60			3.52	178.16	41.83		219.99
Memo: https://thefirealarmsupplier.us/products/fmm-1-												
212 'REL/CR' Detection system, fire alarm control panel,relay module, excluding wires & conduits	**9**	Ea.	12	$1,044	$1,312	$0	$0	$79	$2,436	$572	$0	**$3,008**
			1.357	116.04	145.83			8.75	270.62	63.54		334.17
Memo: https://thefirealarmsupplier.us/products/mix-m500rap-												
213 Detection system, strobe, weatherproof, excluding wires & conduits	**1**	Ea.	1	$126	$149	$0	$0	$9	$283	$67	$0	**$350**
			1.469	125.62	148.74			8.92	283.28	66.52		349.80
Memo: https://thefirealarmsupplier.us/products/simplex-49av-												
214 Notification Appliance Power Extender Panel	**1**	Ea.	7	$623	$963	$0	$0	$58	$1,645	$386	$0	**$2,031**
			7.289	623.46	963.28			57.80	1,644.54	386.14		2,030.68
Memo: https://thefirealarmsupplier.us/products/hpff8-												
215 Detection system, smoke detector, duct type, addressable, excl. wires & conduit	**16**	Ea.	49	$4,208	$3,232	$0	$0	$194	$7,634	$1,793	$0	**$9,427**
			3.075	263.02	202.00			12.12	477.14	112.03		589.17

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$2,203,620 D SERVICES												
$2,203,620 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
BOH, PUBLIC & ADMINISTRATION AREAS												
216 LCD Textual Sign	**4**	Ea.	7	$635	$1,391	$0	$0	$83	$2,109	$495	$0	**$2,605**
			1.856	158.76	347.74			20.86	527.37	123.83		651.19
Memo: https://www.gsaadvantage.gov/advantage/ws/catalog/prod												
217 Outlet boxes, pressed steel, 4" octagon	**10**	Ea.	5	$421	$13	$0	$0	$1	$435	$102	$0	**$537**
			0.492	42.08	1.32			0.08	43.48	10.21		53.69
218 Outlet boxes, pressed steel, 4" square	**180**	Ea.	89	$7,575	$371	$0	$0	$22	$7,968	$1,871	$0	**$9,839**
			0.492	42.08	2.06			0.12	44.27	10.39		54.66
219 Outlet boxes, pressed steel, plaster rings, 4" square, concealed	**21**	Ea.	3	$276	$36	$0	$0	$2	$314	$74	$0	**$388**
			0.154	13.15	1.71			0.10	14.96	3.51		18.48
220 Outlet boxes, pressed steel, covers, blank, 4" square	**18**	Ea.	3	$237	$26	$0	$0	$2	$264	$62	$0	**$326**
			0.154	13.15	1.42			0.09	14.66	3.44		18.10
221 Electric metallic tubing (EMT), 3/4" diameter, to 10' high, incl 2 terminations, 2 field bend elbows, 11 beam clamps, and 11 couplings per 100 LF	**5,580**	L.F.	426	$36,398	$10,825	$0	$0	$650	$47,872	$11,240	$0	**$59,113**
			0.076	6.52	1.94			0.12	8.58	2.01		10.59
222 EMT boxes connectors, compression, steel, 3/4" diameter, to 15' H	**380**	Ea.	34	$2,918	$186	$0	$0	$11	$3,116	$732	$0	**$3,847**
			0.09	7.68	0.49			0.03	8.20	1.93		10.13
223 Fire alarm cable,#18, 1 pair	**21.45**	C.L.	26	$2,257	$729	$0	$0	$44	$3,030	$711	$0	**$3,741**
			1.23	105.21	33.99			2.04	141.24	33.16		174.40
Memo: https://www.showmecables.com/1-pair-18-awg-solid-												
224 Fire alarm cable,#14, 1 pair	**65.34**	C.L.	99	$8,462	$3,175	$0	$0	$191	$11,828	$2,777	$0	**$14,606**
			1.514	129.51	48.60			2.92	181.03	42.51		223.53
Memo: https://www.showmecables.com/fire-alarm-cable-2-												

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$2,203,620 D SERVICES												
$2,203,620 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
BOH, PUBLIC & ADMINISTRATION AREAS												
225 **Testing & Commisioning**	**206**		152	$13,004	$0	$0	$0	$0	$13,004	$3,053	$0	**$16,057**
			0.738	63.13					63.13	14.82		77.95
Subtotal				$102,767	$48,478	$0	$0	$2,909	$154,154	$36,195	$0	**$190,350**
Taxes				$0	$2,909	$0	$0					
Subcontractor Markups				$24,130	$12,066	$0	$0					
TOTAL BOH, PUBLIC & ADMINISTRATION AREAS	**1,201**			**$126,897**	**$63,453**	**$0**	**$0**	**$2,909**	**$154,154**	**$36,195**	**$0**	**$190,350**
65,117.00 SF	*Level Unit Cost-->*			*$1.95*	*$0.97*			*$0.04*	*$2.37*	*$0.56*		*$2.92*
Estimate Tree Structure Rollups												
$2,203,620 D SERVICES												
$2,203,620 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
GARAGE												
226 **Detection system, break glass station, addressable, excluding wires & conduits**	**8**	Ea.	11	$928	$1,328	$0	$0	$80	$2,336	$549	$0	**$2,885**
			1.357	116.05	166.00			9.96	292.01	68.56		360.57
227 **Detection system, strobe & horn, ADA type, excluding wires & conduits**	**10**	Ea.	19	$1,588	$1,320	$0	$0	$79	$2,987	$701	$0	**$3,688**
			1.856	158.76	132.00			7.92	298.68	70.13		368.81
228 **Detection system, visual alarm, ADA type, excluding wires & conduits**	**7**	Ea.	10	$879	$812	$0	$0	$49	$1,740	$409	$0	**$2,149**
			1.469	125.62	116.00			6.96	248.58	58.37		306.94
229 **Detection system, smoke detector, addressable type, excl. wires & conduit**	**2**	Ea.	3	$280	$482	$0	$0	$29	$791	$186	$0	**$977**
			1.64	140.24	241.00			14.46	395.70	92.91		488.61
230 **'MM' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**6**	Ea.	8	$696	$352	$0	$0	$21	$1,069	$251	$0	**$1,320**
			1.357	116.05	58.60			3.52	178.16	41.83		219.99

Memo: https://thefirealarmsupplier.us/products/fmm-1-

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$2,203,620 D SERVICES												
$2,203,620 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
GARAGE												
231 **'REL/CR' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**2**	Ea.	3 1.357	$232 116.05	$292 145.83	$0	$0	$18 8.75	$541 270.63	$127 63.54	$0	**$668** 334.17
Memo: https://thefirealarmsupplier.us/products/mix-m500rap-												
232 **Notification Appliance Power Extender Panel**	**2**	Ea.	15 7.289	$1,247 623.47	$1,927 963.28	$0	$0	$116 57.80	$3,289 1,644.54	$772 386.14	$0	**$4,061** 2,030.68
Memo: https://thefirealarmsupplier.us/products/hpff8-												
233 **Detection system, fire alarm signal bell 10" red 20-24 V P**	**6**	Ea.	7 1.23	$631 105.21	$1,230 205.00	$0	$0	$74 12.30	$1,935 322.51	$454 75.72	$0	**$2,389** 398.23
234 **Detection system, strobe, weatherproof, excluding wires & conduits**	**50**	Ea.	73 1.469	$6,281 125.62	$7,437 148.74	$0	$0	$446 8.92	$14,164 283.28	$3,326 66.52	$0	**$17,490** 349.80
Memo: https://thefirealarmsupplier.us/products/simplex-49av-												
235 **Detection system, strobe & horn, weather proof, ADA type, excluding wires & conduits**	**115**	Ea.	213 1.856	$18,257 158.76	$44,400 386.09	$0	$0	$2,664 23.16	$65,322 568.01	$15,338 133.37	$0	**$80,659** 701.38
Memo: https://www.gordonelectricsupply.com/p/Edwards-												
236 **Detection system, Manual pull station, weather proof, excluding wires & conduits**	**27**	Ea.	37 1.357	$3,133 116.04	$3,901 144.49	$0	$0	$234 8.67	$7,269 269.20	$1,707 63.21	$0	**$8,975** 332.41
Memo: https://www.gordonelectricsupply.com/p/Edwards-Mpsr1-												
237 **Outlet boxes, pressed steel, 4" octagon**	**1**	Ea.	 0.492	$42 42.08	$1 1.32	$0	$0	$0 0.08	$43 43.48	$10 10.21	$0	**$54** 53.69
238 **Outlet boxes, pressed steel, 4" square**	**225**	Ea.	111 0.492	$9,469 42.08	$464 2.06	$0	$0	$28 0.12	$9,960 44.27	$2,339 10.39	$0	**$12,299** 54.66
239 **Outlet boxes, pressed steel, plaster rings, 4" square, concealed**	**47**	Ea.	7 0.154	$618 13.15	$80 1.71	$0	$0	$5 0.10	$703 14.96	$165 3.51	$0	**$868** 18.48

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$2,203,620 D SERVICES												
$2,203,620 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
GARAGE												
240 **Outlet boxes, pressed steel, covers, blank, 4" square**	**8**	Ea.	1	$105	$11	$0	$0	$1	$117	$28	$0	**$145**
			0.154	13.15	1.42			0.09	14.66	3.44		18.10
241 **Rigid galvanized steel conduit, 3/4" diameter, to 10' H, incl 2 terminations, 2elbows, 11 beam clamps, and 11 couplings per 100 LF**	**13,920**	L.F.	1,712	$146,450	$67,373	$0	$0	$4,042	$217,865	$51,155	$0	**$269,019**
			0.123	10.52	4.84			0.29	15.65	3.67		19.33
242 **Conduit fittings for rigid galvanized steel, standard, locknuts, 3/4" diameter**	**936**	Ea.		$0	$534	$0	$0	$32	$566	$133	$0	**$698**
					0.57			0.03	0.60	0.14		0.75
243 **Conduit fittings for rigid galvanized steel, bushings, plastic, 3/4" diameter**	**468**	Ea.	144	$12,309	$112	$0	$0	$7	$12,428	$2,918	$0	**$15,347**
			0.308	26.30	0.24			0.01	26.56	6.24		32.79
244 **Fire alarm cable,#18, 1 pair**	**28.38**	C.L.	35	$2,986	$965	$0	$0	$58	$4,008	$941	$0	**$4,949**
			1.23	105.21	33.99			2.04	141.24	33.16		174.40
Memo: https://www.showmecables.com/1-pair-18-awg-solid-												
245 **Fire alarm cable,#14, 1 pair**	**207.24**	C.L.	314	$26,840	$10,072	$0	$0	$604	$37,516	$8,809	$0	**$46,325**
			1.514	129.51	48.60			2.92	181.03	42.51		223.53
Memo: https://www.showmecables.com/fire-alarm-cable-2-												
246 **Testing & Commisioning**	**235**		173	$14,834	$0	$0	$0	$0	$14,834	$3,483	$0	**$18,317**
			0.738	63.13					63.13	14.82		77.95
Subtotal				$247,807	$143,092	$0	$0	$8,586	$399,484	$93,799	$0	**$493,283**
Taxes				$0	$8,586	$0	$0					
Subcontractor Markups				$58,185	$35,614	$0	$0					
TOTAL GARAGE	**2,897**			**$305,992**	**$187,291**	**$0**	**$0**	**$8,586**	**$399,484**	**$93,799**	**$0**	**$493,283**
318,322.00 SF	*Level Unit Cost-->*			*$0.96*	*$0.59*			*$0.03*	*$1.25*	*$0.29*		*$1.55*

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$2,203,620 D SERVICES												
$2,203,620 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
MECHANICAL ROOM SPACES												
247 Detection system, break glass station, addressable, excluding wires & conduits	**6**	Ea.	8	$696	$996	$0	$0	$60	$1,752	$411	$0	**$2,163**
			1.357	116.05	166.00			9.96	292.01	68.56		360.57
248 Detection system, strobe & horn, ADA type, excluding wires & conduits	**18**	Ea.	33	$2,858	$2,376	$0	$0	$143	$5,376	$1,262	$0	**$6,639**
			1.856	158.76	132.00			7.92	298.68	70.13		368.81
249 Detection system, visual alarm, ADA type, excluding wires & conduits	**3**	Ea.	4	$377	$348	$0	$0	$21	$746	$175	$0	**$921**
			1.469	125.62	116.00			6.96	248.58	58.37		306.95
250 Detection system, smoke detector, addressable type, excl. wires & conduit	**6**	Ea.	10	$841	$1,446	$0	$0	$87	$2,374	$557	$0	**$2,932**
			1.64	140.24	241.00			14.46	395.70	92.91		488.61
251 'MM' Detection system, fire alarm control panel,relay module, excluding wires & conduits	**27**	Ea.	37	$3,133	$1,582	$0	$0	$95	$4,810	$1,129	$0	**$5,940**
			1.357	116.04	58.60			3.52	178.16	41.83		219.99
Memo: https://thefirealarmsupplier.us/products/fmm-1-												
252 'REL/CR' Detection system, fire alarm control panel,relay module, excluding wires & conduits	**23**	Ea.	31	$2,669	$3,354	$0	$0	$201	$6,224	$1,461	$0	**$7,686**
			1.357	116.04	145.83			8.75	270.62	63.54		334.17
Memo: https://thefirealarmsupplier.us/products/mix-m500rap-												
253 Detection system, smoke detector, duct type, addressable, excl. wires & conduit	**2**	Ea.	6	$526	$404	$0	$0	$24	$954	$224	$0	**$1,178**
			3.075	263.02	202.00			12.12	477.14	112.03		589.17
254 Notification Appliance Power Extender Panel	**8**	Ea.	58	$4,988	$7,706	$0	$0	$462	$13,156	$3,089	$0	**$16,245**
			7.289	623.46	963.28			57.80	1,644.54	386.14		2,030.68
Memo: https://thefirealarmsupplier.us/products/hpff8-												
255 Detection system, strobe & horn, weather proof, ADA type, excluding wires & conduits	**5**	Ea.	9	$794	$1,930	$0	$0	$116	$2,840	$667	$0	**$3,507**
			1.856	158.76	386.09			23.16	568.01	133.37		701.38
Memo: https://www.gordonelectricsupply.com/p/Edwards-												

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$2,203,620 D SERVICES											
$2,203,620 D50 ELECTRICAL											
$2,203,620 D5030 COMMUNICATIONS & SECURITY											
$2,203,620 D503001 FIRE ALARM SYSTEMS											
MECHANICAL ROOM SPACES											
256 **'FACP' Detection system, fire alarm control panel, addressable with voice, up to 400 points, excluding wires & conduits**	**3** Ea.	81 27.07	$6,946 2,315.42	$34,200 11,400.00	$0	$0	$2,052 684.00	$43,198 14,399.42	$10,143 3,380.98	$0	**$53,341** 17,780.40
257 **Mass notification system, wireless command center, PC based, 10,000 devices database**	**1** Ea.	15 14.797	$1,266 1,265.65	$3,175 3,175.00	$0	$0	$191 190.50	$4,631 4,631.15	$1,087 1,087.39	$0	**$5,719** 5,718.54
258 **Mass notification system, transmitter, 100 watt**	**1** Ea.	7 7.398	$633 632.83	$6,475 6,475.00	$0	$0	$389 388.50	$7,496 7,496.33	$1,760 1,760.14	$0	**$9,256** 9,256.47
259 **Detection system, fire alarm control panel, battery & rack, automatic charger, excluding wires & conduits**	**3** Ea.	4 1.23	$316 105.21	$1,770 590.00	$0	$0	$106 35.40	$2,192 730.61	$515 171.55	$0	**$2,706** 902.15
260 **'FAAP' Detection system, annunciator panel** Memo: https://www.buyfirealarmparts.com/shop/lcd280.html	**3** Ea.	27 8.946	$2,296 765.18	$2,700 900.00	$0	$0	$162 54.00	$5,158 1,719.18	$1,211 403.66	$0	**$6,369** 2,122.84
261 **Outlet boxes, pressed steel, 4" octagon**	**3** Ea.	1 0.492	$126 42.08	$4 1.32	$0	$0	$0 0.08	$130 43.48	$31 10.21	$0	**$161** 53.69
262 **Outlet boxes, pressed steel, 4" square**	**84** Ea.	41 0.492	$3,535 42.08	$173 2.06	$0	$0	$10 0.12	$3,718 44.27	$873 10.39	$0	**$4,591** 54.66
263 **Outlet boxes, pressed steel, plaster rings, 4" square, concealed**	**25** Ea.	4 0.154	$329 13.15	$43 1.71	$0	$0	$3 0.10	$374 14.96	$88 3.51	$0	**$462** 18.48
264 **Outlet boxes, pressed steel, covers, blank, 4" square**	**35** Ea.	5 0.154	$460 13.15	$50 1.42	$0	$0	$3 0.09	$513 14.66	$120 3.44	$0	**$633** 18.10
265 **Electric metallic tubing (EMT), 3/4" diameter, to 10' high, incl 2 terminations, 2 field bend elbows, 11 beam clamps, and 11 couplings per 100 LF**	**2,610** L.F.	199 0.076	$17,025 6.52	$5,063 1.94	$0	$0	$304 0.12	$22,392 8.58	$5,258 2.01	$0	**$27,650** 10.59

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$2,203,620 D SERVICES												
$2,203,620 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
MECHANICAL ROOM SPACES												
266 **EMT boxes connectors, compression, steel, 3/4" diameter, to 15' H**	**174**	Ea.	16	$1,336	$85	$0	$0	$5	$1,427	$335	$0	**$1,762**
			0.09	7.68	0.49			0.03	8.20	1.93		10.13
267 **Fire alarm cable,#18, 1 pair**	**20.13**	C.L.	25	$2,118	$684	$0	$0	$41	$2,843	$668	$0	**$3,511**
			1.23	105.21	33.99			2.04	141.24	33.16		174.40
Memo: https://www.showmecables.com/1-pair-18-awg-solid-												
268 **Fire alarm cable,#14, 1 pair**	**16.17**	C.L.	24	$2,094	$786	$0	$0	$47	$2,927	$687	$0	**$3,614**
			1.514	129.51	48.60			2.92	181.03	42.51		223.53
Memo: https://www.showmecables.com/fire-alarm-cable-2-												
269 **Testing & Commisioning**	**98**		72	$6,186	$0	$0	$0	$0	$6,186	$1,453	$0	**$7,639**
			0.738	63.13					63.13	14.82		77.95
Subtotal				$61,548	$75,351	$0	$0	$4,521	$141,420	$33,205	$0	$174,625
Taxes				$0	$4,521	$0	$0					
Subcontractor Markups				$14,451	$18,754	$0	$0					
TOTAL MECHANICAL ROOM SPACES	**720**			**$75,999**	**$98,626**	**$0**	**$0**	**$4,521**	**$141,420**	**$33,205**	**$0**	**$174,625**
15,138.00 SF		*Level Unit Cost-->*		*$5.02*	*$6.52*			*$0.30*	*$9.34*	*$2.19*		*$11.54*
Estimate Tree Structure Rollups												
$2,203,620 D SERVICES												
$2,203,620 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
FIRE PUMPS & PUMP ROOM PIPING												
270 **'MM' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**21**	Ea.	28	$2,437	$1,231	$0	$0	$74	$3,741	$878	$0	**$4,620**
			1.357	116.04	58.60			3.52	178.16	41.83		219.99
Memo: https://thefirealarmsupplier.us/products/fmm-1-												
271 **'REL/CR' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**1**	Ea.	1	$116	$146	$0	$0	$9	$271	$64	$0	**$334**
			1.357	116.04	145.83			8.75	270.62	63.54		334.16
Memo: https://thefirealarmsupplier.us/products/mix-m500rap-												

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$2,203,620 D SERVICES												
$2,203,620 D50 ELECTRICAL												
$2,203,620 D5030 COMMUNICATIONS & SECURITY												
$2,203,620 D503001 FIRE ALARM SYSTEMS												
FIRE PUMPS & PUMP ROOM PIPING												
272 **Detection system, strobe & horn, weather proof, ADA type, excluding wires & conduits**	**2**	Ea.	4	$318	$772	$0	$0	$46	$1,136	$267	$0	**$1,403**
			1.856	158.76	386.09			23.17	568.02	133.37		701.38
Memo: https://www.gordonelectricsupply.com/p/Edwards-												
273 **Outlet boxes, pressed steel, 4" square**	**24**	Ea.	12	$1,010	$49	$0	$0	$3	$1,062	$249	$0	**$1,312**
			0.492	42.08	2.06			0.12	44.27	10.39		54.66
274 **Outlet boxes, pressed steel, covers, blank, 4" square**	**22**	Ea.	3	$289	$31	$0	$0	$2	$322	$76	$0	**$398**
			0.154	13.15	1.42			0.09	14.66	3.44		18.10
275 **Electric metallic tubing (EMT), 3/4" diameter, to 10' high, incl 2 terminations, 2 field bend elbows, 11 beam clamps, and 11 couplings per 100 LF**	**720**	L.F.	55	$4,696	$1,397	$0	$0	$84	$6,177	$1,450	$0	**$7,627**
			0.076	6.52	1.94			0.12	8.58	2.01		10.59
276 **EMT boxes connectors, compression, steel, 3/4" diameter, to 15' H**	**48**	Ea.	4	$369	$24	$0	$0	$1	$394	$92	$0	**$486**
			0.09	7.68	0.49			0.03	8.20	1.93		10.13
277 **Fire alarm cable,#18, 1 pair**	**7.26**	C.L.	9	$764	$247	$0	$0	$15	$1,025	$241	$0	**$1,266**
			1.23	105.21	33.99			2.04	141.24	33.16		174.40
Memo: https://www.showmecables.com/1-pair-18-awg-solid-												
278 **Fire alarm cable,#14, 1 pair**	**1.32**	C.L.	2	$171	$64	$0	$0	$4	$239	$56	$0	**$295**
			1.514	129.51	48.60			2.92	181.02	42.51		223.53
Memo: https://www.showmecables.com/fire-alarm-cable-2-												
279 **Testing & Commisioning**	**24**		18	$1,515	$0	$0	$0	$0	$1,515	$356	$0	**$1,871**
			0.738	63.13					63.13	14.82		77.95
Subtotal				$11,685	$3,961	$0	$0	$238	$15,883	$3,729	$0	**$19,612**
Taxes				$0	$238	$0	$0					
Subcontractor Markups				$2,744	$986	$0	$0					
TOTAL FIRE PUMPS & PUMP ROOM PIPING	**137**			**$14,428**	**$5,184**	**$0**	**$0**	**$238**	**$15,883**	**$3,729**	**$0**	**$19,612**
1.00 EA												

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$5,379,080 *CONCEPT 2*											
$597,917 *F SPECIAL CONSTRUCTION & DEMOLITION*											
$597,917 *F20 SELECTIVE BUILDING DEMOLITION*											
$78,434 *F2010 BUILDING ELEMENTS DEMOLITION*											
F201004 INTERIOR CONSTRUCTION & FINISHES											
280 **Walls and partitions demolition, metal or wood studs, finish two sides, plasterboard (gypsum wallboard)**	**96** S.F.	5 0.055	$172 1.79	$0	$0	$0	$0	$172 1.79	$55 0.58	$0	**$227** 2.37
Subtotal			$172	$0	$0	$0	$0	$172	$55	$0	**$227**
Subcontractor Markups			$55	$0	$0	$0					
TOTAL F201004 INTERIOR CONSTRUCTION & FINISHES **1.00 LS**	**5**		**$227**	**$0**	**$0**	**$0**	**$0**	**$172**	**$55**	**$0**	**$227**
Estimate Tree Structure Rollups											
$5,379,080 *CONCEPT 2*											
$597,917 *F SPECIAL CONSTRUCTION & DEMOLITION*											
$597,917 *F20 SELECTIVE BUILDING DEMOLITION*											
$78,434 *F2010 BUILDING ELEMENTS DEMOLITION*											
F201007 ELECTRICAL SYSTEMS											
281 **Fire alarm control panel, 12 to 16 zone, electrical demolition, remove**	**3** Ea.	22 7.371	$1,892 630.51	$0	$0	$0	$0	$1,892 630.51	$444 148.04	$0	**$2,336** 778.56
282 **Fire alarm bell, electrical demolition, remove**	**207** Ea.	127 0.615	$10,889 52.60	$0	$0	$0	$0	$10,889 52.60	$2,557 12.35	$0	**$13,446** 64.95
283 **Fire alarm pull station, electrical demolition, remove**	**206** Ea.	88 0.428	$7,542 36.61	$0	$0	$0	$0	$7,542 36.61	$1,771 8.60	$0	**$9,313** 45.21
284 **Smoke detector, electrical demolition, remove**	**595** Ea.	255 0.428	$21,784 36.61	$0	$0	$0	$0	$21,784 36.61	$5,115 8.60	$0	**$26,899** 45.21
285 **Junction boxes, 4" square & octagon, electrical demolition, remove, including removal of supports and terminations**	**415** Ea.	51 0.123	$4,366 10.52	$0	$0	$0	$0	$4,366 10.52	$1,025 2.47	$0	**$5,391** 12.99
286 **Conduit, electric metallic tubing (EMT), 1/2" to 1" diameter, electrical demolition, remove conduit to 10' high, including fittings & hangers**	**960** L.F.	24 0.025	$2,020 2.10	$0	$0	$0	$0	$2,020 2.10	$474 0.49	$0	**$2,494** 2.60

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$5,379,080 CONCEPT 2												
$597,917 F SPECIAL CONSTRUCTION & DEMOLITION												
$597,917 F20 SELECTIVE BUILDING DEMOLITION												
$78,434 F2010 BUILDING ELEMENTS DEMOLITION												
F201007 ELECTRICAL SYSTEMS												
287 **Conduit, rigid galvanized steel, 1/2" to 1" diameter, electrical demolition, remove conduit to 10' high, including fittings & hangers**	**3,030**	L.F.	123	$10,520	$0	$0	$0	$0	$10,520	$2,470	$0	**$12,990**
			0.041	3.47					3.47	0.81		4.29
288 **Fire Alarm Cable, electrical demolition, remove**	**13,695**	L.F.	51	$4,322	$0	$0	$0	$0	$4,322	$1,015	$0	**$5,337**
			0.004	0.32					0.32	0.07		0.39
Subtotal				$63,335	$0	$0	$0	$0	$63,335	$14,871	$0	**$78,207**
Subcontractor Markups				$14,871	$0	$0	$0					
TOTAL F201007 ELECTRICAL SYSTEMS	**740**			**$78,207**	**$0**	**$0**	**$0**	**$0**	**$63,335**	**$14,871**	**$0**	**$78,207**
1.00 LS												
Estimate Tree Structure Rollups												
$11,872,674 FIRE ALARM - START 3/1/2024												
$5,379,080 CONCEPT 2												
$597,917 F SPECIAL CONSTRUCTION & DEMOLITION												
$597,917 F20 SELECTIVE BUILDING DEMOLITION												
F2020 HAZARDOUS COMPONENTS ABATEMENT												
289 **Asbestos abatement equipment, respirator, single use**	**88**	Ea.		$0	$176	$0	$0	$11	$187	$50	$0	**$237**
					2.00			0.12	2.12	0.57		2.69
Memo: 4 workers for 22 days												
290 **Asbestos abatement equipment, respirator, single use, cartridge**	**88**	Ea.		$0	$1,276	$0	$0	$77	$1,353	$362	$0	**$1,715**
					14.50			0.87	15.37	4.12		19.49
Memo: 4 workers for 20 days												
291 **Asbestos abatement equipment, worker protection, whole body, foot, head cover &gloves, plastic**	**176**	Ea.		$0	$1,866	$0	$0	$112	$1,978	$530	$0	**$2,507**
					10.60			0.64	11.24	3.01		14.25
Memo: 4 workers for 20 days x 2												
292 **Preparation of asbestos containment area, cover surfaces with polyethylene sheeting, floors, each layer, 4 mil, incl. glue & tape**	**35,918**	S.F.	309	$24,069	$2,155	$0	$0	$129	$26,353	$7,059	$0	**$33,413**
			0.009	0.67	0.06				0.73	0.20		0.93

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$11,872,674 *FIRE ALARM - START 3/1/2024*											
$5,379,080 *CONCEPT 2*											
$597,917 *F SPECIAL CONSTRUCTION & DEMOLITION*											
$597,917 *F20 SELECTIVE BUILDING DEMOLITION*											
F2020 HAZARDOUS COMPONENTS ABATEMENT											
293 **Preparation of asbestos containment area, cover surfaces with polyethylene sheeting, walls, each layer, 4 mil, incl. glue & tape**	**190,684** S.F.	2,111 0.011	$164,287 0.86	$11,441 0.06	$0	$0	$686	$176,415 0.93	$47,257 0.25	$0	**$223,672** 1.17
294 **Preparation of asbestos containment area, caulk seams with latex** Memo: =(680)/32=22*12=264*5=13200lf	**24,153** L.F.	1,040 0.043	$56,885 2.36	$5,072 0.21	$0	$0	$304 0.01	$62,261 2.58	$16,678 0.69	$0	**$78,940** 3.27
295 **Preparation of asbestos containment area, separation barrier, 2" x 4" @ 16", 1/2" plywood each side, 12' high**	**5,920** S.F.	364 0.062	$19,918 3.37	$28,712 4.85	$0	$0	$1,723 0.29	$50,353 8.51	$13,488 2.28	$0	**$63,841** 10.78
296 **Cover floor surface with tarpaulins, polyvinyl coated nylon, 14 oz. to 18 oz., min** Memo: 2 layer x floor area	**2,824** S.F.	27 0.01	$2,110 0.75	$3,841 1.36	$0	$0	$230 0.08	$6,181 2.19	$1,656 0.59	$0	**$7,837** 2.77
297 **Selective demolition, saw cutting, masonry walls, brick, per inch of depth, hydraulic saw**	**33** EA	14 0.435	$703 21.31	$12 0.36	$997 30.20	$0	$61 1.83	$1,772 53.70	$475 14.38	$0	**$2,247** 68.08
298 **Concrete core drilling, core, reinforced concrete slab, 1" diameter, up to 6" thick slab, includes bit cost, layout and set up time**	**565** Ea.	654 1.157	$31,376 55.53	$124 0.22	$4,749 8.41	$0	$292 0.52	$36,542 64.68	$9,789 17.32	$0	**$46,331** 82.00
299 **Concrete core drilling, core, reinforced concrete slab, 1" diameter, up to 6" thick slab, includes bit cost, layout and set up time, for each additional**	**1,130** Ea.	15 0.014	$734 0.65	$45 0.04	$111 0.10	$0	$9 0.01	$899 0.80	$241 0.21	$0	**$1,140** 1.01
300 **Demolition in asbestos contaminated area, popcorn ceiling**	**1,412** S.F.	108 0.077	$8,440 5.98	$282 0.20	$0	$0	$17 0.01	$8,739 6.19	$2,341 1.66	$0	**$11,080** 7.85
301 **Asbestos encapsulation with sealants, ceilings & walls, max**	**1,412** S.F.	15 0.011	$1,187 0.84	$734 0.52	$0	$0	$44 0.03	$1,965 1.39	$526 0.37	$0	**$2,492** 1.76
302 **Asbestos abat equip, disposable fiber drums, 55 Gal**	**210** Ea.		$0	$3,822 18.20	$0	$0	$229 1.09	$4,051 19.29	$1,085 5.17	$0	**$5,137** 24.46

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$11,872,674 *FIRE ALARM - START 3/1/2024*												
$5,379,080 *CONCEPT 2*												
$597,917 *F SPECIAL CONSTRUCTION & DEMOLITION*												
$597,917 *F20 SELECTIVE BUILDING DEMOLITION*												
F2020 HAZARDOUS COMPONENTS ABATEMENT												
303 **Asbestos abatement equipment, pressure sensitive caution labels, 3" x 5"**	**210**	Ea.		$0	$685 3.26	$0	$0	$41 0.20	$726 3.46	$194 0.93	$0	**$920** 4.38
304 **Decontamination of asbestos containment area, bag polyethylene sheeting** Memo: Assume 3 bags per drum	**260**	Ea.	51 0.197	$3,982 15.32	$369 1.42	$0	$0	$22 0.09	$4,374 16.82	$1,172 4.51	$0	**$5,545** 21.33
305 **Asbestos abatement equipment & supplies, buy, shower unit, incl. pump & filters** Memo: 1 shower unit to be move to different floors	**5**	Ea.		$0	$4,825 965.00	$0	$0	$290 57.90	$5,115 1,022.90	$1,370 274.01	$0	**$6,485** 1,296.91
306 **Preparation of asbestos containment area, set up and remove portable shower unit** Memo: 1 shower unit to be move to different floors	**5**	Ea.	25 4.92	$1,913 382.61	$0	$0	$0	$0	$1,913 382.61	$512 102.49	$0	**$2,426** 485.10
307 **Asbestos abatement equipment & supplies, buy, vacuum cleaner, HEPA, stainless steel, wet/dry, 16 gal.** Memo: Assuming 4 workers working in 4 locations at the same	**4**	Ea.		$0	$5,800 1,450.00	$0	$0	$348 87.00	$6,148 1,537.00	$1,647 411.72	$0	**$7,795** 1,948.72
308 **Decontamination of asbestos containment area, spray exposed substrate with surfactant (bridging), flat surfaces** Memo: If assuming floor abatement use 100 sf area	**1,412**	S.F.	19 0.013	$1,451 1.03	$635 0.45	$0	$0	$38 0.03	$2,124 1.50	$569 0.40	$0	**$2,693** 1.91
309 **Decontamination of asbestos containment area, final cleaning of protected surfaces** Memo: Includes abatement area and immediate area (wall or	**4,424**	S.F.	16 0.004	$1,241 0.28	$0	$0	$0	$0	$1,241 0.28	$332 0.07	$0	**$1,574** 0.36
310 **Preparation of asbestos containment area, personnel decontamination chamber, 2"x 4" @ 16", 3/4" plywood each side**	**50**	S.F.	3 0.068	$187 3.74	$298 5.95	$0	$0	$18 0.36	$502 10.05	$135 2.69	$0	**$637** 12.74

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$11,872,674 *FIRE ALARM - START 3/1/2024*											
$5,379,080 *CONCEPT 2*											
$597,917 *F SPECIAL CONSTRUCTION & DEMOLITION*											
$597,917 *F20 SELECTIVE BUILDING DEMOLITION*											
F2020 HAZARDOUS COMPONENTS ABATEMENT											
311 **Asbestos waste packaging, handling & disposal, disposal charges, excl. haul, min**	**132** C.Y		$0	$8,052	$0	$0	$483	$8,535	$2,286	$0	**$10,821**
				61.00			3.66	64.66	17.32		81.98
Subtotal			$318,483	$80,222	$5,857	$0	$5,165	$409,727	$109,756	$0	**$519,483**
Taxes			$0	$4,813	$351	$0					
Subcontractor Markups			$85,314	$22,779	$1,663	$0					
TOTAL F2020 HAZARDOUS COMPONENTS ABATEMENT	**1.00 LS**	**4,772**	**$403,797**	**$107,814**	**$7,871**	**$0**	**$5,165**	**$409,727**	**$109,756**	**$0**	**$519,483**

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$9,115,150 CONCEPT 1												
$126,127 C INTERIORS												
$92,124 C10 INTERIOR CONSTRUCTION												
$92,124 C1030 SPECIALTIES												
C1030C INTERIOR SOFFIT												
1 Add soffit in the unit	**2,286**	L.F.	562	$30,766	$36,667	$0	$0	$2,200	$69,633	$22,491	$0	**$92,124**
			0.246	13.46	16.04			0.96	30.46	9.84		40.30
Subtotal				$30,766	$36,667	$0	$0	$2,200	$69,633	$22,491	$0	$92,124
Taxes				$0	$2,200	$0	$0					
Subcontractor Markups				$9,937	$12,554	$0	$0					
TOTAL C1030C INTERIOR SOFFIT			**562**	**$40,703**	**$51,422**	**$0**	**$0**	**$2,200**	**$69,633**	**$22,491**	**$0**	**$92,124**
2,286.00 LF			*Level Unit Cost-->*	*$17.81*	*$22.49*			*$0.96*	*$30.46*	*$9.84*		*$40.30*
Estimate Tree Structure Rollups												
$17,455,822 FIRE SUPPRESSION - START 3/1/2025 (ONE YR AFTER FIRE ALARM)												
$9,115,150 CONCEPT 1												
$126,127 C INTERIORS												
$34,003 C30 INTERIOR FINISHES												
C3030 CEILING FINISHES												
2 Suspended ceiling system, 2" carriers, 24" OC with 1-5/8" channels, 24" OC, incl. carriers	**5,550**	S.F.	246	$14,310	$3,774	$0	$0	$226	$18,310	$0	$0	**$18,310**
			0.044	2.58	0.68			0.04	3.30			3.30
3 Gypsum wallboard, on ceilings, fire resistant, taped & finished (level 4 finish), 1/2" thick	**5,550**	S.F.	143	$7,843	$2,831	$0	$0	$170	$10,843	$0	$0	**$10,843**
			0.026	1.41	0.51			0.03	1.95			1.95
4 Paints & coatings, walls & ceilings, interior, concrete, drywall or plaster, zero voc latex, 2 coats, sand finish, brushwork	**5,550**	S.F.	89	$4,085	$722	$0	$0	$43	$4,849	$0	$0	**$4,849**
			0.016	0.74	0.13			0.01	0.87			0.87
Taxes				$0	$440	$0	$0					
TOTAL C3030 CEILING FINISHES			**478**	**$26,237**	**$7,766**	**$0**	**$0**	**$440**	**$34,003**	**$0**	**$0**	**$34,003**
6,992.00 SF			*Level Unit Cost-->*	*$3.75*	*$1.11*			*$0.06*	*$4.86*			*$4.86*

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$9,115,150 CONCEPT 1												
$8,484,163 D SERVICES												
$500,656 D30 HVAC												
$312,736 D3040 DISTRIBUTION SYSTEMS												
D304007 EXHAUST SYSTEMS												
5 **Garage Exhaust Fans (Vaneaxial to 17,000 CFM 7.5 HP)**	**7**	Ea.	52	$3,812	$129,500	$0	$0	$7,770	$141,082	$38,163	$0	**$179,244**
			7.38	544.50	18,500.00			1,110.00	20,154.50	5,451.79		25,606.30
6 **Stairwell and Elevator Pressurization (Centrifugal Backward Curved to 10 HP)**	**7**	Ea.	69	$4,901	$94,500	$0	$0	$5,670	$105,071	$28,422	$0	**$133,492**
			9.84	700.08	13,500.00			810.00	15,010.08	4,060.22		19,070.30
Subtotal				$8,712	$224,000	$0	$0	$13,440	$246,152	$66,584	$0	$312,736
Taxes				$0	$13,440	$0	$0					
Subcontractor Markups				$2,357	$64,228	$0	$0					
TOTAL D304007 EXHAUST SYSTEMS	**121**			**$11,069**	**$301,668**	**$0**	**$0**	**$13,440**	**$246,152**	**$66,584**	**$0**	**$312,736**
1.00 EA												
Estimate Tree Structure Rollups												
$9,115,150 CONCEPT 1												
$8,484,163 D SERVICES												
$500,656 D30 HVAC												
$160,993 D3060 CONTROLS & INSTRUMENTATION												
D306001 HVAC CONTROLS												
7 **Exhaust Fan Control**	**14**	Ea.	172	$14,746	$23,800	$0	$0	$1,428	$39,974	$10,813	$0	**$50,787**
			12.3	1,053.31	1,700.00			102.00	2,855.31	772.36		3,627.67
8 **Tie-into Existing Operator Station**	**24**	Hrs.	30	$2,528	$0	$0	$0	$0	$2,528	$684	$0	**$3,212**
			1.23	105.33					105.33	28.49		133.82
9 **System Check-out & Programming**	**120**	Hrs.	148	$10,873	$0	$0	$0	$0	$10,873	$2,941	$0	**$13,814**
			1.23	90.61					90.61	24.51		115.12
10 **Electric metallic tubing (EMT), 3/4" diameter, to 15' high, incl 2 terminations, 2 field bend elbows, 11 beam clamps, and 11 couplings per 100 LF**	**50**	C.L.	381	$32,615	$4,800	$0	$0	$288	$37,703	$10,199	$0	**$47,901**
			7.626	652.29	96.00			5.76	754.05	203.97		958.02
11 **Control Wiring**	**50**	C.L.	93	$7,947	$1,250	$0	$0	$75	$9,272	$2,508	$0	**$11,780**
			1.856	158.94	25.00			1.50	185.44	50.16		235.61

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$9,115,150 CONCEPT 1												
$8,484,163 D SERVICES												
$500,656 D30 HVAC												
$160,993 D3060 CONTROLS & INSTRUMENTATION												
D306001 HVAC CONTROLS												
12 Interface wtih Fire Protection Alarm System	**1**	Ea.	246	$21,066	$5,000	$0	$0	$300	$26,366	$7,132	$0	**$33,498**
			246	21,066.21	5,000.00			300.00	26,366.21	7,132.06		33,498.27
Subtotal				$89,775	$34,850	$0	$0	$2,091	$126,716	$34,277	$0	**$160,993**
Taxes				$0	$2,091	$0	$0					
Subcontractor Markups				$24,284	$9,993	$0	$0					
TOTAL D306001 HVAC CONTROLS	**1,069**			**$114,060**	**$46,934**	**$0**	**$0**	**$2,091**	**$126,716**	**$34,277**	**$0**	**$160,993**
1.00 EA												
Estimate Tree Structure Rollups												
$9,115,150 CONCEPT 1												
$8,484,163 D SERVICES												
$500,656 D30 HVAC												
$26,926 D3070 SYSTEMS TESTING & BALANCING												
D307001 TESTING & BALANCING												
13 System Testing & Balance	**60**	Hrs.	74	$3,757	$0	$0	$0	$0	$3,757	$1,016	$0	**$4,773**
			1.23	62.61					62.61	16.94		79.55
14 System Commissioning & Assist in T & B	**120**	Hrs.	148	$11,077	$6,000	$0	$0	$360	$17,437	$4,717	$0	**$22,154**
			1.23	92.31	50.00			3.00	145.31	39.31		184.61
Subtotal				$14,834	$6,000	$0	$0	$360	$21,194	$5,733	$0	**$26,926**
Taxes				$0	$360	$0	$0					
Subcontractor Markups				$4,012	$1,720	$0	$0					
TOTAL D307001 TESTING& BALANCING	**221**			**$18,846**	**$8,080**	**$0**	**$0**	**$360**	**$21,194**	**$5,733**	**$0**	**$26,926**
1.00 EA												

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$17,455,822 FIRE SUPPRESSION - START 3/1/2025 (ONE YR AFTER FIRE ALARM)												
$9,115,150 CONCEPT 1												
$8,484,163 D SERVICES												
$7,797,130 D40 FIRE PROTECTION												
TENANT TOWER												
15 **Pipe, plastic, CPVC fire suppression, C-UL-S, FM, NFPA 13, 13R & 13D, SDR 13.5,1" diameter, socket joint, no couplings or hangers**	**32,960**	L.F.	1,905 0.058	$121,434 3.68	$108,504 3.29	$0	$0	$6,510 0.20	$236,449 7.17	$63,959 1.94	$0	**$300,408** 9.11
16 **Pipe, plastic, CPVC fire suppression, C-UL-S, FM, NFPA 13, 13R & 13D, SDR 13.5,1-1/4" diameter, socket joint, no couplings or hangers**	**8,660**	L.F.	660 0.076	$42,089 4.86	$40,438 4.67	$0	$0	$2,426 0.28	$84,953 9.81	$22,980 2.65	$0	**$107,933** 12.46
17 **Pipe, plastic, CPVC fire suppression, C-UL-S, FM, NFPA 13, 13R & 13D, SDR 13.5,1-1/2" diameter, socket joint, no couplings or hangers**	**5,040**	L.F.	521 0.103	$33,187 6.59	$32,667 6.48	$0	$0	$1,960 0.39	$67,814 13.46	$18,344 3.64	$0	**$86,157** 17.09
18 **Pipe, plastic, CPVC fire suppression, C-UL-S, FM, NFPA 13, 13R & 13D, SDR 13.5,2" diameter, socket joint, no couplings or hangers**	**7,960**	L.F.	1,116 0.14	$71,133 8.94	$74,788 9.40	$0	$0	$4,487 0.56	$150,409 18.90	$40,686 5.11	$0	**$191,094** 24.01
19 **Pipe, fittings & valves, steel, black, grooved joint, 2-1/2" diameter, schedule10, incl coupling & clevis type hanger 10' OC**	**34,980**	L.F.	11,273 0.322	$844,027 24.13	$423,258 12.10	$0	$0	$25,395 0.73	$1,292,681 36.95	$349,670 10.00	$0	**$1,642,351** 46.95
20 **Pipe, fittings & valves, steel, black, grooved joint, 6" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**14,660**	L.F.	9,413 0.642	$730,860 49.85	$447,130 30.50	$0	$0	$26,828 1.83	$1,204,818 82.18	$325,903 22.23	$0	**$1,530,721** 104.42
21 **Sprinkler Head, Sidewall, K4.4, Tyco 4334**	**5,977**	Ea.	3,676 0.615	$275,226 46.05	$145,719 24.38	$0	$0	$8,743 1.46	$429,688 71.89	$116,231 19.45	$0	**$545,919** 91.34
22 **Sprinkler Head, Pendent Conceal include trim plate, K4.9, Tyco 3586**	**365**	Ea.		$0	$13,925 38.15	$0	$0	$835 2.29	$14,760 40.44	$3,993 10.94	$0	**$18,753** 51.38
23 **Wet Pipe Alarm Valve Set 6"**	**6**	Ea.	59 9.84	$4,421 736.76	$18,600 3,100.00	$0	$0	$1,116 186.00	$24,137 4,022.76	$6,529 1,088.16	$0	**$30,665** 5,110.92
24 **Floor Control Valve Set 2-1/2"**	**111**	Ea.	1,092 9.84	$81,780 736.76	$102,120 920.00	$0	$0	$6,127 55.20	$190,027 1,711.96	$51,402 463.08	$0	**$241,430** 2,175.04

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$17,455,822 FIRE SUPPRESSION - START 3/1/2025 (ONE YR AFTER FIRE ALARM)												
$9,115,150 CONCEPT 1												
$8,484,163 D SERVICES												
$7,797,130 D40 FIRE PROTECTION												
TENANT TOWER												
25 **Fire Hose Valve**	**111**	Ea.	1,092	$81,780	$55,500	$0	$0	$3,330	$140,610	$38,035	$0	**$178,645**
			9.84	736.76	500.00			30.00	1,266.76	342.66		1,609.42
26 **Fire Department Connection**	**6**	Ea.	15	$1,105	$9,000	$0	$0	$540	$10,645	$2,880	$0	**$13,525**
			2.46	184.19	1,500.00			90.00	1,774.19	479.92		2,254.11
27 **Seal / Fire Stop Wall Openings**	**4,699**	Ea.	1,445	$55,901	$3,524	$0	$0	$211	$59,637	$16,132	$0	**$75,769**
			0.307	11.90	0.75			0.04	12.69	3.43		16.12
Subtotal				$2,342,943	$1,475,173	$0	$0	$88,510	$3,906,627	$1,056,743	$0	**$4,963,370**
Taxes				$0	$88,510	$0	$0					
Subcontractor Markups				$633,766	$422,976	$0	$0					
TOTAL TENANT TOWER	**32,267**			**$2,976,709**	**$1,986,660**	**$0**	**$0**	**$88,510**	**$3,906,627**	**$1,056,743**	**$0**	**$4,963,370**
969,696.00 SF			*Level Unit Cost–>*	*$3.07*	*$2.05*			*$0.09*	*$4.03*	*$1.09*		*$5.12*
Estimate Tree Structure Rollups												
$17,455,822 FIRE SUPPRESSION - START 3/1/2025 (ONE YR AFTER FIRE ALARM)												
$9,115,150 CONCEPT 1												
$8,484,163 D SERVICES												
$7,797,130 D40 FIRE PROTECTION												
BOH, PUBLIC & ADMINISTRATION AREAS												
28 **Pipe, steel, black, threaded, 1" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**4,340**	L.F.	806	$67,059	$42,098	$0	$0	$2,526	$111,683	$30,210	$0	**$141,894**
			0.186	15.45	9.70			0.58	25.73	6.96		32.69
29 **Pipe, steel, black, threaded, 1-1/4" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**1,320**	L.F.	292	$21,882	$16,896	$0	$0	$1,014	$39,792	$10,764	$0	**$50,555**
			0.221	16.58	12.80			0.77	30.15	8.15		38.30
30 **Pipe, steel, black, threaded, 1-1/2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**880**	L.F.	216	$16,209	$13,420	$0	$0	$805	$30,434	$8,232	$0	**$38,666**
			0.246	18.42	15.25			0.92	34.58	9.36		43.94
31 **Pipe, steel, black, threaded, 2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**540**	L.F.	166	$12,433	$11,070	$0	$0	$664	$24,167	$6,537	$0	**$30,704**
			0.308	23.02	20.50			1.23	44.75	12.11		56.86

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$17,455,822 FIRE SUPPRESSION - START 3/1/2025 (ONE YR AFTER FIRE ALARM)											
$9,115,150 CONCEPT 1											
$8,484,163 D SERVICES											
$7,797,130 D40 FIRE PROTECTION											
BOH, PUBLIC & ADMINISTRATION AREAS											
32 **Pipe, fittings & valves, steel, black, grooved joint, 3" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**440** L.F.	157	$11,792	$6,138	$0	$0	$368	$18,298	$4,950	$0	**$23,248**
		0.358	26.80	13.95			0.84	41.59	11.25		52.84
33 **Pipe, fittings & valves, steel, black, grooved joint, 5" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**1,040** L.F.	512	$38,311	$24,960	$0	$0	$1,498	$64,769	$17,520	$0	**$82,289**
		0.492	36.84	24.00			1.44	62.28	16.85		79.12
34 **Floor Control Valve Assembly 4**	**6** Ea.	22	$1,658	$6,654	$0	$0	$399	$8,711	$2,356	$0	**$11,067**
		3.69	276.29	1,109.00			66.54	1,451.83	392.72		1,844.54
35 **Floor Control Valve Assembly 6**	**1** Ea.	4	$276	$1,379	$0	$0	$83	$1,738	$470	$0	**$2,208**
		3.69	276.28	1,379.00			82.74	1,738.02	470.14		2,208.16
36 **Sprinkler Head, Pendent Conceal include trim plate, K4.9, Tyco 3586**	**470** Ea.		$0	$17,931	$0	$0	$1,076	$19,006	$5,141	$0	**$24,148**
				38.15			2.29	40.44	10.94		51.38
37 **Fire Hose Valve**	**28** Ea.	276	$20,629	$14,000	$0	$0	$840	$35,469	$9,594	$0	**$45,064**
		9.84	736.76	500.00			30.00	1,266.76	342.66		1,609.42
38 **Seal / Fire Stop Wall Openings**	**200** Ea.	62	$2,379	$150	$0	$0	$9	$2,538	$687	$0	**$3,225**
		0.308	11.90	0.75			0.04	12.69	3.43		16.12
Subtotal			$192,628	$154,696	$0	$0	$9,282	$356,606	$96,462	$0	**$453,068**
Taxes			$0	$9,282	$0	$0					
Subcontractor Markups			$52,106	$44,356	$0	$0					
TOTAL BOH, PUBLIC & ADMINISTRATION AREAS	**2,513**		**$244,734**	**$208,333**	**$0**	**$0**	**$9,282**	**$356,606**	**$96,462**	**$0**	**$453,068**
65,117.00 SF	*Level Unit Cost-->*		*$3.76*	*$3.20*			*$0.14*	*$5.48*	*$1.48*		*$6.96*

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$17,455,822 FIRE SUPPRESSION - START 3/1/2025 (ONE YR AFTER FIRE ALARM)											
$9,115,150 CONCEPT 1											
$8,484,163 D SERVICES											
$7,797,130 D40 FIRE PROTECTION											
GARAGE											
39 **Pipe, steel, black, threaded, 1" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**19,720** L.F.	3,663 0.186	$304,703 15.45	$191,284 9.70	$0	$0	$11,477 0.58	$507,464 25.73	$137,269 6.96	$0	**$644,733** 32.69
40 **Pipe, steel, black, threaded, 1-1/4" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**120** L.F.	27 0.221	$1,989 16.58	$1,536 12.80	$0	$0	$92 0.77	$3,617 30.15	$979 8.15	$0	**$4,596** 38.30
41 **Pipe, steel, black, threaded, 1-1/2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**160** L.F.	39 0.246	$2,947 18.42	$2,440 15.25	$0	$0	$146 0.92	$5,533 34.58	$1,497 9.36	$0	**$7,030** 43.94
42 **Pipe, steel, black, threaded, 2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**220** L.F.	68 0.308	$5,065 23.02	$4,510 20.50	$0	$0	$271 1.23	$9,846 44.75	$2,663 12.11	$0	**$12,509** 56.86
43 **Pipe, fittings & valves, steel, black, grooved joint, 2-1/2" diameter, schedule10, incl coupling & clevis type hanger 10' OC**	**6,340** L.F.	2,043 0.322	$152,977 24.13	$76,714 12.10	$0	$0	$4,603 0.73	$234,294 36.95	$63,376 10.00	$0	**$297,670** 46.95
44 **Pipe, fittings & valves, steel, black, grooved joint, 4" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**5,500** L.F.	2,212 0.402	$165,633 30.11	$104,775 19.05	$0	$0	$6,287 1.14	$276,694 50.31	$74,846 13.61	$0	**$351,540** 63.92
45 **Pipe, fittings & valves, steel, black, grooved joint, 5" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**1,620** L.F.	797 0.492	$59,677 36.84	$38,880 24.00	$0	$0	$2,333 1.44	$100,890 62.28	$27,291 16.85	$0	**$128,181** 79.12
46 **Pipe, fittings & valves, steel, black, grooved joint, 6" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**3,000** L.F.	1,926 0.642	$149,562 49.85	$91,500 30.50	$0	$0	$5,490 1.83	$246,552 82.18	$66,692 22.23	$0	**$313,244** 104.42
47 **Dry Sprinkler Head - Pendant**	**1,498** Ea.	921 0.615	$68,979 46.05	$104,860 70.00	$0	$0	$6,292 4.20	$180,131 120.25	$48,725 32.53	$0	**$228,856** 152.77
48 **Dry System Valve Set and Controller 4"**	**2** Ea.	39 19.68	$2,947 1,473.52	$24,000 12,000.00	$0	$0	$1,440 720.00	$28,387 14,193.52	$7,679 3,839.35	$0	**$36,066** 18,032.87

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$17,455,822 FIRE SUPPRESSION - START 3/1/2025 (ONE YR AFTER FIRE ALARM)											
$9,115,150 CONCEPT 1											
$8,484,163 D SERVICES											
$7,797,130 D40 FIRE PROTECTION											
GARAGE											
49 **Dry System Valve Set and Controller 6"**	**5** Ea.	98	$7,368	$70,000	$0	$0	$4,200	$81,568	$22,064	$0	**$103,632**
		19.68	1,473.52	14,000.00			840.00	16,313.52	4,412.81		20,726.33
Subtotal			$921,847	$710,499	$0	$0	$42,630	$1,674,976	$453,081	$0	**$2,128,057**
Taxes			$0	$42,630	$0	$0					
Subcontractor Markups			$249,360	$203,721	$0	$0					
TOTAL GARAGE	**11,834**		**$1,171,207**	**$956,850**	**$0**	**$0**	**$42,630**	**$1,674,976**	**$453,081**	**$0**	**$2,128,057**
318,322.00 SF	*Level Unit Cost-->*		*$3.68*	*$3.01*			*$0.13*	*$5.26*	*$1.42*		*$6.69*

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$17,455,822 FIRE SUPPRESSION - START 3/1/2025 (ONE YR AFTER FIRE ALARM)											
$9,115,150 CONCEPT 1											
$8,484,163 D SERVICES											
$7,797,130 D40 FIRE PROTECTION											
MECHANICAL ROOM SPACES											
50 **Pipe, steel, black, threaded, 1" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**800** L.F.	149	$12,361	$7,760	$0	$0	$466	$20,587	$5,569	$0	**$26,156**
		0.186	15.45	9.70			0.58	25.73	6.96		32.69
51 **Pipe, steel, black, threaded, 1-1/4" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**160** L.F.	35	$2,652	$2,048	$0	$0	$123	$4,823	$1,305	$0	**$6,128**
		0.221	16.58	12.80			0.77	30.15	8.15		38.30
52 **Pipe, steel, black, threaded, 1-1/2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**100** L.F.	25	$1,842	$1,525	$0	$0	$92	$3,458	$935	$0	**$4,394**
		0.246	18.42	15.25			0.92	34.58	9.36		43.94
53 **Pipe, steel, black, threaded, 2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**120** L.F.	37	$2,763	$2,460	$0	$0	$148	$5,370	$1,453	$0	**$6,823**
		0.308	23.02	20.50			1.23	44.75	12.11		56.86
54 **Pipe, fittings & valves, steel, black, grooved joint, 2-1/2" diameter, schedule10, incl coupling & clevis type hanger 10' OC**	**140** L.F.	45	$3,378	$1,694	$0	$0	$102	$5,174	$1,399	$0	**$6,573**
		0.322	24.13	12.10			0.73	36.95	10.00		46.95
55 **Pipe, fittings & valves, steel, black, grooved joint, 3" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**140** L.F.	50	$3,752	$1,953	$0	$0	$117	$5,822	$1,575	$0	**$7,397**
		0.358	26.80	13.95			0.84	41.59	11.25		52.84

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$17,455,822 FIRE SUPPRESSION - START 3/1/2025 (ONE YR AFTER FIRE ALARM)												
$9,115,150 CONCEPT 1												
$8,484,163 D SERVICES												
$7,797,130 D40 FIRE PROTECTION												
MECHANICAL ROOM SPACES												
56 **Pipe, fittings & valves, steel, black, grooved joint, 4" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**200**	L.F.	80	$6,023	$3,810	$0	$0	$229	$10,062	$2,722	$0	**$12,783**
			0.402	30.11	19.05			1.14	50.31	13.61		63.92
57 **Pipe, fittings & valves, steel, black, grooved joint, 6" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**60**	L.F.	39	$2,991	$1,830	$0	$0	$110	$4,931	$1,334	$0	**$6,265**
			0.642	49.85	30.50			1.83	82.18	22.23		104.42
58 **Floor Control Valve Assembly 6**	**1**	Ea.	4	$276	$1,379	$0	$0	$83	$1,738	$470	$0	**$2,208**
			3.69	276.28	1,379.00			82.74	1,738.02	470.14		2,208.16
59 **Sprinkler Head - standard coverage quick response, upright K=8.0 (Tyco 4131)**	**110**	Ea.	162	$12,157	$2,640	$0	$0	$158	$14,955	$3,141	$0	**$18,095**
			1.476	110.51	24.00			1.44	135.95	28.55		164.50
Subtotal				$48,195	$27,099	$0	$0	$1,626	$76,920	$19,902	$0	$96,822
Taxes				$0	$1,626	$0	$0					
Subcontractor Markups				$12,301	$7,601	$0	$0					
TOTAL MECHANICAL ROOM SPACES	**626**			**$60,497**	**$36,326**	**$0**	**$0**	**$1,626**	**$76,920**	**$19,902**	**$0**	$96,822
15,138.00 SF		*Level Unit Cost-->*		*$4.00*	*$2.40*			*$0.11*	*$5.08*	*$1.31*		*$6.40*
Estimate Tree Structure Rollups												
$17,455,822 FIRE SUPPRESSION - START 3/1/2025 (ONE YR AFTER FIRE ALARM)												
$9,115,150 CONCEPT 1												
$8,484,163 D SERVICES												
$7,797,130 D40 FIRE PROTECTION												
FIRE PUMPS & PUMP ROOM PIPING												
60 **Fire pumps, electric, 750 GPM, 150 psi, 75 HP, 3550 RPM, 5" pump, including controller, fittings and relief valve**	**1**	Ea.	79	$5,305	$28,500	$0	$0	$1,710	$35,515	$9,607	$0	**$45,122**
			78.72	5,305.45	28,500.00			1,710.00	35,515.45	9,606.93		45,122.38
61 **Jockey Pump**	**1**	Ea.	30	$1,990	$2,500	$0	$0	$150	$4,640	$1,255	$0	**$5,895**
			29.52	1,989.55	2,500.00			150.00	4,639.55	1,255.00		5,894.55
62 **Fire Pump Room Piping**	**1**	L.S.	369	$28,652	$40,000	$1,195	$0	$2,472	$72,319	$19,562	$0	**$91,881**
			369	28,651.74	40,000.00	1,195.41		2,471.72	72,318.87	19,562.25		91,881.13

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$17,455,822 FIRE SUPPRESSION - START 3/1/2025 (ONE YR AFTER FIRE ALARM)												
$9,115,150 CONCEPT 1												
$8,484,163 D SERVICES												
$7,797,130 D40 FIRE PROTECTION												
FIRE PUMPS & PUMP ROOM PIPING												
63 **Backflow preventer, RPZ, 8" pipe size**	1	Ea.	15	$1,146	$8,509	$0	$0	$511	$10,166	$2,750	$0	**$12,915**
			14.76	1,146.07	8,509.00			510.54	10,165.61	2,749.80		12,915.41
Subtotal				$37,093	$79,509	$1,195	$0	$4,842	$122,639	$33,174	$0	**$155,813**
Taxes				$0	$4,771	$72	$0					
Subcontractor Markups				$10,034	$22,798	$343	$0					
TOTAL FIRE PUMPS & PUMP ROOM PIPING	**492**			**$47,126**	**$107,077**	**$1,610**	**$0**	**$4,842**	**$122,639**	**$33,174**	**$0**	**$155,813**
1.00 EA												
Estimate Tree Structure Rollups												
$9,115,150 CONCEPT 1												
$8,484,163 D SERVICES												
$186,377 D50 ELECTRICAL												
$126,212 D5010 ELECTRICAL SERVICE & DISTRIBUTION												
D501099 OTHER SERVICE AND DISTRIBUTION												
64 **Generator set, diesel, 3 phase 4 wire, 277/480 V, 350 kW, incl battery, charger, muffler, & day tank, excl conduit, wiring, & concrete**	1	Ea.	123	$9,930	$79,000	$796	$0	$4,788	$94,514	$22,192	$0	**$116,706**
			123	9,929.78	79,000.00	796.42		4,787.78	94,513.99	22,191.89		116,705.87
65 **Automatic transfer switches, enclosed, 3 pole, 480 volt, 600 amp**	1	Ea.	20	$1,683	$5,675	$0	$0	$341	$7,699	$1,808	$0	**$9,507**
			19.68	1,683.33	5,675.00			340.50	7,698.83	1,807.68		9,506.51
Subtotal				$11,613	$84,675	$796	$0	$5,128	$102,213	$24,000	$0	**$126,212**
Taxes				$0	$5,081	$48	$0					
Subcontractor Markups				$2,727	$21,075	$198	$0					
TOTAL D501099 OTHER SERVICE AND DISTRIBUTION	**143**			**$14,340**	**$110,830**	**$1,042**	**$0**	**$5,128**	**$102,213**	**$24,000**	**$0**	**$126,212**
350.00 kW			*Level Unit Cost-->*	*$40.97*	*$316.66*	*$2.98*		*$14.65*	*$292.04*	*$68.57*		*$360.61*

Estimate Tree Structure Rollups

$9,115,150 CONCEPT 1
$8,484,163 D SERVICES
$186,377 D50 ELECTRICAL
$60,165 D5020 LIGHTING & BRANCH WIRING

D502099 OTHER LIGHTING AND BRANCH WIRING

	LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
66	**Motor connections 'Fire Pump', flexible conduit and fittings, 3 phase, 460 volt, 150 HP motor**	**1**	Ea.	5	$468	$78	$0	$0	$5	$550	$129	$0	**$679**
				5.466	467.54	77.50			4.65	549.69	129.07		678.76
67	**Rigid galvanized steel conduit, 2-1/2" diameter, to 10' H, incl 2 terminations,2 elbows, 11 beam clamps, and 11 couplings per 100 LF**	**600**	L.F.	169	$14,456	$18,300	$0	$0	$1,098	$33,854	$7,949	$0	**$41,802**
				0.282	24.09	30.50			1.83	56.42	13.25		69.67
68	**Rigid galvanized steel conduit elbows, 2-1/2" diameter, to 10' high**	**6**	Ea.	7	$631	$387	$0	$0	$23	$1,041	$245	$0	**$1,286**
				1.23	105.21	64.50			3.87	173.58	40.76		214.34
69	**Conduit fittings for rigid galvanized steel, standard, locknuts, 2-1/2" diameter**	**8**	Ea.		$0	$56	$0	$0	$3	$59	$14	$0	**$73**
						6.95			0.42	7.37	1.73		9.10
70	**Conduit fittings for rigid galvanized steel, bushings, plastic, 2-1/2" diameter**	**4**	Ea.	3	$259	$10	$0	$0	$1	$269	$63	$0	**$332**
				0.757	64.70	2.39			0.14	67.24	15.79		83.02
71	**Wire, aluminum, stranded, 600 volt, 250 kcmil, type THHN, normal installation conditions in wireway, conduit, cable tray**	**19.80**	C.L.	67	$5,747	$4,792	$0	$0	$287	$10,826	$2,542	$0	**$13,368**
				3.394	290.27	242.00			14.52	546.79	128.39		675.17
72	**Insulated ground wire, copper, stranded, #4**	**6.60**	C.L.	12	$1,048	$1,016	$0	$0	$61	$2,125	$499	$0	**$2,624**
				1.856	158.76	154.00			9.24	322.00	75.61		397.61
	Subtotal				$22,608	$24,638	$0	$0	$1,478	$48,724	$11,440	$0	**$60,165**
	Taxes				$0	$1,478	$0	$0					
	Subcontractor Markups				$5,308	$6,132	$0	$0					
	TOTAL D502099 OTHER LIGHTING AND BRANCH WIRING	**264**			**$27,917**	**$32,248**	**$0**	**$0**	**$1,478**	**$48,724**	**$11,440**	**$0**	**$60,165**
	1.00 EA												

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$9,115,150 CONCEPT 1											
$504,859 F SPECIAL CONSTRUCTION & DEMOLITION											
$504,859 F20 SELECTIVE BUILDING DEMOLITION											
$504,859 F2010 BUILDING ELEMENTS DEMOLITION											
F201004 INTERIOR CONSTRUCTION & FINISHES											
73 **Remove & salvage soffit in the unit (to be reinstalled after fire supression work done)**	**2,286** L.F.	562	$30,766	$20,117	$0	$0	$1,207	$52,089	$16,825	$0	**$68,914**
		0.246	13.46	8.80			0.53	22.79	7.36		30.15
74 **Ceiling demolition, gypsum board, on suspension system, remove (Ceiling demolition for fire supression work in hallway)**	**5,550** S.F.	150	$4,768	$0	$0	$0	$0	$4,768	$1,540	$0	**$6,308**
		0.027	0.86					0.86	0.28		1.14
75 **Temporary protection, flooring, taped seams, 1/8" tempered hardboard**	**5,550** S.F.	75	$4,108	$2,553	$0	$0	$153	$6,814	$2,201	$0	**$9,015**
		0.014	0.74	0.46			0.03	1.23	0.40		1.62
76 **Temporary protect existing walls in the hallways durign ceilign demo work**	**17,350** S.F.	149	$11,626	$1,041	$0	$0	$62	$12,730	$4,112	$0	**$16,842**
		0.009	0.67	0.06				0.73	0.24		0.97
Subtotal			$51,268	$23,711	$0	$0	$1,423	$76,401	$24,678	$0	**$101,079**
Taxes			$0	$1,423	$0	$0					
Subcontractor Markups			$16,560	$8,118	$0	$0					
TOTAL F201004 INTERIOR CONSTRUCTION & FINISHES	**937**		**$67,827**	**$33,252**	**$0**	**$0**	**$1,423**	**$76,401**	**$24,678**	**$0**	**$101,079**
1.00 LS											
Estimate Tree Structure Rollups											
$9,115,150 CONCEPT 1											
$504,859 F SPECIAL CONSTRUCTION & DEMOLITION											
$504,859 F20 SELECTIVE BUILDING DEMOLITION											
$504,859 F2010 BUILDING ELEMENTS DEMOLITION											
F201006 MECHANICAL SYSTEMS											
77 **Pipe, metal pipe, to 1-1/2" diam., selective demolition**	**27,600** L.F.	1,358	$112,970	$0	$0	$0	$0	$112,970	$30,558	$0	**$143,528**
		0.049	4.09					4.09	1.11		5.20
78 **Pipe, metal pipe, 2" to 3-1/2" diam., selective demolition**	**7,940** L.F.	518	$43,062	$0	$0	$0	$0	$43,062	$11,648	$0	**$54,710**
		0.065	5.42					5.42	1.47		6.89
79 **Pipe, metal pipe, 4" to 6" diam., selective demolition**	**8,420** L.F.	1,657	$137,856	$0	$0	$0	$0	$137,856	$37,290	$0	**$175,146**
		0.197	16.37					16.37	4.43		20.80

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$9,115,150 CONCEPT 1											
$504,859 F SPECIAL CONSTRUCTION & DEMOLITION											
$504,859 F20 SELECTIVE BUILDING DEMOLITION											
$504,859 F2010 BUILDING ELEMENTS DEMOLITION											
F201006 MECHANICAL SYSTEMS											
80 **Fans, 1-1/2 thru 10 HP or 20,000 CFM, selective demolition**	**14** Ea.	276	$19,602	$0	$0	$0	$0	$19,602	$5,302	$0	**$24,904**
		19.68	1,400.15					1,400.15	378.74		1,778.89
Subtotal			$313,489	$0	$0	$0	$0	$313,489	$84,799	$0	$398,288
Subcontractor Markups			$84,799	$0	$0	$0					
TOTAL F201006 MECHANICAL SYSTEMS	**3,808**		**$398,288**	**$0**	**$0**	**$0**	**$0**	**$313,489**	**$84,799**	**$0**	$398,288
1.00 LS											
Estimate Tree Structure Rollups											
$9,115,150 CONCEPT 1											
$504,859 F SPECIAL CONSTRUCTION & DEMOLITION											
$504,859 F20 SELECTIVE BUILDING DEMOLITION											
$504,859 F2010 BUILDING ELEMENTS DEMOLITION											
F201007 ELECTRICAL SYSTEMS											
81 **Generator set, 3 phase 4 wire, 277/480 V, 200 kW, electrical demolition, remove, incl accessories**	**1** Ea.	50	$4,280	$0	$0	$0	$0	$4,280	$1,005	$0	**$5,285**
		50.034	4,279.65					4,279.65	1,004.86		5,284.51
82 **Transfer switches, enclosed, 260 A, electrical demolition, remove**	**1** Ea.	2	$168	$0	$0	$0	$0	$168	$40	$0	**$208**
		1.968	168.33					168.33	39.52		207.85
Subtotal			$4,448	$0	$0	$0	$0	$4,448	$1,044	$0	$5,492
Subcontractor Markups			$1,044	$0	$0	$0					
TOTAL F201007 ELECTRICAL SYSTEMS	**52**		**$5,492**	**$0**	**$0**	**$0**	**$0**	**$4,448**	**$1,044**	**$0**	$5,492
1.00 LS											
Estimate Tree Structure Rollups											
$8,340,672 CONCEPT 2											
$162,044 C INTERIORS											
$162,044 C10 INTERIOR CONSTRUCTION											
$162,044 C1030 SPECIALTIES											
C1030C INTERIOR SOFFIT											
83 **Add soffit in the unit**	**2,286** L.F.	562	$30,766	$36,667	$0	$0	$2,200	$69,633	$22,491	$0	**$92,124**
		0.246	13.46	16.04			0.96	30.46	9.84		40.30

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$8,340,672 CONCEPT 2												
$162,044 C INTERIORS												
$162,044 C10 INTERIOR CONSTRUCTION												
$162,044 C1030 SPECIALTIES												
C1030C INTERIOR SOFFIT												
84 **Add soffit in the hallway**	**1,735**	L.F.	427	$23,350	$27,829	$0	$0	$1,670	$52,849	$17,070	$0	**$69,919**
			0.246	13.46	16.04			0.96	30.46	9.84		40.30
Subtotal				$54,116	$64,497	$0	$0	$3,870	$122,482	$39,562	$0	**$162,044**
Taxes				$0	$3,870	$0	$0					
Subcontractor Markups				$17,479	$22,082	$0	$0					
TOTAL C1030C INTERIOR SOFFIT	**989**			**$71,595**	**$90,449**	**$0**	**$0**	**$3,870**	**$122,482**	**$39,562**	**$0**	**$162,044**
4,021.00 LF			*Level Unit Cost-->*	*$17.81*	*$22.49*			*$0.96*	*$30.46*	*$9.84*		*$40.30*
Estimate Tree Structure Rollups												
$8,340,672 CONCEPT 2												
$7,627,773 D SERVICES												
$500,656 D30 HVAC												
$312,736 D3040 DISTRIBUTION SYSTEMS												
D304007 EXHAUST SYSTEMS												
85 **Garage Exhaust Fans (Vaneaxial to 17,000 CFM 7.5 HP)**	**7**	Ea.	52	$3,812	$129,500	$0	$0	$7,770	$141,082	$38,163	$0	**$179,244**
			7.38	544.50	18,500.00			1,110.00	20,154.50	5,451.79		25,606.30
86 **Stairwell and Elevator Pressurization (Centrifugal Backward Curved to 10 HP)**	**7**	Ea.	69	$4,901	$94,500	$0	$0	$5,670	$105,071	$28,422	$0	**$133,492**
			9.84	700.08	13,500.00			810.00	15,010.08	4,060.22		19,070.30
Subtotal				$8,712	$224,000	$0	$0	$13,440	$246,152	$66,584	$0	**$312,736**
Taxes				$0	$13,440	$0	$0					
Subcontractor Markups				$2,357	$64,228	$0	$0					
TOTAL D304007 EXHAUST SYSTEMS	**121**			**$11,069**	**$301,668**	**$0**	**$0**	**$13,440**	**$246,152**	**$66,584**	**$0**	**$312,736**
1.00 EA												

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$8,340,672 CONCEPT 2											
$7,627,773 D SERVICES											
$500,656 D30 HVAC											
$160,993 D3060 CONTROLS & INSTRUMENTATION											
D306001 HVAC CONTROLS											
87 **Exhaust Fan Control**	**14** Ea.	172	$14,746	$23,800	$0	$0	$1,428	$39,974	$10,813	$0	**$50,787**
		12.3	1,053.31	1,700.00			102.00	2,855.31	772.36		3,627.67
88 **Tie-into Existing Operator Station**	**24** Hrs.	30	$2,528	$0	$0	$0	$0	$2,528	$684	$0	**$3,212**
		1.23	105.33					105.33	28.49		133.82
89 **System Check-out & Programming**	**120** Hrs.	148	$10,873	$0	$0	$0	$0	$10,873	$2,941	$0	**$13,814**
		1.23	90.61					90.61	24.51		115.12
90 **Electric metallic tubing (EMT), 3/4" diameter, to 15' high, incl 2 terminations, 2 field bend elbows, 11 beam clamps, and 11 couplings per 100 LF**	**50** C.L.	381	$32,615	$4,800	$0	$0	$288	$37,703	$10,199	$0	**$47,901**
		7.626	652.29	96.00			5.76	754.05	203.97		958.02
91 **Control Wiring**	**50** C.L.	93	$7,947	$1,250	$0	$0	$75	$9,272	$2,508	$0	**$11,780**
		1.856	158.94	25.00			1.50	185.44	50.16		235.61
92 **Interface wtih Fire Protection Alarm System**	**1** Ea.	246	$21,066	$5,000	$0	$0	$300	$26,366	$7,132	$0	**$33,498**
		246	21,066.21	5,000.00			300.00	26,366.21	7,132.06		33,498.27
Subtotal			$89,775	$34,850	$0	$0	$2,091	$126,716	$34,277	$0	**$160,993**
Taxes			$0	$2,091	$0	$0					
Subcontractor Markups			$24,284	$9,993	$0	$0					
TOTAL D306001 HVAC CONTROLS	**1,069**		**$114,060**	**$46,934**	**$0**	**$0**	**$2,091**	**$126,716**	**$34,277**	**$0**	**$160,993**
1.00 EA											
Estimate Tree Structure Rollups											
$8,340,672 CONCEPT 2											
$7,627,773 D SERVICES											
$500,656 D30 HVAC											
$26,926 D3070 SYSTEMS TESTING & BALANCING											
D307001 TESTING & BALANCING											
93 **System Testing & Balance**	**60** Hrs.	74	$3,757	$0	$0	$0	$0	$3,757	$1,016	$0	**$4,773**
		1.23	62.61					62.61	16.94		79.55

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$8,340,672 CONCEPT 2											
$7,627,773 D SERVICES											
$500,656 D30 HVAC											
$26,926 D3070 SYSTEMS TESTING & BALANCING											
D307001 TESTING & BALANCING											
94 **System Commissioning & Assist in T & B**	**120** Hrs.	148	$11,077	$6,000	$0	$0	$360	$17,437	$4,717	$0	**$22,154**
		1.23	92.31	50.00			3.00	145.31	39.31		184.61
Subtotal			$14,834	$6,000	$0	$0	$360	$21,194	$5,733	$0	**$26,926**
Taxes			$0	$360	$0	$0					
Subcontractor Markups			$4,012	$1,720	$0	$0					
TOTAL D307001 TESTING & BALANCING	**221**		**$18,846**	**$8,080**	**$0**	**$0**	**$360**	**$21,194**	**$5,733**	**$0**	**$26,926**
1.00 EA											
Estimate Tree Structure Rollups											
$17,455,822 FIRE SUPPRESSION - START 3/1/2025 (ONE YR AFTER FIRE ALARM)											
$8,340,672 CONCEPT 2											
$7,627,773 D SERVICES											
$6,940,740 D40 FIRE PROTECTION											
TENANT TOWER											
95 **Pipe, plastic, CPVC fire suppression, C-UL-S, FM, NFPA 13, 13R & 13D, SDR 13.5,1" diameter, socket joint, no couplings or hangers**	**30,040** L.F.	1,737	$110,676	$98,892	$0	$0	$5,934	$215,501	$58,293	$0	**$273,794**
		0.058	3.68	3.29			0.20	7.17	1.94		9.11
96 **Pipe, plastic, CPVC fire suppression, C-UL-S, FM, NFPA 13, 13R & 13D, SDR 13.5,1-1/4" diameter, socket joint, no couplings or hangers**	**6,880** L.F.	525	$33,438	$32,126	$0	$0	$1,928	$67,491	$18,256	$0	**$85,748**
		0.076	4.86	4.67			0.28	9.81	2.65		12.46
97 **Pipe, plastic, CPVC fire suppression, C-UL-S, FM, NFPA 13, 13R & 13D, SDR 13.5,1-1/2" diameter, socket joint, no couplings or hangers**	**3,940** L.F.	407	$25,944	$25,537	$0	$0	$1,532	$53,013	$14,340	$0	**$67,353**
		0.103	6.59	6.48			0.39	13.46	3.64		17.09
98 **Pipe, plastic, CPVC fire suppression, C-UL-S, FM, NFPA 13, 13R & 13D, SDR 13.5,2" diameter, socket joint, no couplings or hangers**	**7,060** L.F.	990	$63,091	$66,332	$0	$0	$3,980	$133,403	$36,085	$0	**$169,488**
		0.14	8.94	9.40			0.56	18.90	5.11		24.01
99 **Pipe, fittings & valves, steel, black, grooved joint, 2-1/2" diameter, schedule10, incl coupling & clevis type hanger 10' OC**	**18,640** L.F.	6,007	$449,762	$225,544	$0	$0	$13,533	$688,839	$186,331	$0	**$875,169**
		0.322	24.13	12.10			0.73	36.95	10.00		46.95
100 **Pipe, fittings & valves, steel, black, grooved joint, 6" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**14,660** L.F.	9,413	$730,860	$447,130	$0	$0	$26,828	$1,204,818	$325,903	$0	**$1,530,721**
		0.642	49.85	30.50			1.83	82.18	22.23		104.42

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$17,455,822 FIRE SUPPRESSION - START 3/1/2025 (ONE YR AFTER FIRE ALARM)												
$8,340,672 CONCEPT 2												
$7,627,773 D SERVICES												
$6,940,740 D40 FIRE PROTECTION												
TENANT TOWER												
101 Sprinkler Head, Sidewall, K4.4, Tyco 4334	**5,977**	Ea.	3,676	$275,226	$145,719	$0	$0	$8,743	$429,688	$116,231	$0	**$545,919**
			0.615	46.05	24.38			1.46	71.89	19.45		91.34
102 Sprinkler Head, Pendent Conceal include trim plate, K4.9, Tyco 3586	**365**	Ea.		$0	$13,925	$0	$0	$835	$14,760	$3,993	$0	**$18,753**
					38.15			2.29	40.44	10.94		51.38
103 Wet Pipe Alarm Valve Set 6"	**6**	Ea.	59	$4,421	$18,600	$0	$0	$1,116	$24,137	$6,529	$0	**$30,665**
			9.84	736.76	3,100.00			186.00	4,022.76	1,088.16		5,110.92
104 Floor Control Valve Set 2-1/2"	**111**	Ea.	1,092	$81,780	$102,120	$0	$0	$6,127	$190,027	$51,402	$0	**$241,430**
			9.84	736.76	920.00			55.20	1,711.96	463.08		2,175.04
105 Fire Hose Valve	**111**	Ea.	1,092	$81,780	$55,500	$0	$0	$3,330	$140,610	$38,035	$0	**$178,645**
			9.84	736.76	500.00			30.00	1,266.76	342.66		1,609.42
106 Fire Department Connection	**6**	Ea.	15	$1,105	$9,000	$0	$0	$540	$10,645	$2,880	$0	**$13,525**
			2.46	184.19	1,500.00			90.00	1,774.19	479.92		2,254.11
107 Seal / Fire Stop Wall Openings	**4,699**	Ea.	1,445	$55,901	$3,524	$0	$0	$211	$59,637	$16,132	$0	**$75,769**
			0.307	11.90	0.75			0.04	12.69	3.43		16.12
Subtotal				$1,913,983	$1,243,949	$0	$0	$74,637	$3,232,569	$874,410	$0	**$4,106,979**
Taxes				$0	$74,637	$0	$0					
Subcontractor Markups				$517,732	$356,678	$0	$0					
TOTAL TENANT TOWER	**26,457**			**$2,431,715**	**$1,675,264**	**$0**	**$0**	**$74,637**	**$3,232,569**	**$874,410**	**$0**	**$4,106,979**
969,696.00 SF			*Level Unit Cost-->*	*$2.51*	*$1.73*			*$0.08*	*$3.33*	*$0.90*		*$4.24*

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$17,455,822 FIRE SUPPRESSION - START 3/1/2025 (ONE YR AFTER FIRE ALARM)												
$8,340,672 CONCEPT 2												
$7,627,773 D SERVICES												
$6,940,740 D40 FIRE PROTECTION												
BOH, PUBLIC & ADMINISTRATION AREAS												
108 **Pipe, steel, black, threaded, 1" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**4,340**	L.F.	806 0.186	$67,059 15.45	$42,098 9.70	$0	$0	$2,526 0.58	$111,683 25.73	$30,210 6.96	$0	**$141,894** 32.69
109 **Pipe, steel, black, threaded, 1-1/4" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**1,320**	L.F.	292 0.221	$21,882 16.58	$16,896 12.80	$0	$0	$1,014 0.77	$39,792 30.15	$10,764 8.15	$0	**$50,555** 38.30
110 **Pipe, steel, black, threaded, 1-1/2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**880**	L.F.	216 0.246	$16,209 18.42	$13,420 15.25	$0	$0	$805 0.92	$30,434 34.58	$8,232 9.36	$0	**$38,666** 43.94
111 **Pipe, steel, black, threaded, 2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**540**	L.F.	166 0.308	$12,433 23.02	$11,070 20.50	$0	$0	$664 1.23	$24,167 44.75	$6,537 12.11	$0	**$30,704** 56.86
112 **Pipe, fittings & valves, steel, black, grooved joint, 3" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**440**	L.F.	157 0.358	$11,792 26.80	$6,138 13.95	$0	$0	$368 0.84	$18,298 41.59	$4,950 11.25	$0	**$23,248** 52.84
113 **Pipe, fittings & valves, steel, black, grooved joint, 5" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**1,040**	L.F.	512 0.492	$38,311 36.84	$24,960 24.00	$0	$0	$1,498 1.44	$64,769 62.28	$17,520 16.85	$0	**$82,289** 79.12
114 **Floor Control Valve Assembly 4**	**6**	Ea.	22 3.69	$1,658 276.29	$6,654 1,109.00	$0	$0	$399 66.54	$8,711 1,451.83	$2,356 392.72	$0	**$11,067** 1,844.54
115 **Floor Control Valve Assembly 6**	**1**	Ea.	4 3.69	$276 276.28	$1,379 1,379.00	$0	$0	$83 82.74	$1,738 1,738.02	$470 470.14	$0	**$2,208** 2,208.16
116 **Sprinkler Head, Pendent Conceal include trim plate, K4.9, Tyco 3586**	**470**	Ea.		$0 	$17,931 38.15	$0	$0	$1,076 2.29	$19,006 40.44	$5,141 10.94	$0	**$24,148** 51.38
117 **Fire Hose Valve**	**28**	Ea.	276 9.84	$20,629 736.76	$14,000 500.00	$0	$0	$840 30.00	$35,469 1,266.76	$9,594 342.66	$0	**$45,064** 1,609.42

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$17,455,822 FIRE SUPPRESSION - START 3/1/2025 (ONE YR AFTER FIRE ALARM)												
$8,340,672 CONCEPT 2												
$7,627,773 D SERVICES												
$6,940,740 D40 FIRE PROTECTION												
BOH, PUBLIC & ADMINISTRATION AREAS												
118 **Seal / Fire Stop Wall Openings**	**200**	Ea.	62	$2,379	$150	$0	$0	$9	$2,538	$687	$0	**$3,225**
			0.308	11.90	0.75			0.04	12.69	3.43		16.12
Subtotal				$192,628	$154,696	$0	$0	$9,282	$356,606	$96,462	$0	$453,068
Taxes				$0	$9,282	$0	$0					
Subcontractor Markups				$52,106	$44,356	$0	$0					
TOTAL BOH, PUBLIC & ADMINISTRATION AREAS	**2,513**			**$244,734**	**$208,333**	**$0**	**$0**	**$9,282**	**$356,606**	**$96,462**	**$0**	**$453,068**
65,117.00 SF		*Level Unit Cost–>*		*$3.76*	*$3.20*			*$0.14*	*$5.48*	*$1.48*		*$6.96*
Estimate Tree Structure Rollups												
$17,455,822 FIRE SUPPRESSION - START 3/1/2025 (ONE YR AFTER FIRE ALARM)												
$8,340,672 CONCEPT 2												
$7,627,773 D SERVICES												
$6,940,740 D40 FIRE PROTECTION												
GARAGE												
119 **Pipe, steel, black, threaded, 1" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**19,720**	L.F.	3,663	$304,703	$191,284	$0	$0	$11,477	$507,464	$137,269	$0	**$644,733**
			0.186	15.45	9.70			0.58	25.73	6.96		32.69
120 **Pipe, steel, black, threaded, 1-1/4" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**120**	L.F.	27	$1,989	$1,536	$0	$0	$92	$3,617	$979	$0	**$4,596**
			0.221	16.58	12.80			0.77	30.15	8.15		38.30
121 **Pipe, steel, black, threaded, 1-1/2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**160**	L.F.	39	$2,947	$2,440	$0	$0	$146	$5,533	$1,497	$0	**$7,030**
			0.246	18.42	15.25			0.92	34.58	9.36		43.94
122 **Pipe, steel, black, threaded, 2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**220**	L.F.	68	$5,065	$4,510	$0	$0	$271	$9,846	$2,663	$0	**$12,509**
			0.308	23.02	20.50			1.23	44.75	12.11		56.86
123 **Pipe, fittings & valves, steel, black, grooved joint, 2-1/2" diameter, schedule10, incl coupling & clevis type hanger 10' OC**	**6,340**	L.F.	2,043	$152,977	$76,714	$0	$0	$4,603	$234,294	$63,376	$0	**$297,670**
			0.322	24.13	12.10			0.73	36.95	10.00		46.95
124 **Pipe, fittings & valves, steel, black, grooved joint, 4" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**5,500**	L.F.	2,212	$165,633	$104,775	$0	$0	$6,287	$276,694	$74,846	$0	**$351,540**
			0.402	30.11	19.05			1.14	50.31	13.61		63.92

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$17,455,822 FIRE SUPPRESSION - START 3/1/2025 (ONE YR AFTER FIRE ALARM)											
$8,340,672 CONCEPT 2											
$7,627,773 D SERVICES											
$6,940,740 D40 FIRE PROTECTION											
GARAGE											
125 **Pipe, fittings & valves, steel, black, grooved joint, 5" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**1,620** L.F.	797	$59,677	$38,880	$0	$0	$2,333	$100,890	$27,291	$0	**$128,181**
		0.492	36.84	24.00			1.44	62.28	16.85		79.12
126 **Pipe, fittings & valves, steel, black, grooved joint, 6" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**3,000** L.F.	1,926	$149,562	$91,500	$0	$0	$5,490	$246,552	$66,692	$0	**$313,244**
		0.642	49.85	30.50			1.83	82.18	22.23		104.42
127 **Dry Sprinkler Head - Pendant**	**1,498** Ea.	921	$68,979	$104,860	$0	$0	$6,292	$180,131	$48,725	$0	**$228,856**
		0.615	46.05	70.00			4.20	120.25	32.53		152.77
128 **Dry System Valve Set and Controller 4"**	**2** Ea.	39	$2,947	$24,000	$0	$0	$1,440	$28,387	$7,679	$0	**$36,066**
		19.68	1,473.52	12,000.00			720.00	14,193.52	3,839.35		18,032.87
129 **Dry System Valve Set and Controller 6"**	**5** Ea.	98	$7,368	$70,000	$0	$0	$4,200	$81,568	$22,064	$0	**$103,632**
		19.68	1,473.52	14,000.00			840.00	16,313.52	4,412.81		20,726.33
Subtotal			$921,847	$710,499	$0	$0	$42,630	$1,674,976	$453,081	$0	**$2,128,057**
Taxes			$0	$42,630	$0	$0					
Subcontractor Markups			$249,360	$203,721	$0	$0					
TOTAL GARAGE	**11,834**		**$1,171,207**	**$956,850**	**$0**	**$0**	**$42,630**	**$1,674,976**	**$453,081**	**$0**	**$2,128,057**
318,322.00 SF	*Level Unit Cost-->*		*$3.68*	*$3.01*			*$0.13*	*$5.26*	*$1.42*		*$6.69*
Estimate Tree Structure Rollups											
$17,455,822 FIRE SUPPRESSION - START 3/1/2025 (ONE YR AFTER FIRE ALARM)											
$8,340,672 CONCEPT 2											
$7,627,773 D SERVICES											
$6,940,740 D40 FIRE PROTECTION											
MECHANICAL ROOM SPACES											
130 **Pipe, steel, black, threaded, 1" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**800** L.F.	149	$12,361	$7,760	$0	$0	$466	$20,587	$5,569	$0	**$26,156**
		0.186	15.45	9.70			0.58	25.73	6.96		32.69
131 **Pipe, steel, black, threaded, 1-1/4" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**160** L.F.	35	$2,652	$2,048	$0	$0	$123	$4,823	$1,305	$0	**$6,128**
		0.221	16.58	12.80			0.77	30.15	8.15		38.30

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$17,455,822 FIRE SUPPRESSION - START 3/1/2025 (ONE YR AFTER FIRE ALARM)											
$8,340,672 CONCEPT 2											
$7,627,773 D SERVICES											
$6,940,740 D40 FIRE PROTECTION											
MECHANICAL ROOM SPACES											
132 **Pipe, steel, black, threaded, 1-1/2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**100** L.F.	25 0.246	$1,842 18.42	$1,525 15.25	$0	$0	$92 0.92	$3,458 34.58	$935 9.36	$0	**$4,394** 43.94
133 **Pipe, steel, black, threaded, 2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**120** L.F.	37 0.308	$2,763 23.02	$2,460 20.50	$0	$0	$148 1.23	$5,370 44.75	$1,453 12.11	$0	**$6,823** 56.86
134 **Pipe, fittings & valves, steel, black, grooved joint, 2-1/2" diameter, schedule10, incl coupling & clevis type hanger 10' OC**	**140** L.F.	45 0.322	$3,378 24.13	$1,694 12.10	$0	$0	$102 0.73	$5,174 36.95	$1,399 10.00	$0	**$6,573** 46.95
135 **Pipe, fittings & valves, steel, black, grooved joint, 3" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**140** L.F.	50 0.358	$3,752 26.80	$1,953 13.95	$0	$0	$117 0.84	$5,822 41.59	$1,575 11.25	$0	**$7,397** 52.84
136 **Pipe, fittings & valves, steel, black, grooved joint, 4" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**200** L.F.	80 0.402	$6,023 30.11	$3,810 19.05	$0	$0	$229 1.14	$10,062 50.31	$2,722 13.61	$0	**$12,783** 63.92
137 **Pipe, fittings & valves, steel, black, grooved joint, 6" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**60** L.F.	39 0.642	$2,991 49.85	$1,830 30.50	$0	$0	$110 1.83	$4,931 82.18	$1,334 22.23	$0	**$6,265** 104.42
138 **Floor Control Valve Assembly 6**	**1** Ea.	4 3.69	$276 276.28	$1,379 1,379.00	$0	$0	$83 82.74	$1,738 1,738.02	$470 470.14	$0	**$2,208** 2,208.16
139 **Sprinkler Head - standard coverage quick response, upright K=8.0 (Tyco 4131)**	**110** Ea.	162 1.476	$12,157 110.51	$2,640 24.00	$0	$0	$158 1.44	$14,955 135.95	$3,141 28.55	$0	**$18,095** 164.50
Subtotal			$48,195	$27,099	$0	$0	$1,626	$76,920	$19,902	$0	**$96,822**
Taxes			$0	$1,626	$0	$0					
Subcontractor Markups			$12,301	$7,601	$0	$0					
TOTAL MECHANICAL ROOM SPACES	**626**		**$60,497**	**$36,326**	**$0**	**$0**	**$1,626**	**$76,920**	**$19,902**	**$0**	**$96,822**
15,138.00 SF	*Level Unit Cost-->*		*$4.00*	*$2.40*			*$0.11*	*$5.08*	*$1.31*		*$6.40*

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$17,455,822 FIRE SUPPRESSION - START 3/1/2025 (ONE YR AFTER FIRE ALARM)												
$8,340,672 CONCEPT 2												
$7,627,773 D SERVICES												
$6,940,740 D40 FIRE PROTECTION												
FIRE PUMPS & PUMP ROOM PIPING												
140 **Fire pumps, electric, 750 GPM, 150 psi, 75 HP, 3550 RPM, 5" pump, including controller, fittings and relief valve**	1	Ea.	79	$5,305	$28,500	$0	$0	$1,710	$35,515	$9,607	$0	**$45,122**
			78.72	5,305.45	28,500.00			1,710.00	35,515.45	9,606.93		45,122.38
141 **Jockey Pump**	1	Ea.	30	$1,990	$2,500	$0	$0	$150	$4,640	$1,255	$0	**$5,895**
			29.52	1,989.55	2,500.00			150.00	4,639.55	1,255.00		5,894.55
142 **Fire Pump Room Piping**	1	L.S.	369	$28,652	$40,000	$1,195	$0	$2,472	$72,319	$19,562	$0	**$91,881**
			369	28,651.74	40,000.00	1,195.41		2,471.72	72,318.87	19,562.25		91,881.13
143 **Backflow preventer, RPZ, 8" pipe size**	1	Ea.	15	$1,146	$8,509	$0	$0	$511	$10,166	$2,750	$0	**$12,915**
			14.76	1,146.07	8,509.00			510.54	10,165.61	2,749.80		12,915.41
Subtotal				$37,093	$79,509	$1,195	$0	$4,842	$122,639	$33,174	$0	$155,813
Taxes				$0	$4,771	$72	$0					
Subcontractor Markups				$10,034	$22,798	$343	$0					
TOTAL FIRE PUMPS & PUMP ROOM PIPING	**492**			**$47,126**	**$107,077**	**$1,610**	**$0**	**$4,842**	**$122,639**	**$33,174**	**$0**	**$155,813**
1.00 EA												
Estimate Tree Structure Rollups												
$8,340,672 CONCEPT 2												
$7,627,773 D SERVICES												
$186,377 D50 ELECTRICAL												
$126,212 D5010 ELECTRICAL SERVICE & DISTRIBUTION												
D501099 OTHER SERVICE AND DISTRIBUTION												
144 **Generator set, diesel, 3 phase 4 wire, 277/480 V, 350 kW, incl battery, charger, muffler, & day tank, excl conduit, wiring, & concrete**	1	Ea.	123	$9,930	$79,000	$796	$0	$4,788	$94,514	$22,192	$0	**$116,706**
			123	9,929.78	79,000.00	796.42		4,787.78	94,513.99	22,191.89		116,705.87

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$8,340,672 CONCEPT 2											
$7,627,773 D SERVICES											
$186,377 D50 ELECTRICAL											
$126,212 D5010 ELECTRICAL SERVICE & DISTRIBUTION											
D501099 OTHER SERVICE AND DISTRIBUTION											
145 **Automatic transfer switches, enclosed, 3 pole, 480 volt, 600 amp**	**1** Ea.	20	$1,683	$5,675	$0	$0	$341	$7,699	$1,808	$0	**$9,507**
		19.68	1,683.33	5,675.00			340.50	7,698.83	1,807.68		9,506.51
Subtotal			$11,613	$84,675	$796	$0	$5,128	$102,213	$24,000	$0	**$126,212**
Taxes			$0	$5,081	$48	$0					
Subcontractor Markups			$2,727	$21,075	$198	$0					
TOTAL D501099 OTHER SERVICE AND DISTRIBUTION	**143**		**$14,340**	**$110,830**	**$1,042**	**$0**	**$5,128**	**$102,213**	**$24,000**	**$0**	**$126,212**
3.50 kW	*Level Unit Cost-->*		*$4,097.11*	*$31,665.74*	*$297.84*		*$1,465.22*	*$29,203.66*	*$6,857.02*		*$36,060.68*
Estimate Tree Structure Rollups											
$8,340,672 CONCEPT 2											
$7,627,773 D SERVICES											
$186,377 D50 ELECTRICAL											
$60,165 D5020 LIGHTING & BRANCH WIRING											
D502099 OTHER LIGHTING AND BRANCH WIRING											
146 **Motor connections 'Fire Pump', flexible conduit and fittings, 3 phase, 460 volt, 150 HP motor**	**1** Ea.	5	$468	$78	$0	$0	$5	$550	$129	$0	**$679**
		5.466	467.54	77.50			4.65	549.69	129.07		678.76
147 **Rigid galvanized steel conduit, 2-1/2" diameter, to 10' H, incl 2 terminations,2 elbows, 11 beam clamps, and 11 couplings per 100 LF**	**600** L.F.	169	$14,456	$18,300	$0	$0	$1,098	$33,854	$7,949	$0	**$41,802**
		0.282	24.09	30.50			1.83	56.42	13.25		69.67
148 **Rigid galvanized steel conduit elbows, 2-1/2" diameter, to 10' high**	**6** Ea.	7	$631	$387	$0	$0	$23	$1,041	$245	$0	**$1,286**
		1.23	105.21	64.50			3.87	173.58	40.76		214.34
149 **Conduit fittings for rigid galvanized steel, standard, locknuts, 2-1/2" diameter**	**8** Ea.		$0	$56	$0	$0	$3	$59	$14	$0	**$73**
				6.95			0.42	7.37	1.73		9.10
150 **Conduit fittings for rigid galvanized steel, bushings, plastic, 2-1/2" diameter**	**4** Ea.	3	$259	$10	$0	$0	$1	$269	$63	$0	**$332**
		0.757	64.70	2.39			0.14	67.24	15.79		83.02
151 **Wire, aluminum, stranded, 600 volt, 250 kcmil, type THHN, normal installation conditions in wireway, conduit, cable tray**	**19.80** C.L.	67	$5,747	$4,792	$0	$0	$287	$10,826	$2,542	$0	**$13,368**
		3.394	290.27	242.00			14.52	546.79	128.39		675.17

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$8,340,672 CONCEPT 2											
$7,627,773 D SERVICES											
$186,377 D50 ELECTRICAL											
$60,165 D5020 LIGHTING & BRANCH WIRING											
D502099 OTHER LIGHTING AND BRANCH WIRING											
152 **Insulated ground wire, copper, stranded, #4**	**6.60** C.L.	12	$1,048	$1,016	$0	$0	$61	$2,125	$499	$0	**$2,624**
		1.856	158.76	154.00			9.24	322.00	75.61		397.61
Subtotal			$22,608	$24,638	$0	$0	$1,478	$48,724	$11,440	$0	**$60,165**
Taxes			$0	$1,478	$0	$0					
Subcontractor Markups			$5,308	$6,132	$0	$0					
TOTAL D502099 OTHER LIGHTING AND BRANCH WIRING	**264**		**$27,917**	**$32,248**	**$0**	**$0**	**$1,478**	**$48,724**	**$11,440**	**$0**	**$60,165**
1.00 EA											
Estimate Tree Structure Rollups											
$8,340,672 CONCEPT 2											
$550,855 F SPECIAL CONSTRUCTION & DEMOLITION											
$550,855 F20 SELECTIVE BUILDING DEMOLITION											
$550,855 F2010 BUILDING ELEMENTS DEMOLITION											
F201004 INTERIOR CONSTRUCTION & FINISHES											
153 **Remove & salvage soffit in the unit & hallway (to be reinstalled after fire supression work done)**	**4,021** L.F.	989	$54,116	$35,385	$0	$0	$2,123	$91,623	$29,594	$0	**$121,218**
		0.246	13.46	8.80			0.53	22.79	7.36		30.15
154 **Temporary protection, flooring, taped seams, 1/8" tempered hardboard**	**5,550** S.F	75	$4,108	$2,553	$0	$0	$153	$6,814	$2,201	$0	**$9,015**
		0.014	0.74	0.46			0.03	1.23	0.40		1.62
155 **Temporary protect existing walls in the hallways durign ceilign demo work**	**17,350** S.F	149	$11,626	$1,041	$0	$0	$62	$12,730	$4,112	$0	**$16,842**
		0.009	0.67	0.06				0.73	0.24		0.97
Subtotal			$69,850	$38,979	$0	$0	$2,339	$111,168	$35,907	$0	**$147,075**
Taxes			$0	$2,339	$0	$0					
Subcontractor Markups			$22,562	$13,346	$0	$0					
TOTAL F201004 INTERIOR CONSTRUCTION & FINISHES	**1,214**		**$92,412**	**$54,663**	**$0**	**$0**	**$2,339**	**$111,168**	**$35,907**	**$0**	**$147,075**
1.00 LS											

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$8,340,672 CONCEPT 2											
$550,855 F SPECIAL CONSTRUCTION & DEMOLITION											
$550,855 F20 SELECTIVE BUILDING DEMOLITION											
$550,855 F2010 BUILDING ELEMENTS DEMOLITION											
F201006 MECHANICAL SYSTEMS											
156 **Pipe, metal pipe, to 1-1/2" diam., selective demolition**	**27,600** L.F.	1,358	$112,970	$0	$0	$0	$0	$112,970	$30,558	$0	**$143,528**
		0.049	4.09					4.09	1.11		5.20
157 **Pipe, metal pipe, 2" to 3-1/2" diam., selective demolition**	**7,940** L.F.	518	$43,062	$0	$0	$0	$0	$43,062	$11,648	$0	**$54,710**
		0.065	5.42					5.42	1.47		6.89
158 **Pipe, metal pipe, 4" to 6" diam., selective demolition**	**8,420** L.F.	1,657	$137,856	$0	$0	$0	$0	$137,856	$37,290	$0	**$175,146**
		0.197	16.37					16.37	4.43		20.80
159 **Fans, 1-1/2 thru 10 HP or 20,000 CFM, selective demolition**	**14** Ea.	276	$19,602	$0	$0	$0	$0	$19,602	$5,302	$0	**$24,904**
		19.68	1,400.15					1,400.15	378.74		1,778.89
Subtotal			$313,489	$0	$0	$0	$0	$313,489	$84,799	$0	$398,288
Subcontractor Markups			$84,799	$0	$0	$0					
TOTAL F201006 MECHANICAL SYSTEMS	**3,808**		**$398,288**	**$0**	**$0**	**$0**	**$0**	**$313,489**	**$84,799**	**$0**	$398,288
1.00 LS											
Estimate Tree Structure Rollups											
$8,340,672 CONCEPT 2											
$550,855 F SPECIAL CONSTRUCTION & DEMOLITION											
$550,855 F20 SELECTIVE BUILDING DEMOLITION											
$550,855 F2010 BUILDING ELEMENTS DEMOLITION											
F201007 ELECTRICAL SYSTEMS											
160 **Generator set, 3 phase 4 wire, 277/480 V, 200 kW, electrical demolition, remove, incl accessories**	**1** Ea.	50	$4,280	$0	$0	$0	$0	$4,280	$1,005	$0	**$5,285**
		50.034	4,279.65					4,279.65	1,004.86		5,284.51

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$8,340,672 *CONCEPT 2*												
$550,855 *F SPECIAL CONSTRUCTION & DEMOLITION*												
$550,855 *F20 SELECTIVE BUILDING DEMOLITION*												
$550,855 *F2010 BUILDING ELEMENTS DEMOLITION*												
F201007 ELECTRICAL SYSTEMS												
161 Transfer switches, enclosed, 260 A, electrical demolition, remove	**1**	Ea.	2	$168	$0	$0	$0	$0	$168	$40	$0	**$208**
			1.968	168.33					168.33	39.52		207.85
Subtotal				$4,448	$0	$0	$0	$0	$4,448	$1,044	$0	**$5,492**
Subcontractor Markups				$1,044	$0	$0	$0					
TOTAL F201007 ELECTRICAL SYSTEMS	**52**			**$5,492**	**$0**	**$0**	**$0**	**$0**	**$4,448**	**$1,044**	**$0**	**$5,492**
1.00 LS												

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$13,211,416 CONCEPT 1											
$457,051 C INTERIORS											
$383,066 C10 INTERIOR CONSTRUCTION											
$279,926 C1010 PARTITIONS											
C1010145A PARTITION W1											
1 **Firestopping, construction joints, floor slab to drywall partition**	**84** L.F.	8	$452	$1,243	$0	$0	$75	$1,770	$572	$0	**$2,342**
		0.098	5.38	14.80			0.89	21.07	6.81		27.88
2 **Gypsum wallboard, on walls, fire resistant, 5/8" thick, finish excluded**	**218** S.F.	2	$117	$89	$0	$0	$5	$212	$69	$0	**$281**
		0.01	0.54	0.41			0.03	0.97	0.31		1.29
3 **Sound attenuation blanket, 3" thick**	**109** S.F.	1	$66	$82	$0	$0	$5	$153	$49	$0	**$202**
		0.011	0.61	0.75			0.04	1.40	0.45		1.85
4 **Metal stud partition, non-load bearing, galvanized, 3-5/8" wide, 20 gauge, 16" OC, includes top & bottom track**	**109** S.F.	3	$154	$146	$0	$0	$9	$309	$100	$0	**$409**
		0.026	1.41	1.34			0.08	2.83	0.92		3.75
5 **Channels, cold rolled, galvanized, 16 ga., 3/4" deep**	**10.90** C.L.		$0	$545	$0	$0	$33	$578	$187	$0	**$764**
				50.00			3.00	53.00	17.12		70.12
Subtotal			$790	$2,105	$0	$0	$126	$3,021	$976	$0	**$3,997**
Taxes			$0	$126	$0	$0					
Subcontractor Markups			$255	$721	$0	$0					
TOTAL C1010145A PARTITION W1	**14**		**$1,045**	**$2,953**	**$0**	**$0**	**$126**	**$3,021**	**$976**	**$0**	**$3,997**
109.00 SF	*Level Unit Cost-->*		*$9.58*	*$27.09*			*$1.16*	*$27.72*	*$8.95*		*$36.67*
Estimate Tree Structure Rollups											
$13,211,416 CONCEPT 1											
$457,051 C INTERIORS											
$383,066 C10 INTERIOR CONSTRUCTION											
$279,926 C1010 PARTITIONS											
C1010145B PARTITION W2											
6 **Firestopping, construction joints, floor slab to drywall partition**	**80** L.F.	8	$431	$1,184	$0	$0	$71	$1,686	$544	$0	**$2,230**
		0.098	5.38	14.80			0.89	21.07	6.81		27.88
7 **Gypsum wallboard, on walls, fire resistant, 5/8" thick, finish excluded**	**198** S.F.	2	$107	$81	$0	$0	$5	$193	$62	$0	**$255**
		0.01	0.54	0.41			0.03	0.97	0.31		1.29

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$13,211,416 CONCEPT 1												
$457,051 C INTERIORS												
$383,066 C10 INTERIOR CONSTRUCTION												
$279,926 C1010 PARTITIONS												
C1010145B PARTITION W2												
8 **Sound attenuation blanket, 3" thick**	**99**	S.F.	1	$60	$74	$0	$0	$4	$139	$45	$0	**$183**
			0.011	0.61	0.75			0.04	1.40	0.45		1.85
9 **Metal stud partition, non-load bearing, galvanized, 3-5/8" wide, 20 gauge, 16" OC, includes top & bottom track**	**99**	S.F.	3	$140	$133	$0	$0	$8	$281	$91	$0	**$371**
			0.026	1.41	1.34			0.08	2.83	0.92		3.75
10 **Channels, cold rolled, galvanized, 16 ga., 3/4" deep**	**9.90**	C.L.		$0	$495	$0	$0	$30	$525	$169	$0	**$694**
					50.00			3.00	53.00	17.12		70.12
Subtotal				$737	$1,967	$0	$0	$118	$2,822	$912	$0	$3,734
Taxes				$0	$118	$0	$0					
Subcontractor Markups				$238	$673	$0	$0					
TOTAL C1010145B PARTITION W2			**13**	**$975**	**$2,759**	**$0**	**$0**	**$118**	**$2,822**	**$912**	**$0**	**$3,734**
99.00 SF			*Level Unit Cost-->*	*$9.85*	*$27.86*			*$1.19*	*$28.51*	*$9.21*		*$37.72*
Estimate Tree Structure Rollups												
$13,211,416 CONCEPT 1												
$457,051 C INTERIORS												
$383,066 C10 INTERIOR CONSTRUCTION												
$279,926 C1010 PARTITIONS												
C1010145C PILASTER												
11 **U-Shield 6"h x 12"w x 6"h (00" Perimeter) @ 10' ht, 20 Gauge material**	**572**	EA	1,055	$74,176	$113,771	$0	$0	$6,826	$194,773	$62,912	$0	**$257,685**
			1.845	129.68	198.90			11.93	340.51	109.99		450.50
12 **Laser Cut holes for installation of electrical boxes**	**919.73**	EA		$0	$10,347	$0	$0	$621	$10,968	$3,543	$0	**$14,510**
					11.25			0.68	11.93	3.85		15.78
Subtotal				$74,176	$124,118	$0	$0	$7,447	$205,741	$66,454	$0	$272,195
Taxes				$0	$7,447	$0	$0					
Subcontractor Markups				$23,959	$42,495	$0	$0					
TOTAL C1010145C PILASTER			**1,055**	**$98,135**	**$174,060**	**$0**	**$0**	**$7,447**	**$205,741**	**$66,454**	**$0**	**$272,195**
572.00 EA			*Level Unit Cost-->*	*$171.56*	*$304.30*			*$13.02*	*$359.69*	*$116.18*		*$475.87*

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$13,211,416 CONCEPT 1											
$457,051 C INTERIORS											
$383,066 C10 INTERIOR CONSTRUCTION											
$3,873 C1020 INTERIOR DOORS											
C1020300 INTERIOR DOORS AND FRAMES											
13 **Doors, fire, flush, "B" label, 90 minutes, composite, 20 ga., 3'-0" x 7'-0"**	**1** Ea.	1	$67	$1,025	$0	$0	$62	$1,154	$373	$0	**$1,526**
		1.23	67.29	1,025.00			61.50	1,153.79	372.68		1,526.46
14 **Frames, steel, knock down, hollow metal, single, 90 minutes, 14 ga., up to 3-7/8" deep, 3'-0" x 7'-0"**	**1** Ea.	1	$67	$465	$0	$0	$28	$560	$181	$0	**$741**
		1.23	67.29	465.00			27.90	560.19	180.94		741.13
15 **Paints & coatings, interior latex, zero voc, doors, panel, both sides, roll & brush, primer + 2 coats, incl. frame & trim**	**1** Ea.	4	$181	$30	$0	$0	$2	$212	$69	$0	**$281**
		3.936	181.16	29.50			1.77	212.43	68.61		281.05
Subtotal			$316	$1,520	$0	$0	$91	$1,926	$622	$0	**$2,549**
Taxes			$0	$91	$0	$0					
Subcontractor Markups			$102	$520	$0	$0					
TOTAL C1020300 INTERIOR DOORS AND FRAMES	**6**		**$418**	**$2,131**	**$0**	**$0**	**$91**	**$1,926**	**$622**	**$0**	**$2,549**
1.00 EA											
Estimate Tree Structure Rollups											
$13,211,416 CONCEPT 1											
$457,051 C INTERIORS											
$383,066 C10 INTERIOR CONSTRUCTION											
$3,873 C1020 INTERIOR DOORS											
C1020400 DOOR HARDWARE											
16 **Door hardware, single, interior, regular use, incl. lever handle**	**1** Door	3	$179	$775	$0	$0	$47	$1,001	$323	$0	**$1,324**
		3.28	179.47	775.00			46.50	1,000.97	323.31		1,324.28
Subtotal			$179	$775	$0	$0	$47	$1,001	$323	$0	**$1,324**
Taxes			$0	$47	$0	$0					
Subcontractor Markups			$58	$265	$0	$0					
TOTAL C1020400 DOOR HARDWARE	**3**		**$237**	**$1,087**	**$0**	**$0**	**$47**	**$1,001**	**$323**	**$0**	**$1,324**
1.00 EA											

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$13,211,416 CONCEPT 1											
$457,051 C INTERIORS											
$383,066 C10 INTERIOR CONSTRUCTION											
$99,267 C1030 SPECIALTIES											
C1030A IDENTIFYING DEVICES											
17 **Signs, flexible door sign, adhesive back, w/Braille, 5/8" letters, 8" x 4"**	**2** Ea.	1	$20	$126	$0	$0	$8	$153	$0	$0	**$153**
		0.308	9.76	63.00			3.78	76.54			76.54
Taxes			$0	$8	$0	$0					
TOTAL C1030A IDENTIFYING DEVICES	**1**		**$20**	**$134**	**$0**	**$0**	**$8**	**$153**	**$0**	**$0**	**$153**
2.00 EA	*Level Unit Cost-->*		*$9.76*	*$66.78*			*$3.78*	*$76.54*			*$76.54*
Estimate Tree Structure Rollups											
$13,211,416 CONCEPT 1											
$457,051 C INTERIORS											
$383,066 C10 INTERIOR CONSTRUCTION											
$99,267 C1030 SPECIALTIES											
C1030B RAILING											
18 **Railing, pipe, aluminum, 2 rails, 3'-6" high, posts @ 4' OC, 1-1/2" diameter, shop fabricated**	**54** L.F.	13	$940	$3,942	$59	$0	$240	$5,181	$1,674	$0	**$6,855**
		0.246	17.41	73.00	1.09		4.45	95.95	30.99		126.94
19 **Prime railingwith Rustoleum Primer**	**54** L.F.	1	$37	$3	$0	$0	$0	$40	$13	$0	**$52**
		0.015	0.68	0.05				0.73	0.24		0.97
20 **Paints & coatings, pipe railing, paint 2 coats, spray**	**54** S.F.	1	$40	$21	$0	$0	$1	$62	$20	$0	**$82**
		0.016	0.74	0.39			0.02	1.15	0.37		1.52
Subtotal			$1,017	$3,966	$59	$0	$241	$5,283	$1,706	$0	$6,989
Taxes			$0	$238	$4	$0					
Subcontractor Markups			$328	$1,358	$20	$0					
TOTAL C1030B RAILING	**15**		**$1,345**	**$5,562**	**$83**	**$0**	**$241**	**$5,283**	**$1,706**	**$0**	**$6,989**
54.00 LF	*Level Unit Cost-->*		*$24.91*	*$102.99*	*$1.53*		*$4.47*	*$97.83*	*$31.60*		*$129.43*

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$13,211,416 CONCEPT 1											
$457,051 C INTERIORS											
$383,066 C10 INTERIOR CONSTRUCTION											
$99,267 C1030 SPECIALTIES											
C1030C INTERIOR SOFFIT											
21 **Add soffit in the unit**	**2,286** L.F.	562	$30,766	$36,667	$0	$0	$2,200	$69,633	$22,491	$0	**$92,124**
		0.246	13.46	16.04			0.96	30.46	9.84		40.30
Subtotal			$30,766	$36,667	$0	$0	$2,200	$69,633	$22,491	$0	**$92,124**
Taxes			$0	$2,200	$0	$0					
Subcontractor Markups			$9,937	$12,554	$0	$0					
TOTAL C1030C INTERIOR SOFFIT		**562**	**$40,703**	**$51,422**	**$0**	**$0**	**$2,200**	**$69,633**	**$22,491**	**$0**	**$92,124**
2,286.00 LF	*Level Unit Cost-->*		*$17.81*	*$22.49*			*$0.96*	*$30.46*	*$9.84*		*$40.30*
Estimate Tree Structure Rollups											
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)											
$13,211,416 CONCEPT 1											
$457,051 C INTERIORS											
$73,985 C30 INTERIOR FINISHES											
C3010 WALL FINISHES											
22 **Painting walls, complete, on drywall or plaster, primer and 2 finish coats, with roller, including surface preparation**	**4,493** S.F.	135	$6,204	$1,977	$0	$0	$119	$8,300	$2,681	$0	**$10,980**
		0.03	1.38	0.44			0.03	1.85	0.60		2.44
Subtotal			$6,204	$1,977	$0	$0	$119	$8,300	$2,681	$0	**$10,980**
Taxes			$0	$119	$0	$0					
Subcontractor Markups			$2,004	$677	$0	$0					
TOTAL C3010 WALL FINISHES		**135**	**$8,208**	**$2,772**	**$0**	**$0**	**$119**	**$8,300**	**$2,681**	**$0**	**$10,980**
4,493.00 SF	*Level Unit Cost-->*		*$1.83*	*$0.62*			*$0.03*	*$1.85*	*$0.60*		*$2.44*
Estimate Tree Structure Rollups											
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)											
$13,211,416 CONCEPT 1											
$457,051 C INTERIORS											
$73,985 C30 INTERIOR FINISHES											
C3030 CEILING FINISHES											
23 **Patch & Repair existing ceiling near wall demo**	**30** S.F.	4	$202	$120	$0	$0	$7	$329	$106	$0	**$435**
		0.123	6.73	4.00			0.24	10.97	3.54		14.51

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)											
$13,211,416 CONCEPT 1											
$457,051 C INTERIORS											
$73,985 C30 INTERIOR FINISHES											
C3030 CEILING FINISHES											
24 **Surface preparation, interior, ceiling, Patch & Prep for new finish**	**1,412** S.F.	52	$2,398	$635	$0	$0	$38	$3,072	$992	$0	**$4,064**
		0.037	1.70	0.45			0.03	2.17	0.70		2.88
25 **Paints & coatings, walls & ceilings, interior, concrete, drywall or plaster, zero voc latex, 3 coats, smooth finish, spray**	**1,412** S.F.	35	$1,599	$480	$0	$0	$29	$2,108	$681	$0	**$2,788**
		0.025	1.13	0.34			0.02	1.49	0.48		1.98
26 **Suspended ceiling system, 2" carriers, 24" OC with 1-5/8" channels, 24" OC, incl. carriers**	**5,550** S.F.	200	$11,634	$3,774	$0	$0	$226	$15,634	$0	$0	**$15,634**
		0.036	2.10	0.68			0.04	2.82			2.82
27 **Gypsum wallboard, on ceilings, fire resistant, taped & finished (level 4 finish), 1/2" thick**	**5,550** S.F.	117	$6,376	$2,831	$0	$0	$170	$9,377	$0	$0	**$9,377**
		0.021	1.15	0.51			0.03	1.69			1.69
28 **Paints & coatings, walls & ceilings, interior, concrete, drywall or plaster, zero voc latex, 2 coats, sand finish, brushwork**	**5,550** S.F.	89	$4,085	$722	$0	$0	$43	$4,849	$0	$0	**$4,849**
		0.016	0.74	0.13			0.01	0.87			0.87
29 **Temporary protection, flooring, taped seams, 1/8" tempered hardboard**	**5,550** S.F.	75	$4,108	$2,553	$0	$0	$153	$6,814	$2,201	$0	**$9,015**
		0.014	0.74	0.46			0.03	1.23	0.40		1.62
30 **Temporary protect existing walls in the hallways durign ceilign demo work**	**17,350** S.F.	149	$11,626	$1,041	$0	$0	$62	$12,730	$4,112	$0	**$16,842**
		0.009	0.67	0.06				0.73	0.24		0.97
Subtotal			$42,028	$12,155	$0	$0	$729	$54,913	$8,092	$0	**$63,005**
Taxes			$0	$729	$0	$0					
Subcontractor Markups			$6,438	$1,654	$0	$0					
TOTAL C3030 CEILING FINISHES	**720**		**$48,467**	**$14,538**	**$0**	**$0**	**$729**	**$54,913**	**$8,092**	**$0**	**$63,005**
6,992.00 SF	*Level Unit Cost-->*		*$6.93*	*$2.08*			*$0.10*	*$7.85*	*$1.16*		*$9.01*

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$13,211,416 CONCEPT 1												
$11,752,667 D SERVICES												
$500,656 D30 HVAC												
$312,736 D3040 DISTRIBUTION SYSTEMS												
D304007 EXHAUST SYSTEMS												
31 **Garage Exhaust Fans (Vaneaxial to 17,000 CFM 7.5 HP)**	**7**	Ea.	52	$3,812	$129,500	$0	$0	$7,770	$141,082	$38,163	$0	**$179,244**
			7.38	544.50	18,500.00			1,110.00	20,154.50	5,451.79		25,606.30
32 **Stairwell and Elevator Pressurization (Centrifugal Backward Curved to 10 HP)**	**7**	Ea.	69	$4,901	$94,500	$0	$0	$5,670	$105,071	$28,422	$0	**$133,492**
			9.84	700.08	13,500.00			810.00	15,010.08	4,060.22		19,070.30
Subtotal				$8,712	$224,000	$0	$0	$13,440	$246,152	$66,584	$0	$312,736
Taxes				$0	$13,440	$0	$0					
Subcontractor Markups				$2,357	$64,228	$0	$0					
TOTAL D304007 EXHAUST SYSTEMS	**121**			**$11,069**	**$301,668**	**$0**	**$0**	**$13,440**	**$246,152**	**$66,584**	**$0**	**$312,736**
1.00 EA												
Estimate Tree Structure Rollups												
$13,211,416 CONCEPT 1												
$11,752,667 D SERVICES												
$500,656 D30 HVAC												
$160,993 D3060 CONTROLS & INSTRUMENTATION												
D306001 HVAC CONTROLS												
33 **Exhaust Fan Control**	**14**	Ea.	172	$14,746	$23,800	$0	$0	$1,428	$39,974	$10,813	$0	**$50,787**
			12.3	1,053.31	1,700.00			102.00	2,855.31	772.36		3,627.67
34 **Tie-into Existing Operator Station**	**24**	Hrs.	30	$2,528	$0	$0	$0	$0	$2,528	$684	$0	**$3,212**
			1.23	105.33					105.33	28.49		133.82
35 **System Check-out & Programming**	**120**	Hrs.	148	$10,873	$0	$0	$0	$0	$10,873	$2,941	$0	**$13,814**
			1.23	90.61					90.61	24.51		115.12
36 **Electric metallic tubing (EMT), 3/4" diameter, to 15' high, incl 2 terminations, 2 field bend elbows, 11 beam clamps, and 11 couplings per 100 LF**	**50**	C.L.	381	$32,615	$4,800	$0	$0	$288	$37,703	$10,199	$0	**$47,901**
			7.626	652.29	96.00			5.76	754.05	203.97		958.02
37 **Control Wiring**	**50**	C.L.	93	$7,947	$1,250	$0	$0	$75	$9,272	$2,508	$0	**$11,780**
			1.856	158.94	25.00			1.50	185.44	50.16		235.61

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$13,211,416 *CONCEPT 1*											
$11,752,667 *D SERVICES*											
$500,656 *D30 HVAC*											
$160,993 *D3060 CONTROLS & INSTRUMENTATION*											
D306001 HVAC CONTROLS											
38 **Interface wtih Fire Protection Alarm System**	**1** Ea.	246	$21,066	$5,000	$0	$0	$300	$26,366	$7,132	$0	**$33,498**
		246	21,066.21	5,000.00			300.00	26,366.21	7,132.06		33,498.27
Subtotal			$89,775	$34,850	$0	$0	$2,091	$126,716	$34,277	$0	**$160,993**
Taxes			$0	$2,091	$0	$0					
Subcontractor Markups			$24,284	$9,993	$0	$0					
TOTAL D306001 HVAC CONTROLS	**1,069**		**$114,060**	**$46,934**	**$0**	**$0**	**$2,091**	**$126,716**	**$34,277**	**$0**	**$160,993**
1.00 EA											
Estimate Tree Structure Rollups											
$13,211,416 *CONCEPT 1*											
$11,752,667 *D SERVICES*											
$500,656 *D30 HVAC*											
$26,926 *D3070 SYSTEMS TESTING & BALANCING*											
D307001 TESTING & BALANCING											
39 **System Testing & Balance**	**60** Hrs.	74	$3,757	$0	$0	$0	$0	$3,757	$1,016	$0	**$4,773**
		1.23	62.61					62.61	16.94		79.55
40 **System Commissioning & Assist in T & B**	**120** Hrs.	148	$11,077	$6,000	$0	$0	$360	$17,437	$4,717	$0	**$22,154**
		1.23	92.31	50.00			3.00	145.31	39.31		184.61
Subtotal			$14,834	$6,000	$0	$0	$360	$21,194	$5,733	$0	**$26,926**
Taxes			$0	$360	$0	$0					
Subcontractor Markups			$4,012	$1,720	$0	$0					
TOTAL D307001 TESTING& BALANCING	**221**		**$18,846**	**$8,080**	**$0**	**$0**	**$360**	**$21,194**	**$5,733**	**$0**	**$26,926**
1.00 EA											

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)												
$13,211,416 CONCEPT 1												
$11,752,667 D SERVICES												
$7,797,130 D40 FIRE PROTECTION												
TENANT TOWER												
41 **Pipe, plastic, CPVC fire suppression, C-UL-S, FM, NFPA 13, 13R & 13D, SDR 13.5,1" diameter, socket joint, no couplings or hangers**	**32,960**	L.F.	1,905 0.058	$121,434 3.68	$108,504 3.29	$0	$0	$6,510 0.20	$236,449 7.17	$63,959 1.94	$0	**$300,408** 9.11
42 **Pipe, plastic, CPVC fire suppression, C-UL-S, FM, NFPA 13, 13R & 13D, SDR 13.5,1-1/4" diameter, socket joint, no couplings or hangers**	**8,660**	L.F.	660 0.076	$42,089 4.86	$40,438 4.67	$0	$0	$2,426 0.28	$84,953 9.81	$22,980 2.65	$0	**$107,933** 12.46
43 **Pipe, plastic, CPVC fire suppression, C-UL-S, FM, NFPA 13, 13R & 13D, SDR 13.5,1-1/2" diameter, socket joint, no couplings or hangers**	**5,040**	L.F.	521 0.103	$33,187 6.59	$32,667 6.48	$0	$0	$1,960 0.39	$67,814 13.46	$18,344 3.64	$0	**$86,157** 17.09
44 **Pipe, plastic, CPVC fire suppression, C-UL-S, FM, NFPA 13, 13R & 13D, SDR 13.5,2" diameter, socket joint, no couplings or hangers**	**7,960**	L.F.	1,116 0.14	$71,133 8.94	$74,788 9.40	$0	$0	$4,487 0.56	$150,409 18.90	$40,686 5.11	$0	**$191,094** 24.01
45 **Pipe, fittings & valves, steel, black, grooved joint, 2-1/2" diameter, schedule10, incl coupling & clevis type hanger 10' OC**	**34,980**	L.F.	11,273 0.322	$844,027 24.13	$423,258 12.10	$0	$0	$25,395 0.73	$1,292,681 36.95	$349,670 10.00	$0	**$1,642,351** 46.95
46 **Pipe, fittings & valves, steel, black, grooved joint, 6" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**14,660**	L.F.	9,413 0.642	$730,860 49.85	$447,130 30.50	$0	$0	$26,828 1.83	$1,204,818 82.18	$325,903 22.23	$0	**$1,530,721** 104.42
47 **Sprinkler Head, Sidewall, K4.4, Tyco 4334**	**5,977**	Ea.	3,676 0.615	$275,226 46.05	$145,719 24.38	$0	$0	$8,743 1.46	$429,688 71.89	$116,231 19.45	$0	**$545,919** 91.34
48 **Sprinkler Head, Pendent Conceal include trim plate, K4.9, Tyco 3586**	**365**	Ea.		$0	$13,925 38.15	$0	$0	$835 2.29	$14,760 40.44	$3,993 10.94	$0	**$18,753** 51.38
49 **Wet Pipe Alarm Valve Set 6"**	**6**	Ea.	59 9.84	$4,421 736.76	$18,600 3,100.00	$0	$0	$1,116 186.00	$24,137 4,022.76	$6,529 1,088.16	$0	**$30,665** 5,110.92
50 **Floor Control Valve Set 2-1/2"**	**111**	Ea.	1,092 9.84	$81,780 736.76	$102,120 920.00	$0	$0	$6,127 55.20	$190,027 1,711.96	$51,402 463.08	$0	**$241,430** 2,175.04

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)												
$13,211,416 CONCEPT 1												
$11,752,667 D SERVICES												
$7,797,130 D40 FIRE PROTECTION												
TENANT TOWER												
51 **Fire Hose Valve**	**111**	Ea.	1,092	$81,780	$55,500	$0	$0	$3,330	$140,610	$38,035	$0	**$178,645**
			9.84	736.76	500.00			30.00	1,266.76	342.66		1,609.42
52 **Fire Department Connection**	**6**	Ea.	15	$1,105	$9,000	$0	$0	$540	$10,645	$2,880	$0	**$13,525**
			2.46	184.19	1,500.00			90.00	1,774.19	479.92		2,254.11
53 **Seal / Fire Stop Wall Openings**	**4,699**	Ea.	1,445	$55,901	$3,524	$0	$0	$211	$59,637	$16,132	$0	**$75,769**
			0.307	11.90	0.75			0.04	12.69	3.43		16.12
Subtotal				$2,342,943	$1,475,173	$0	$0	$88,510	$3,906,627	$1,056,743	$0	**$4,963,370**
Taxes				$0	$88,510	$0	$0					
Subcontractor Markups				$633,766	$422,976	$0	$0					
TOTAL TENANT TOWER	**32,267**			**$2,976,709**	**$1,986,660**	**$0**	**$0**	**$88,510**	**$3,906,627**	**$1,056,743**	**$0**	**$4,963,370**
969,696.00 SF			*Level Unit Cost-->*	*$3.07*	*$2.05*			*$0.09*	*$4.03*	*$1.09*		*$5.12*
Estimate Tree Structure Rollups												
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)												
$13,211,416 CONCEPT 1												
$11,752,667 D SERVICES												
$7,797,130 D40 FIRE PROTECTION												
BOH, PUBLIC & ADMINISTRATION AREAS												
54 **Pipe, steel, black, threaded, 1" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**4,340**	L.F.	806	$67,059	$42,098	$0	$0	$2,526	$111,683	$30,210	$0	**$141,894**
			0.186	15.45	9.70			0.58	25.73	6.96		32.69
55 **Pipe, steel, black, threaded, 1-1/4" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**1,320**	L.F.	292	$21,882	$16,896	$0	$0	$1,014	$39,792	$10,764	$0	**$50,555**
			0.221	16.58	12.80			0.77	30.15	8.15		38.30
56 **Pipe, steel, black, threaded, 1-1/2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**880**	L.F.	216	$16,209	$13,420	$0	$0	$805	$30,434	$8,232	$0	**$38,666**
			0.246	18.42	15.25			0.92	34.58	9.36		43.94
57 **Pipe, steel, black, threaded, 2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**540**	L.F.	166	$12,433	$11,070	$0	$0	$664	$24,167	$6,537	$0	**$30,704**
			0.308	23.02	20.50			1.23	44.75	12.11		56.86

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)											
$13,211,416 CONCEPT 1											
$11,752,667 D SERVICES											
$7,797,130 D40 FIRE PROTECTION											
BOH, PUBLIC & ADMINISTRATION AREAS											
58 **Pipe, fittings & valves, steel, black, grooved joint, 3" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**440** L.F.	157	$11,792	$6,138	$0	$0	$368	$18,298	$4,950	$0	**$23,248**
		0.358	26.80	13.95			0.84	41.59	11.25		52.84
59 **Pipe, fittings & valves, steel, black, grooved joint, 5" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**1,040** L.F.	512	$38,311	$24,960	$0	$0	$1,498	$64,769	$17,520	$0	**$82,289**
		0.492	36.84	24.00			1.44	62.28	16.85		79.12
60 **Floor Control Valve Assembly 4**	**6** Ea.	22	$1,658	$6,654	$0	$0	$399	$8,711	$2,356	$0	**$11,067**
		3.69	276.29	1,109.00			66.54	1,451.83	392.72		1,844.54
61 **Floor Control Valve Assembly 6**	**1** Ea.	4	$276	$1,379	$0	$0	$83	$1,738	$470	$0	**$2,208**
		3.69	276.28	1,379.00			82.74	1,738.02	470.14		2,208.16
62 **Sprinkler Head, Pendent Conceal include trim plate, K4.9, Tyco 3586**	**470** Ea.		$0	$17,931	$0	$0	$1,076	$19,006	$5,141	$0	**$24,148**
				38.15			2.29	40.44	10.94		51.38
63 **Fire Hose Valve**	**28** Ea.	276	$20,629	$14,000	$0	$0	$840	$35,469	$9,594	$0	**$45,064**
		9.84	736.76	500.00			30.00	1,266.76	342.66		1,609.42
64 **Seal / Fire Stop Wall Openings**	**200** Ea.	62	$2,379	$150	$0	$0	$9	$2,538	$687	$0	**$3,225**
		0.308	11.90	0.75			0.04	12.69	3.43		16.12
Subtotal			$192,628	$154,696	$0	$0	$9,282	$356,606	$96,462	$0	**$453,068**
Taxes			$0	$9,282	$0	$0					
Subcontractor Markups			$52,106	$44,356	$0	$0					
TOTAL BOH, PUBLIC & ADMINISTRATION AREAS	**2,513**		**$244,734**	**$208,333**	**$0**	**$0**	**$9,282**	**$356,606**	**$96,462**	**$0**	**$453,068**
65,117.00 SF	*Level Unit Cost-->*		*$3.76*	*$3.20*			*$0.14*	*$5.48*	*$1.48*		*$6.96*

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$24,267,300 *FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)*											
$13,211,416 *CONCEPT 1*											
$11,752,667 *D SERVICES*											
$7,797,130 *D40 FIRE PROTECTION*											
GARAGE											
65 **Pipe, steel, black, threaded, 1" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**19,720** L.F.	3,663 0.186	$304,703 15.45	$191,284 9.70	$0	$0	$11,477 0.58	$507,464 25.73	$137,269 6.96	$0	**$644,733** 32.69
66 **Pipe, steel, black, threaded, 1-1/4" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**120** L.F.	27 0.221	$1,989 16.58	$1,536 12.80	$0	$0	$92 0.77	$3,617 30.15	$979 8.15	$0	**$4,596** 38.30
67 **Pipe, steel, black, threaded, 1-1/2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**160** L.F.	39 0.246	$2,947 18.42	$2,440 15.25	$0	$0	$146 0.92	$5,533 34.58	$1,497 9.36	$0	**$7,030** 43.94
68 **Pipe, steel, black, threaded, 2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**220** L.F.	68 0.308	$5,065 23.02	$4,510 20.50	$0	$0	$271 1.23	$9,846 44.75	$2,663 12.11	$0	**$12,509** 56.86
69 **Pipe, fittings & valves, steel, black, grooved joint, 2-1/2" diameter, schedule10, incl coupling & clevis type hanger 10' OC**	**6,340** L.F.	2,043 0.322	$152,977 24.13	$76,714 12.10	$0	$0	$4,603 0.73	$234,294 36.95	$63,376 10.00	$0	**$297,670** 46.95
70 **Pipe, fittings & valves, steel, black, grooved joint, 4" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**5,500** L.F.	2,212 0.402	$165,633 30.11	$104,775 19.05	$0	$0	$6,287 1.14	$276,694 50.31	$74,846 13.61	$0	**$351,540** 63.92
71 **Pipe, fittings & valves, steel, black, grooved joint, 5" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**1,620** L.F.	797 0.492	$59,677 36.84	$38,880 24.00	$0	$0	$2,333 1.44	$100,890 62.28	$27,291 16.85	$0	**$128,181** 79.12
72 **Pipe, fittings & valves, steel, black, grooved joint, 6" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**3,000** L.F.	1,926 0.642	$149,562 49.85	$91,500 30.50	$0	$0	$5,490 1.83	$246,552 82.18	$66,692 22.23	$0	**$313,244** 104.42
73 **Dry Sprinkler Head - Pendant**	**1,498** Ea.	921 0.615	$68,979 46.05	$104,860 70.00	$0	$0	$6,292 4.20	$180,131 120.25	$48,725 32.53	$0	**$228,856** 152.77
74 **Dry System Valve Set and Controller 4"**	**2** Ea.	39 19.68	$2,947 1,473.52	$24,000 12,000.00	$0	$0	$1,440 720.00	$28,387 14,193.52	$7,679 3,839.35	$0	**$36,066** 18,032.87

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)											
$13,211,416 CONCEPT 1											
$11,752,667 D SERVICES											
$7,797,130 D40 FIRE PROTECTION											
GARAGE											
75 **Dry System Valve Set and Controller 6"**	**5** Ea.	98	$7,368	$70,000	$0	$0	$4,200	$81,568	$22,064	$0	**$103,632**
		19.68	1,473.52	14,000.00			840.00	16,313.52	4,412.81		20,726.33
Subtotal			$921,847	$710,499	$0	$0	$42,630	$1,674,976	$453,081	$0	**$2,128,057**
Taxes			$0	$42,630	$0	$0					
Subcontractor Markups			$249,360	$203,721	$0	$0					
TOTAL GARAGE	**11,834**		**$1,171,207**	**$956,850**	**$0**	**$0**	**$42,630**	**$1,674,976**	**$453,081**	**$0**	**$2,128,057**
318,322.00 SF	*Level Unit Cost–>*		*$3.68*	*$3.01*			*$0.13*	*$5.26*	*$1.42*		*$6.69*
Estimate Tree Structure Rollups											
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)											
$13,211,416 CONCEPT 1											
$11,752,667 D SERVICES											
$7,797,130 D40 FIRE PROTECTION											
MECHANICAL ROOM SPACES											
76 **Pipe, steel, black, threaded, 1" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**800** L.F.	149	$12,361	$7,760	$0	$0	$466	$20,587	$5,569	$0	**$26,156**
		0.186	15.45	9.70			0.58	25.73	6.96		32.69
77 **Pipe, steel, black, threaded, 1-1/4" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**160** L.F.	35	$2,652	$2,048	$0	$0	$123	$4,823	$1,305	$0	**$6,128**
		0.221	16.58	12.80			0.77	30.15	8.15		38.30
78 **Pipe, steel, black, threaded, 1-1/2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**100** L.F.	25	$1,842	$1,525	$0	$0	$92	$3,458	$935	$0	**$4,394**
		0.246	18.42	15.25			0.92	34.58	9.36		43.94
79 **Pipe, steel, black, threaded, 2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**120** L.F.	37	$2,763	$2,460	$0	$0	$148	$5,370	$1,453	$0	**$6,823**
		0.308	23.02	20.50			1.23	44.75	12.11		56.86
80 **Pipe, fittings & valves, steel, black, grooved joint, 2-1/2" diameter, schedule10, incl coupling & clevis type hanger 10' OC**	**140** L.F.	45	$3,378	$1,694	$0	$0	$102	$5,174	$1,399	$0	**$6,573**
		0.322	24.13	12.10			0.73	36.95	10.00		46.95
81 **Pipe, fittings & valves, steel, black, grooved joint, 3" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**140** L.F.	50	$3,752	$1,953	$0	$0	$117	$5,822	$1,575	$0	**$7,397**
		0.358	26.80	13.95			0.84	41.59	11.25		52.84

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)												
$13,211,416 CONCEPT 1												
$11,752,667 D SERVICES												
$7,797,130 D40 FIRE PROTECTION												
MECHANICAL ROOM SPACES												
82 **Pipe, fittings & valves, steel, black, grooved joint, 4" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**200**	L.F.	80	$6,023	$3,810	$0	$0	$229	$10,062	$2,722	$0	**$12,783**
			0.402	30.11	19.05			1.14	50.31	13.61		63.92
83 **Pipe, fittings & valves, steel, black, grooved joint, 6" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**60**	L.F.	39	$2,991	$1,830	$0	$0	$110	$4,931	$1,334	$0	**$6,265**
			0.642	49.85	30.50			1.83	82.18	22.23		104.42
84 **Floor Control Valve Assembly 6**	**1**	Ea.	4	$276	$1,379	$0	$0	$83	$1,738	$470	$0	**$2,208**
			3.69	276.28	1,379.00			82.74	1,738.02	470.14		2,208.16
85 **Sprinkler Head - standard coverage quick response, upright K=8.0 (Tyco 4131)**	**110**	Ea.	162	$12,157	$2,640	$0	$0	$158	$14,955	$3,141	$0	**$18,095**
			1.476	110.51	24.00			1.44	135.95	28.55		164.50
Subtotal				$48,195	$27,099	$0	$0	$1,626	$76,920	$19,902	$0	$96,822
Taxes				$0	$1,626	$0	$0					
Subcontractor Markups				$12,301	$7,601	$0	$0					
TOTAL MECHANICAL ROOM SPACES	**626**			**$60,497**	**$36,326**	**$0**	**$0**	**$1,626**	**$76,920**	**$19,902**	**$0**	$96,822
15,138.00 SF		*Level Unit Cost-->*		*$4.00*	*$2.40*			*$0.11*	*$5.08*	*$1.31*		*$6.40*
Estimate Tree Structure Rollups												
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)												
$13,211,416 CONCEPT 1												
$11,752,667 D SERVICES												
$7,797,130 D40 FIRE PROTECTION												
FIRE PUMPS & PUMP ROOM PIPING												
86 **Fire pumps, electric, 750 GPM, 150 psi, 75 HP, 3550 RPM, 5" pump, including controller, fittings and relief valve**	**1**	Ea.	79	$5,305	$28,500	$0	$0	$1,710	$35,515	$9,607	$0	**$45,122**
			78.72	5,305.45	28,500.00			1,710.00	35,515.45	9,606.93		45,122.38
87 **Jockey Pump**	**1**	Ea.	30	$1,990	$2,500	$0	$0	$150	$4,640	$1,255	$0	**$5,895**
			29.52	1,989.55	2,500.00			150.00	4,639.55	1,255.00		5,894.55
88 **Fire Pump Room Piping**	**1**	L.S.	369	$28,652	$40,000	$1,195	$0	$2,472	$72,319	$19,562	$0	**$91,881**
			369	28,651.74	40,000.00	1,195.41		2,471.72	72,318.87	19,562.25		91,881.13

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)												
$13,211,416 CONCEPT 1												
$11,752,667 D SERVICES												
$7,797,130 D40 FIRE PROTECTION												
FIRE PUMPS & PUMP ROOM PIPING												
89 **Backflow preventer, RPZ, 8" pipe size**	1	Ea.	15	$1,146	$8,509	$0	$0	$511	$10,166	$2,750	$0	**$12,915**
			14.76	1,146.07	8,509.00			510.54	10,165.61	2,749.80		12,915.41
Subtotal				$37,093	$79,509	$1,195	$0	$4,842	$122,639	$33,174	$0	**$155,813**
Taxes				$0	$4,771	$72	$0					
Subcontractor Markups				$10,034	$22,798	$343	$0					
TOTAL FIRE PUMPS & PUMP ROOM PIPING	**492**			**$47,126**	**$107,077**	**$1,610**	**$0**	**$4,842**	**$122,639**	**$33,174**	**$0**	**$155,813**
1.00 EA												
Estimate Tree Structure Rollups												
$13,211,416 CONCEPT 1												
$11,752,667 D SERVICES												
$3,454,881 D50 ELECTRICAL												
$126,212 D5010 ELECTRICAL SERVICE & DISTRIBUTION												
D501099 OTHER SERVICE AND DISTRIBUTION												
90 **Generator set, diesel, 3 phase 4 wire, 277/480 V, 350 kW, incl battery, charger, muffler, & day tank, excl conduit, wiring, & concrete**	1	Ea.	123	$9,930	$79,000	$796	$0	$4,788	$94,514	$22,192	$0	**$116,706**
			123	9,929.78	79,000.00	796.42		4,787.78	94,513.99	22,191.89		116,705.87
91 **Automatic transfer switches, enclosed, 3 pole, 480 volt, 600 amp**	1	Ea.	20	$1,683	$5,675	$0	$0	$341	$7,699	$1,808	$0	**$9,507**
			19.68	1,683.33	5,675.00			340.50	7,698.83	1,807.68		9,506.51
Subtotal				$11,613	$84,675	$796	$0	$5,128	$102,213	$24,000	$0	**$126,212**
Taxes				$0	$5,081	$48	$0					
Subcontractor Markups				$2,727	$21,075	$198	$0					
TOTAL D501099 OTHER SERVICE AND DISTRIBUTION	**143**			**$14,340**	**$110,830**	**$1,042**	**$0**	**$5,128**	**$102,213**	**$24,000**	**$0**	**$126,212**
350.00 kW			*Level Unit Cost-->*	*$40.97*	*$316.66*	*$2.98*		*$14.65*	*$292.04*	*$68.57*		*$360.61*

Estimate Tree Structure Rollups

$13,211,416 CONCEPT 1
$11,752,667 D SERVICES
$3,454,881 D50 ELECTRICAL
$1,373,227 D5020 LIGHTING & BRANCH WIRING

D502002 LIGHTING EQUIPMENT

	LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
92	**Fluorescent fixtures, interior, electrical demolition, remove, recessed drop-in, to 10' high, including supports & whips**	**2,100**	Ea.	1,377 0.656	$117,759 56.08	$0	$0	$0	$0	$117,759 56.08	$27,650 13.17	$0	**$145,409** 69.24
93	**Interior LED fixts, troffer, recess mounted, 2' x 2', 4,000K**	**2,100**	Ea.	2,431 1.157	$207,902 99.00	$344,400 164.00	$0	$0	$20,664 9.84	$572,966 272.84	$134,532 64.06	$0	**$707,498** 336.90
94	**Fixture whips, 3/8" greenfield, 2 connectors, THHN wire, three #12, 6' long**	**2,100**	Ea.	646 0.308	$55,234 26.30	$25,830 12.30	$0	$0	$1,550 0.74	$82,614 39.34	$19,398 9.24	$0	**$102,012** 48.58
95	**Lighting devices, occupancy sensors, dual technology, ceiling mounted**	**340**	Ea.	515 1.514	$44,034 129.51	$37,740 111.00	$0	$0	$2,264 6.66	$84,038 247.17	$19,732 58.04	$0	**$103,770** 305.21
96	**Outlet boxes, pressed steel, 4" square**	**2,440**	Ea.	1,200 0.492	$102,683 42.08	$5,026 2.06	$0	$0	$302 0.12	$108,011 44.27	$25,361 10.39	$0	**$133,372** 54.66
97	**Outlet boxes, pressed steel, covers, blank, 4" square**	**2,440**	Ea.	375 0.154	$32,088 13.15	$3,465 1.42	$0	$0	$208 0.09	$35,761 14.66	$8,397 3.44	$0	**$44,158** 18.10
98	**Lighting control relay panel, 16 relay, with timeclock**	**20**	Ea.	109 5.466	$9,351 467.55	$28,000 1,400.00	$0	$0	$1,680 84.00	$39,031 1,951.55	$9,164 458.22	$0	**$48,195** 2,409.77
99	**Unshielded twisted pair (UTP) cable, solid, plenum, #24, 4 pair, category 6**	**170**	C.L.	239 1.406	$20,443 120.25	$2,601 15.30	$0	$0	$156 0.92	$23,200 136.47	$5,447 32.04	$0	**$28,647** 168.51
	Subtotal				$589,494	$447,062	$0	$0	$26,824	$1,063,380	$249,682	$0	**$1,313,062**
	Taxes				$0	$26,824	$0	$0					
	Subcontractor Markups				$138,413	$111,268	$0	$0					
	TOTAL D502002 LIGHTING EQUIPMENT	**6,892**			**$727,908**	**$585,154**	**$0**	**$0**	**$26,824**	**$1,063,380**	**$249,682**	**$0**	**$1,313,062**
	2,100.00 EA		*Level Unit Cost-->*		*$346.62*	*$278.64*			*$12.77*	*$506.37*	*$118.90*		*$625.27*

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$13,211,416 CONCEPT 1												
$11,752,667 D SERVICES												
$3,454,881 D50 ELECTRICAL												
$1,373,227 D5020 LIGHTING & BRANCH WIRING												
D502099 OTHER LIGHTING AND BRANCH WIRING												
100 **Motor connections 'Fire Pump', flexible conduit and fittings, 3 phase, 460 volt, 150 HP motor**	**1**	Ea.	5	$468	$78	$0	$0	$5	$550	$129	$0	**$679**
			5.466	467.54	77.50			4.65	549.69	129.07		678.76
101 **Rigid galvanized steel conduit, 2-1/2" diameter, to 10' H, incl 2 terminations,2 elbows, 11 beam clamps, and 11 couplings per 100 LF**	**600**	L.F.	169	$14,456	$18,300	$0	$0	$1,098	$33,854	$7,949	$0	**$41,802**
			0.282	24.09	30.50			1.83	56.42	13.25		69.67
102 **Rigid galvanized steel conduit elbows, 2-1/2" diameter, to 10' high**	**6**	Ea.	7	$631	$387	$0	$0	$23	$1,041	$245	$0	**$1,286**
			1.23	105.21	64.50			3.87	173.58	40.76		214.34
103 **Conduit fittings for rigid galvanized steel, standard, locknuts, 2-1/2" diameter**	**8**	Ea.		$0	$56	$0	$0	$3	$59	$14	$0	**$73**
					6.95			0.42	7.37	1.73		9.10
104 **Conduit fittings for rigid galvanized steel, bushings, plastic, 2-1/2" diameter**	**4**	Ea.	3	$259	$10	$0	$0	$1	$269	$63	$0	**$332**
			0.757	64.70	2.39			0.14	67.24	15.79		83.02
105 **Wire, aluminum, stranded, 600 volt, 250 kcmil, type THHN, normal installation conditions in wireway, conduit, cable tray**	**19.80**	C.L.	67	$5,747	$4,792	$0	$0	$287	$10,826	$2,542	$0	**$13,368**
			3.394	290.27	242.00			14.52	546.79	128.39		675.17
106 **Insulated ground wire, copper, stranded, #4**	**6.60**	C.L.	12	$1,048	$1,016	$0	$0	$61	$2,125	$499	$0	**$2,624**
			1.856	158.76	154.00			9.24	322.00	75.61		397.61
Subtotal				$22,608	$24,638	$0	$0	$1,478	$48,724	$11,440	$0	**$60,165**
Taxes				$0	$1,478	$0	$0					
Subcontractor Markups				$5,308	$6,132	$0	$0					
TOTAL D502099 OTHER LIGHTING AND BRANCH WIRING	**264**			**$27,917**	**$32,248**	**$0**	**$0**	**$1,478**	**$48,724**	**$11,440**	**$0**	**$60,165**
1.00 EA												

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$11,752,667 D SERVICES												
$3,454,881 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
TENANT TOWER												
107 Detection system, break glass station, addressable, excluding wires & conduits	**145**	Ea.	197	$16,826	$24,070	$0	$0	$1,444	$42,341	$9,942	$0	**$52,282**
			1.357	116.04	166.00			9.96	292.00	68.56		360.57
108 Detection system, strobe & horn, ADA type, excluding wires & conduits	**308**	Ea.	572	$48,898	$40,656	$0	$0	$2,439	$91,993	$21,600	$0	**$113,593**
			1.856	158.76	132.00			7.92	298.68	70.13		368.81
109 Detection system, visual alarm, ADA type, excluding wires & conduits	**61**	Ea.	90	$7,663	$7,076	$0	$0	$425	$15,163	$3,560	$0	**$18,724**
			1.469	125.62	116.00			6.96	248.58	58.37		306.94
110 Detection system, smoke detector, addressable type, excl. wires & conduit	**526**	Ea.	862	$73,767	$126,766	$0	$0	$7,606	$208,139	$48,871	$0	**$257,011**
			1.64	140.24	241.00			14.46	395.70	92.91		488.61
111 'MM' Detection system, fire alarm control panel,relay module, excluding wires & conduits	**4**	Ea.	5	$464	$234	$0	$0	$14	$713	$167	$0	**$880**
			1.357	116.05	58.60			3.52	178.16	41.83		219.99
Memo: https://thefirealarmsupplier.us/products/fmm-1-												
112 'REL/CR' Detection system, fire alarm control panel,relay module, excluding wires & conduits	**2**	Ea.	3	$232	$292	$0	$0	$18	$541	$127	$0	**$668**
			1.357	116.05	145.83			8.75	270.63	63.54		334.17
Memo: https://thefirealarmsupplier.us/products/mix-m500rap-												
113 Door closer, electric automatic operators, surface mounted, universal heavy duty, regular arm	**2**	Ea.	3	$179	$700	$0	$0	$42	$921	$216	$0	**$1,138**
			1.64	89.70	350.00			21.00	460.70	108.17		568.87
114 Detection system, strobe, weatherproof, excluding wires & conduits	**1**	Ea.	1	$126	$149	$0	$0	$9	$283	$67	$0	**$350**
			1.469	125.62	148.74			8.92	283.28	66.52		349.80
Memo: https://thefirealarmsupplier.us/products/simplex-49av-												
115 Smoke alarm photoelectric - battery powered	**1,087**	Ea.	445	$38,082	$52,176	$0	$0	$3,131	$93,389	$21,928	$0	**$115,317**
			0.41	35.03	48.00			2.88	85.91	20.17		106.09

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$11,752,667 D SERVICES												
$3,454,881 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
TENANT TOWER												
116 **Smoke alarm photoelectric -120V wired**	**785**	Ea.	643	$55,004	$50,570	$0	$0	$3,034	$108,608	$25,501	$0	**$134,109**
			0.819	70.07	64.42			3.87	138.35	32.48		170.84
Memo: https://www.gsaadvantage.gov/advantage/ws/catalog/prod												
117 **Speaker - battery powered**	**1,442**	Ea.	591	$50,519	$69,216	$0	$0	$4,153	$123,888	$29,089	$0	**$152,977**
			0.41	35.03	48.00			2.88	85.91	20.17		106.09
118 **Outlet boxes, pressed steel, 4" octagon**	**470**	Ea.	231	$19,779	$620	$0	$0	$37	$20,437	$4,799	$0	**$25,235**
			0.492	42.08	1.32			0.08	43.48	10.21		53.69
119 **Outlet boxes, pressed steel, 4" square**	**521**	Ea.	256	$21,925	$1,073	$0	$0	$64	$23,063	$5,415	$0	**$28,478**
			0.492	42.08	2.06			0.12	44.27	10.39		54.66
120 **Outlet boxes, pressed steel, plaster rings, 4" square, concealed**	**497**	Ea.	76	$6,536	$850	$0	$0	$51	$7,437	$1,746	$0	**$9,183**
			0.154	13.15	1.71			0.10	14.96	3.51		18.48
121 **Outlet boxes, pressed steel, covers, blank, 4" square**	**6**	Ea.	1	$79	$9	$0	$0	$1	$88	$21	$0	**$109**
			0.154	13.15	1.42			0.09	14.66	3.44		18.10
122 **Fire alarm cable,#18, 1 pair**	**204.93**	C.L.	252	$21,560	$6,966	$0	$0	$418	$28,944	$6,796	$0	**$35,740**
			1.23	105.21	33.99			2.04	141.24	33.16		174.40
Memo: https://www.showmecables.com/1-pair-18-awg-solid-												
123 **Fire alarm cable,#14, 1 pair**	**223.74**	C.L.	339	$28,977	$10,874	$0	$0	$652	$40,503	$9,510	$0	**$50,013**
			1.514	129.51	48.60			2.92	181.03	42.51		223.53
Memo: https://www.showmecables.com/fire-alarm-cable-2-												

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$11,752,667 D SERVICES												
$3,454,881 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
TENANT TOWER												
124 **Testing & Commisioning**	**1,049**		774	$66,218	$0	$0	$0	$0	$66,218	$15,548	$0	**$81,766**
			0.738	63.13					63.13	14.82		77.95
Subtotal				$456,836	$392,296	$0	$0	$23,538	$872,669	$204,903	$0	**$1,077,572**
Taxes				$0	$23,538	$0	$0					
Subcontractor Markups				$107,265	$97,638	$0	$0					
TOTAL TENANT TOWER	**5,342**			**$564,101**	**$513,471**	**$0**	**$0**	**$23,538**	**$872,669**	**$204,903**	**$0**	**$1,077,572**
969,696.00 SF			*Level Unit Cost–>*	*$0.58*	*$0.53*			*$0.02*	*$0.90*	*$0.21*		*$1.11*
Estimate Tree Structure Rollups												
$11,752,667 D SERVICES												
$3,454,881 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
BOH, PUBLIC & ADMINISTRATION AREAS												
125 **Detection system, break glass station, addressable, excluding wires & conduits**	**21**	Ea.	28	$2,437	$3,486	$0	$0	$209	$6,132	$1,440	$0	**$7,572**
			1.357	116.04	166.00			9.96	292.00	68.56		360.57
126 **Detection system, strobe & horn, ADA type, excluding wires & conduits**	**72**	Ea.	134	$11,431	$9,504	$0	$0	$570	$21,505	$5,049	$0	**$26,554**
			1.856	158.76	132.00			7.92	298.68	70.13		368.81
127 **Detection system, visual alarm, ADA type, excluding wires & conduits**	**52**	Ea.	76	$6,532	$6,032	$0	$0	$362	$12,926	$3,035	$0	**$15,961**
			1.469	125.62	116.00			6.96	248.58	58.37		306.94
128 **Detection system, smoke detector, addressable type, excl. wires & conduit**	**29**	Ea.	48	$4,067	$6,989	$0	$0	$419	$11,475	$2,694	$0	**$14,170**
			1.64	140.24	241.00			14.46	395.70	92.91		488.61
129 **'MM' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**1**	Ea.	1	$116	$59	$0	$0	$4	$178	$42	$0	**$220**
			1.357	116.04	58.60			3.52	178.16	41.83		219.99
Memo: https://thefirealarmsupplier.us/products/fmm-1-												

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$11,752,667 D SERVICES												
$3,454,881 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
BOH, PUBLIC & ADMINISTRATION AREAS												
130 **'REL/CR' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**9**	Ea.	12 1.357	$1,044 116.04	$1,312 145.83	$0	$0	$79 8.75	$2,436 270.62	$572 63.54	$0	**$3,008** 334.17
Memo: https://thefirealarmsupplier.us/products/mix-m500rap-												
131 **Detection system, strobe, weatherproof, excluding wires & conduits**	**1**	Ea.	1 1.469	$126 125.62	$149 148.74	$0	$0	$9 8.92	$283 283.28	$67 66.52	$0	**$350** 349.80
Memo: https://thefirealarmsupplier.us/products/simplex-49av-												
132 **Notification Appliance Power Extender Panel**	**1**	Ea.	7 7.289	$623 623.46	$963 963.28	$0	$0	$58 57.80	$1,645 1,644.54	$386 386.14	$0	**$2,031** 2,030.68
Memo: https://thefirealarmsupplier.us/products/hpff8-												
133 **Detection system, smoke detector, duct type, addressable, excl. wires & conduit**	**16**	Ea.	49 3.075	$4,208 263.02	$3,232 202.00	$0	$0	$194 12.12	$7,634 477.14	$1,793 112.03	$0	**$9,427** 589.17
134 **LCD Textual Sign**	**4**	Ea.	7 1.856	$635 158.76	$1,391 347.74	$0	$0	$83 20.86	$2,109 527.37	$495 123.83	$0	**$2,605** 651.19
Memo: https://www.gsaadvantage.gov/advantage/ws/catalog/prod												
135 **Outlet boxes, pressed steel, 4" octagon**	**10**	Ea.	5 0.492	$421 42.08	$13 1.32	$0	$0	$1 0.08	$435 43.48	$102 10.21	$0	**$537** 53.69
136 **Outlet boxes, pressed steel, 4" square**	**180**	Ea.	89 0.492	$7,575 42.08	$371 2.06	$0	$0	$22 0.12	$7,968 44.27	$1,871 10.39	$0	**$9,839** 54.66
137 **Outlet boxes, pressed steel, plaster rings, 4" square, concealed**	**21**	Ea.	3 0.154	$276 13.15	$36 1.71	$0	$0	$2 0.10	$314 14.96	$74 3.51	$0	**$388** 18.48
138 **Outlet boxes, pressed steel, covers, blank, 4" square**	**18**	Ea.	3 0.154	$237 13.15	$26 1.42	$0	$0	$2 0.09	$264 14.66	$62 3.44	$0	**$326** 18.10

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$11,752,667 *D SERVICES*											
$3,454,881 *D50 ELECTRICAL*											
$1,955,442 *D5030 COMMUNICATIONS & SECURITY*											
$1,955,442 *D503001 FIRE ALARM SYSTEMS*											
BOH, PUBLIC & ADMINISTRATION AREAS											
139 **Electric metallic tubing (EMT), 3/4" diameter, to 10' high, incl 2 terminations, 2 field bend elbows, 11 beam clamps, and 11 couplings per 100 LF**	**5,580** L.F.	426	$36,398	$10,825	$0	$0	$650	$47,872	$11,240	$0	**$59,113**
		0.076	6.52	1.94			0.12	8.58	2.01		10.59
140 **EMT boxes connectors, compression, steel, 3/4" diameter, to 15' H**	**380** Ea.	34	$2,918	$186	$0	$0	$11	$3,116	$732	$0	**$3,847**
		0.09	7.68	0.49			0.03	8.20	1.93		10.13
141 **Fire alarm cable,#18, 1 pair**	**21.45** C.L.	26	$2,257	$729	$0	$0	$44	$3,030	$711	$0	**$3,741**
		1.23	105.21	33.99			2.04	141.24	33.16		174.40
Memo: https://www.showmecables.com/1-pair-18-awg-solid-											
142 **Fire alarm cable,#14, 1 pair**	**65.34** C.L.	99	$8,462	$3,175	$0	$0	$191	$11,828	$2,777	$0	**$14,606**
		1.514	129.51	48.60			2.92	181.03	42.51		223.53
Memo: https://www.showmecables.com/fire-alarm-cable-2-											
143 **Testing & Commisioning**	**206**	152	$13,004	$0	$0	$0	$0	$13,004	$3,053	$0	**$16,057**
		0.738	63.13					63.13	14.82		77.95
Subtotal			$102,767	$48,478	$0	$0	$2,909	$154,154	$36,195	$0	$190,350
Taxes			$0	$2,909	$0	$0					
Subcontractor Markups			$24,130	$12,066	$0	$0					
TOTAL BOH, PUBLIC & ADMINISTRATION AREAS	**1,201**		**$126,897**	**$63,453**	**$0**	**$0**	**$2,909**	**$154,154**	**$36,195**	**$0**	**$190,350**
65,117.00 SF	*Level Unit Cost-->*		*$1.95*	*$0.97*			*$0.04*	*$2.37*	*$0.56*		*$2.92*
Estimate Tree Structure Rollups											
$11,752,667 *D SERVICES*											
$3,454,881 *D50 ELECTRICAL*											
$1,955,442 *D5030 COMMUNICATIONS & SECURITY*											
$1,955,442 *D503001 FIRE ALARM SYSTEMS*											
GARAGE											
144 **Detection system, break glass station, addressable, excluding wires & conduits**	**8** Ea.	11	$928	$1,328	$0	$0	$80	$2,336	$549	$0	**$2,885**
		1.357	116.05	166.00			9.96	292.01	68.56		360.57

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$11,752,667 D SERVICES												
$3,454,881 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
GARAGE												
145 **Detection system, strobe & horn, ADA type, excluding wires & conduits**	**10**	Ea.	19	$1,588	$1,320	$0	$0	$79	$2,987	$701	$0	**$3,688**
			1.856	158.76	132.00			7.92	298.68	70.13		368.81
146 **Detection system, visual alarm, ADA type, excluding wires & conduits**	**7**	Ea.	10	$879	$812	$0	$0	$49	$1,740	$409	$0	**$2,149**
			1.469	125.62	116.00			6.96	248.58	58.37		306.94
147 **Detection system, smoke detector, addressable type, excl. wires & conduit**	**2**	Ea.	3	$280	$482	$0	$0	$29	$791	$186	$0	**$977**
			1.64	140.24	241.00			14.46	395.70	92.91		488.61
148 **'MM' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**6**	Ea.	8	$696	$352	$0	$0	$21	$1,069	$251	$0	**$1,320**
			1.357	116.05	58.60			3.52	178.16	41.83		219.99
Memo: https://thefirealarmsupplier.us/products/fmm-1-												
149 **'REL/CR' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**2**	Ea.	3	$232	$292	$0	$0	$18	$541	$127	$0	**$668**
			1.357	116.05	145.83			8.75	270.63	63.54		334.17
Memo: https://thefirealarmsupplier.us/products/mix-m500rap-												
150 **Notification Appliance Power Extender Panel**	**2**	Ea.	15	$1,247	$1,927	$0	$0	$116	$3,289	$772	$0	**$4,061**
			7.289	623.47	963.28			57.80	1,644.54	386.14		2,030.68
Memo: https://thefirealarmsupplier.us/products/hpff8-												
151 **Detection system, fire alarm signal bell 10" red 20-24 V P**	**6**	Ea.	7	$631	$1,230	$0	$0	$74	$1,935	$454	$0	**$2,389**
			1.23	105.21	205.00			12.30	322.51	75.72		398.23
152 **Detection system, strobe, weatherproof, excluding wires & conduits**	**50**	Ea.	73	$6,281	$7,437	$0	$0	$446	$14,164	$3,326	$0	**$17,490**
			1.469	125.62	148.74			8.92	283.28	66.52		349.80
Memo: https://thefirealarmsupplier.us/products/simplex-49av-												
153 **Detection system, strobe & horn, weather proof, ADA type, excluding wires & conduits**	**115**	Ea.	213	$18,257	$44,400	$0	$0	$2,664	$65,322	$15,338	$0	**$80,659**
			1.856	158.76	386.09			23.16	568.01	133.37		701.38
Memo: https://www.gordonelectricsupply.com/p/Edwards-												

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$11,752,667 D SERVICES												
$3,454,881 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
GARAGE												
154 **Detection system, Manual pull station, weather proof, excluding wires & conduits**	**27**	Ea.	37	$3,133	$3,901	$0	$0	$234	$7,269	$1,707	$0	**$8,975**
			1.357	116.04	144.49			8.67	269.20	63.21		332.41
Memo: https://www.gordonelectricsupply.com/p/Edwards-Mpsr1-												
155 **Outlet boxes, pressed steel, 4" octagon**	**1**	Ea.		$42	$1	$0	$0	$0	$43	$10	$0	**$54**
			0.492	42.08	1.32			0.08	43.48	10.21		53.69
156 **Outlet boxes, pressed steel, 4" square**	**225**	Ea.	111	$9,469	$464	$0	$0	$28	$9,960	$2,339	$0	**$12,299**
			0.492	42.08	2.06			0.12	44.27	10.39		54.66
157 **Outlet boxes, pressed steel, plaster rings, 4" square, concealed**	**47**	Ea.	7	$618	$80	$0	$0	$5	$703	$165	$0	**$868**
			0.154	13.15	1.71			0.10	14.96	3.51		18.48
158 **Outlet boxes, pressed steel, covers, blank, 4" square**	**8**	Ea.	1	$105	$11	$0	$0	$1	$117	$28	$0	**$145**
			0.154	13.15	1.42			0.09	14.66	3.44		18.10
159 **Rigid galvanized steel conduit, 3/4" diameter, to 10' H, incl 2 terminations, 2elbows, 11 beam clamps, and 11 couplings per 100 LF**	**13,920**	L.F.	1,712	$146,450	$67,373	$0	$0	$4,042	$217,865	$51,155	$0	**$269,019**
			0.123	10.52	4.84			0.29	15.65	3.67		19.33
160 **Conduit fittings for rigid galvanized steel, standard, locknuts, 3/4" diameter**	**936**	Ea.		$0	$534	$0	$0	$32	$566	$133	$0	**$698**
					0.57			0.03	0.60	0.14		0.75
161 **Conduit fittings for rigid galvanized steel, bushings, plastic, 3/4" diameter**	**468**	Ea.	144	$12,309	$112	$0	$0	$7	$12,428	$2,918	$0	**$15,347**
			0.308	26.30	0.24			0.01	26.56	6.24		32.79
162 **Fire alarm cable,#18, 1 pair**	**28.38**	C.L.	35	$2,986	$965	$0	$0	$58	$4,008	$941	$0	**$4,949**
			1.23	105.21	33.99			2.04	141.24	33.16		174.40
Memo: https://www.showmecables.com/1-pair-18-awg-solid-												
163 **Fire alarm cable,#14, 1 pair**	**207.24**	C.L.	314	$26,840	$10,072	$0	$0	$604	$37,516	$8,809	$0	**$46,325**
			1.514	129.51	48.60			2.92	181.03	42.51		223.53
Memo: https://www.showmecables.com/fire-alarm-cable-2-												

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$11,752,667 D SERVICES												
$3,454,881 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
GARAGE												
164 **Testing & Commisioning**	**235**		173	$14,834	$0	$0	$0	$0	$14,834	$3,483	$0	**$18,317**
			0.738	63.13					63.13	14.82		77.95
Subtotal				$247,807	$143,092	$0	$0	$8,586	$399,484	$93,799	$0	**$493,283**
Taxes				$0	$8,586	$0	$0					
Subcontractor Markups				$58,185	$35,614	$0	$0					
TOTAL GARAGE	**2,897**			**$305,992**	**$187,291**	**$0**	**$0**	**$8,586**	**$399,484**	**$93,799**	**$0**	**$493,283**
318,322.00 SF			*Level Unit Cost–>*	*$0.96*	*$0.59*			*$0.03*	*$1.25*	*$0.29*		*$1.55*
Estimate Tree Structure Rollups												
$11,752,667 D SERVICES												
$3,454,881 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
MECHANICAL ROOM SPACES												
165 **Detection system, break glass station, addressable, excluding wires & conduits**	**6**	Ea.	8	$696	$996	$0	$0	$60	$1,752	$411	$0	**$2,163**
			1.357	116.05	166.00			9.96	292.01	68.56		360.57
166 **Detection system, strobe & horn, ADA type, excluding wires & conduits**	**18**	Ea.	33	$2,858	$2,376	$0	$0	$143	$5,376	$1,262	$0	**$6,639**
			1.856	158.76	132.00			7.92	298.68	70.13		368.81
167 **Detection system, visual alarm, ADA type, excluding wires & conduits**	**3**	Ea.	4	$377	$348	$0	$0	$21	$746	$175	$0	**$921**
			1.469	125.62	116.00			6.96	248.58	58.37		306.95
168 **Detection system, smoke detector, addressable type, excl. wires & conduit**	**6**	Ea.	10	$841	$1,446	$0	$0	$87	$2,374	$557	$0	**$2,932**
			1.64	140.24	241.00			14.46	395.70	92.91		488.61
169 **'MM' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**27**	Ea.	37	$3,133	$1,582	$0	$0	$95	$4,810	$1,129	$0	**$5,940**
			1.357	116.04	58.60			3.52	178.16	41.83		219.99

Memo: https://thefirealarmsupplier.us/products/fmm-1-

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$11,752,667 D SERVICES												
$3,454,881 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
MECHANICAL ROOM SPACES												
170 **'REL/CR' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**23**	Ea.	31	$2,669	$3,354	$0	$0	$201	$6,224	$1,461	$0	**$7,686**
			1.357	116.04	145.83			8.75	270.62	63.54		334.17
Memo: https://thefirealarmsupplier.us/products/mix-m500rap-												
171 **Detection system, smoke detector, duct type, addressable, excl. wires & conduit**	**2**	Ea.	6	$526	$404	$0	$0	$24	$954	$224	$0	**$1,178**
			3.075	263.02	202.00			12.12	477.14	112.03		589.17
172 **Notification Appliance Power Extender Panel**	**8**	Ea.	58	$4,988	$7,706	$0	$0	$462	$13,156	$3,089	$0	**$16,245**
			7.289	623.46	963.28			57.80	1,644.54	386.14		2,030.68
Memo: https://thefirealarmsupplier.us/products/hpff8-												
173 **Detection system, strobe & horn, weather proof, ADA type, excluding wires & conduits**	**5**	Ea.	9	$794	$1,930	$0	$0	$116	$2,840	$667	$0	**$3,507**
			1.856	158.76	386.09			23.16	568.01	133.37		701.38
Memo: https://www.gordonelectricsupply.com/p/Edwards-												
174 **'FACP' Detection system, fire alarm control panel, addressable with voice, up to 400 points, excluding wires & conduits**	**3**	Ea.	81	$6,946	$34,200	$0	$0	$2,052	$43,198	$10,143	$0	**$53,341**
			27.07	2,315.42	11,400.00			684.00	14,399.42	3,380.98		17,780.40
175 **Mass notification system, wireless command center, PC based, 10,000 devices database**	**1**	Ea.	15	$1,266	$3,175	$0	$0	$191	$4,631	$1,087	$0	**$5,719**
			14.797	1,265.65	3,175.00			190.50	4,631.15	1,087.39		5,718.54
176 **Mass notification system, transmitter, 100 watt**	**1**	Ea.	7	$633	$6,475	$0	$0	$389	$7,496	$1,760	$0	**$9,256**
			7.398	632.83	6,475.00			388.50	7,496.33	1,760.14		9,256.47
177 **Detection system, fire alarm control panel, battery & rack, automatic charger, excluding wires & conduits**	**3**	Ea.	4	$316	$1,770	$0	$0	$106	$2,192	$515	$0	**$2,706**
			1.23	105.21	590.00			35.40	730.61	171.55		902.15
178 **'FAAP' Detection system, annunciator panel**	**3**	Ea.	27	$2,296	$2,700	$0	$0	$162	$5,158	$1,211	$0	**$6,369**
			8.946	765.18	900.00			54.00	1,719.18	403.66		2,122.84
Memo: https://www.buyfirealarmparts.com/shop/lcd280.html												

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$11,752,667 D SERVICES												
$3,454,881 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
MECHANICAL ROOM SPACES												
179 Outlet boxes, pressed steel, 4" octagon	**3**	Ea.	1	$126	$4	$0	$0	$0	$130	$31	$0	**$161**
			0.492	42.08	1.32			0.08	43.48	10.21		53.69
180 Outlet boxes, pressed steel, 4" square	**84**	Ea.	41	$3,535	$173	$0	$0	$10	$3,718	$873	$0	**$4,591**
			0.492	42.08	2.06			0.12	44.27	10.39		54.66
181 Outlet boxes, pressed steel, plaster rings, 4" square, concealed	**25**	Ea.	4	$329	$43	$0	$0	$3	$374	$88	$0	**$462**
			0.154	13.15	1.71			0.10	14.96	3.51		18.48
182 Outlet boxes, pressed steel, covers, blank, 4" square	**35**	Ea.	5	$460	$50	$0	$0	$3	$513	$120	$0	**$633**
			0.154	13.15	1.42			0.09	14.66	3.44		18.10
183 Electric metallic tubing (EMT), 3/4" diameter, to 10' high, incl 2 terminations, 2 field bend elbows, 11 beam clamps, and 11 couplings per 100 LF	**2,610**	L.F.	199	$17,025	$5,063	$0	$0	$304	$22,392	$5,258	$0	**$27,650**
			0.076	6.52	1.94			0.12	8.58	2.01		10.59
184 EMT boxes connectors, compression, steel, 3/4" diameter, to 15' H	**174**	Ea.	16	$1,336	$85	$0	$0	$5	$1,427	$335	$0	**$1,762**
			0.09	7.68	0.49			0.03	8.20	1.93		10.13
185 Fire alarm cable,#18, 1 pair	**20.13**	C.L.	25	$2,118	$684	$0	$0	$41	$2,843	$668	$0	**$3,511**
			1.23	105.21	33.99			2.04	141.24	33.16		174.40
Memo: https://www.showmecables.com/1-pair-18-awg-solid-												
186 Fire alarm cable,#14, 1 pair	**16.17**	C.L.	24	$2,094	$786	$0	$0	$47	$2,927	$687	$0	**$3,614**
			1.514	129.51	48.60			2.92	181.03	42.51		223.53
Memo: https://www.showmecables.com/fire-alarm-cable-2-												

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$11,752,667 D SERVICES												
$3,454,881 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
MECHANICAL ROOM SPACES												
187 **Testing & Commisioning**	**98**		72	$6,186	$0	$0	$0	$0	$6,186	$1,453	$0	**$7,639**
			0.738	63.13					63.13	14.82		77.95
Subtotal				$61,548	$75,351	$0	$0	$4,521	$141,420	$33,205	$0	**$174,625**
Taxes				$0	$4,521	$0	$0					
Subcontractor Markups				$14,451	$18,754	$0	$0					
TOTAL MECHANICAL ROOM SPACES	**720**			**$75,999**	**$98,626**	**$0**	**$0**	**$4,521**	**$141,420**	**$33,205**	**$0**	**$174,625**
15,138.00 SF			*Level Unit Cost-->*	*$5.02*	*$6.52*			*$0.30*	*$9.34*	*$2.19*		*$11.54*
Estimate Tree Structure Rollups												
$11,752,667 D SERVICES												
$3,454,881 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
FIRE PUMPS & PUMP ROOM PIPING												
188 **'MM' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**21**	Ea.	28	$2,437	$1,231	$0	$0	$74	$3,741	$878	$0	**$4,620**
			1.357	116.04	58.60			3.52	178.16	41.83		219.99
Memo: https://thefirealarmsupplier.us/products/fmm-1-												
189 **'REL/CR' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**1**	Ea.	1	$116	$146	$0	$0	$9	$271	$64	$0	**$334**
			1.357	116.04	145.83			8.75	270.62	63.54		334.16
Memo: https://thefirealarmsupplier.us/products/mix-m500rap-												
190 **Detection system, strobe & horn, weather proof, ADA type, excluding wires & conduits**	**2**	Ea.	4	$318	$772	$0	$0	$46	$1,136	$267	$0	**$1,403**
			1.856	158.76	386.09			23.17	568.02	133.37		701.38
Memo: https://www.gordonelectricsupply.com/p/Edwards-												
191 **Outlet boxes, pressed steel, 4" square**	**24**	Ea.	12	$1,010	$49	$0	$0	$3	$1,062	$249	$0	**$1,312**
			0.492	42.08	2.06			0.12	44.27	10.39		54.66
192 **Outlet boxes, pressed steel, covers, blank, 4" square**	**22**	Ea.	3	$289	$31	$0	$0	$2	$322	$76	$0	**$398**
			0.154	13.15	1.42			0.09	14.66	3.44		18.10

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$11,752,667 D SERVICES											
$3,454,881 D50 ELECTRICAL											
$1,955,442 D5030 COMMUNICATIONS & SECURITY											
$1,955,442 D503001 FIRE ALARM SYSTEMS											
FIRE PUMPS & PUMP ROOM PIPING											
193 **Electric metallic tubing (EMT), 3/4" diameter, to 10' high, incl 2 terminations, 2 field bend elbows, 11 beam clamps, and 11 couplings per 100 LF**	**720** L.F.	55	$4,696	$1,397	$0	$0	$84	$6,177	$1,450	$0	**$7,627**
		0.076	6.52	1.94			0.12	8.58	2.01		10.59
194 **EMT boxes connectors, compression, steel, 3/4" diameter, to 15' H**	**48** Ea.	4	$369	$24	$0	$0	$1	$394	$92	$0	**$486**
		0.09	7.68	0.49			0.03	8.20	1.93		10.13
195 **Fire alarm cable,#18, 1 pair**	**7.26** C.L.	9	$764	$247	$0	$0	$15	$1,025	$241	$0	**$1,266**
		1.23	105.21	33.99			2.04	141.24	33.16		174.40
Memo: https://www.showmecables.com/1-pair-18-awg-solid-											
196 **Fire alarm cable,#14, 1 pair**	**1.32** C.L.	2	$171	$64	$0	$0	$4	$239	$56	$0	**$295**
		1.514	129.51	48.60			2.92	181.02	42.51		223.53
Memo: https://www.showmecables.com/fire-alarm-cable-2-											
197 **Testing & Commisioning**	**24**	18	$1,515	$0	$0	$0	$0	$1,515	$356	$0	**$1,871**
		0.738	63.13					63.13	14.82		77.95
Subtotal			$11,685	$3,961	$0	$0	$238	$15,883	$3,729	$0	$19,612
Taxes			$0	$238	$0	$0					
Subcontractor Markups			$2,744	$986	$0	$0					
TOTAL FIRE PUMPS & PUMP ROOM PIPING	**137**		**$14,428**	**$5,184**	**$0**	**$0**	**$238**	**$15,883**	**$3,729**	**$0**	$19,612
1.00 EA											
Estimate Tree Structure Rollups											
$13,211,416 CONCEPT 1											
$1,001,697 F SPECIAL CONSTRUCTION & DEMOLITION											
$1,001,697 F20 SELECTIVE BUILDING DEMOLITION											
$482,214 F2010 BUILDING ELEMENTS DEMOLITION											
F201004 INTERIOR CONSTRUCTION & FINISHES											
198 **Walls and partitions demolition, metal or wood studs, finish two sides, plasterboard (gypsum wallboard)**	**96** S.F.	5	$172	$0	$0	$0	$0	$172	$55	$0	**$227**
		0.055	1.79					1.79	0.58		2.37

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$13,211,416 CONCEPT 1											
$1,001,697 F SPECIAL CONSTRUCTION & DEMOLITION											
$1,001,697 F20 SELECTIVE BUILDING DEMOLITION											
$482,214 F2010 BUILDING ELEMENTS DEMOLITION											
F201004 INTERIOR CONSTRUCTION & FINISHES											
Subtotal			$172	$0	$0	$0	$0	$172	$55	$0	**$227**
Subcontractor Markups			$55	$0	$0	$0					
TOTAL F201004 INTERIOR CONSTRUCTION & FINISHES	**5**		**$227**	**$0**	**$0**	**$0**	**$0**	**$172**	**$55**	**$0**	**$227**
1.00 LS											
Estimate Tree Structure Rollups											
$13,211,416 CONCEPT 1											
$1,001,697 F SPECIAL CONSTRUCTION & DEMOLITION											
$1,001,697 F20 SELECTIVE BUILDING DEMOLITION											
$482,214 F2010 BUILDING ELEMENTS DEMOLITION											
F201006 MECHANICAL SYSTEMS											
199 **Pipe, metal pipe, to 1-1/2" diam., selective demolition**	**27,600** L.F.	1,358	$112,970	$0	$0	$0	$0	$112,970	$30,558	$0	**$143,528**
		0.049	4.09					4.09	1.11		5.20
200 **Pipe, metal pipe, 2" to 3-1/2" diam., selective demolition**	**7,940** L.F.	518	$43,062	$0	$0	$0	$0	$43,062	$11,648	$0	**$54,710**
		0.065	5.42					5.42	1.47		6.89
201 **Pipe, metal pipe, 4" to 6" diam., selective demolition**	**8,420** L.F.	1,657	$137,856	$0	$0	$0	$0	$137,856	$37,290	$0	**$175,146**
		0.197	16.37					16.37	4.43		20.80
202 **Fans, 1-1/2 thru 10 HP or 20,000 CFM, selective demolition**	**14** Ea.	276	$19,602	$0	$0	$0	$0	$19,602	$5,302	$0	**$24,904**
		19.68	1,400.15					1,400.15	378.74		1,778.89
Subtotal			$313,489	$0	$0	$0	$0	$313,489	$84,799	$0	**$398,288**
Subcontractor Markups			$84,799	$0	$0	$0					
TOTAL F201006 MECHANICAL SYSTEMS	**3,808**		**$398,288**	**$0**	**$0**	**$0**	**$0**	**$313,489**	**$84,799**	**$0**	**$398,288**
1.00 LS											

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$13,211,416 CONCEPT 1											
$1,001,697 F SPECIAL CONSTRUCTION & DEMOLITION											
$1,001,697 F20 SELECTIVE BUILDING DEMOLITION											
$482,214 F2010 BUILDING ELEMENTS DEMOLITION											
F201007 ELECTRICAL SYSTEMS											
203 **Fire alarm control panel, 12 to 16 zone, electrical demolition, remove**	**3** Ea.	22 7.371	$1,892 630.51	$0	$0	$0	$0	$1,892 630.51	$444 148.04	$0	**$2,336** 778.56
204 **Fire alarm bell, electrical demolition, remove**	**207** Ea.	127 0.615	$10,889 52.60	$0	$0	$0	$0	$10,889 52.60	$2,557 12.35	$0	**$13,446** 64.95
205 **Fire alarm pull station, electrical demolition, remove**	**206** Ea.	88 0.428	$7,542 36.61	$0	$0	$0	$0	$7,542 36.61	$1,771 8.60	$0	**$9,313** 45.21
206 **Smoke detector, electrical demolition, remove**	**595** Ea.	255 0.428	$21,784 36.61	$0	$0	$0	$0	$21,784 36.61	$5,115 8.60	$0	**$26,899** 45.21
207 **Junction boxes, 4" square & octagon, electrical demolition, remove, including removal of supports and terminations**	**415** Ea.	51 0.123	$4,366 10.52	$0	$0	$0	$0	$4,366 10.52	$1,025 2.47	$0	**$5,391** 12.99
208 **Conduit, electric metallic tubing (EMT), 1/2" to 1" diameter, electrical demolition, remove conduit to 10' high, including fittings & hangers**	**960** L.F.	24 0.025	$2,020 2.10	$0	$0	$0	$0	$2,020 2.10	$474 0.49	$0	**$2,494** 2.60
209 **Conduit, rigid galvanized steel, 1/2" to 1" diameter, electrical demolition, remove conduit to 10' high, including fittings & hangers**	**3,030** L.F.	123 0.041	$10,520 3.47	$0	$0	$0	$0	$10,520 3.47	$2,470 0.81	$0	**$12,990** 4.29
210 **Fire Alarm Cable, electrical demolition, remove**	**13,695** L.F.	51 0.004	$4,322 0.32	$0	$0	$0	$0	$4,322 0.32	$1,015 0.07	$0	**$5,337** 0.39
211 **Generator set, 3 phase 4 wire, 277/480 V, 200 kW, electrical demolition, remove, incl accessories**	**1** Ea.	50 50.034	$4,280 4,279.65	$0	$0	$0	$0	$4,280 4,279.65	$1,005 1,004.86	$0	**$5,285** 5,284.51

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$13,211,416 CONCEPT 1												
$1,001,697 F SPECIAL CONSTRUCTION & DEMOLITION												
$1,001,697 F20 SELECTIVE BUILDING DEMOLITION												
$482,214 F2010 BUILDING ELEMENTS DEMOLITION												
F201007 ELECTRICAL SYSTEMS												
212 **Transfer switches, enclosed, 260 A, electrical demolition, remove**	**1**	Ea.	2	$168	$0	$0	$0	$0	$168	$40	$0	**$208**
			1.968	168.33					168.33	39.52		207.85
Subtotal				$67,783	$0	$0	$0	$0	$67,783	$15,916	$0	$83,699
Subcontractor Markups				$15,916	$0	$0	$0					
TOTAL F201007 ELECTRICAL SYSTEMS	**792**			**$83,699**	**$0**	**$0**	**$0**	**$0**	**$67,783**	**$15,916**	**$0**	**$83,699**
1.00 LS												
Estimate Tree Structure Rollups												
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)												
$13,211,416 CONCEPT 1												
$1,001,697 F SPECIAL CONSTRUCTION & DEMOLITION												
$1,001,697 F20 SELECTIVE BUILDING DEMOLITION												
F2020 HAZARDOUS COMPONENTS ABATEMENT												
213 **Asbestos abatement equipment, respirator, single use**	**88**	Ea.		$0	$176	$0	$0	$11	$187	$50	$0	**$237**
					2.00			0.12	2.12	0.57		2.69
Memo: 4 workers for 22 days												
214 **Asbestos abatement equipment, respirator, single use, cartridge**	**88**	Ea.		$0	$1,276	$0	$0	$77	$1,353	$362	$0	**$1,715**
					14.50			0.87	15.37	4.12		19.49
Memo: 4 workers for 20 days												
215 **Asbestos abatement equipment, worker protection, whole body, foot, head cover &gloves, plastic**	**176**	Ea.		$0	$1,866	$0	$0	$112	$1,978	$530	$0	**$2,507**
					10.60			0.64	11.24	3.01		14.25
Memo: 4 workers for 20 days x 2												
216 **Preparation of asbestos containment area, cover surfaces with polyethylene sheeting, floors, each layer, 4 mil, incl. glue & tape**	**35,918**	S.F.	309	$24,069	$2,155	$0	$0	$129	$26,353	$7,059	$0	**$33,413**
			0.009	0.67	0.06				0.73	0.20		0.93
217 **Preparation of asbestos containment area, cover surfaces with polyethylene sheeting, walls, each layer, 4 mil, incl. glue & tape**	**190,684**	S.F.	2,111	$164,287	$11,441	$0	$0	$686	$176,415	$47,257	$0	**$223,672**
			0.011	0.86	0.06				0.93	0.25		1.17

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)											
$13,211,416 CONCEPT 1											
$1,001,697 F SPECIAL CONSTRUCTION & DEMOLITION											
$1,001,697 F20 SELECTIVE BUILDING DEMOLITION											
F2020 HAZARDOUS COMPONENTS ABATEMENT											
218 **Preparation of asbestos containment area, caulk seams with latex**	**24,153** L.F.	1,040	$56,885	$5,072	$0	$0	$304	$62,261	$16,678	$0	**$78,940**
		0.043	2.36	0.21			0.01	2.58	0.69		3.27
Memo: =(680)/32=22*12=264*5=13200lf											
219 **Preparation of asbestos containment area, separation barrier, 2" x 4" @ 16", 1/2" plywood each side, 12' high**	**5,920** S.F.	364	$19,918	$28,712	$0	$0	$1,723	$50,353	$13,488	$0	**$63,841**
		0.062	3.37	4.85			0.29	8.51	2.28		10.78
220 **Cover floor surface with tarpaulins, polyvinyl coated nylon, 14 oz. to 18 oz., min**	**2,824** S.F.	27	$2,110	$3,841	$0	$0	$230	$6,181	$1,656	$0	**$7,837**
		0.01	0.75	1.36			0.08	2.19	0.59		2.77
Memo: 2 layer x floor area											
221 **Selective demolition, saw cutting, masonry walls, brick, per inch of depth, hydraulic saw**	**33** EA	14	$703	$12	$997	$0	$61	$1,772	$475	$0	**$2,247**
		0.435	21.31	0.36	30.20		1.83	53.70	14.38		68.08
222 **Concrete core drilling, core, reinforced concrete slab, 1" diameter, up to 6" thick slab, includes bit cost, layout and set up time**	**565** Ea.	654	$31,376	$124	$4,749	$0	$292	$36,542	$9,789	$0	**$46,331**
		1.157	55.53	0.22	8.41		0.52	64.68	17.32		82.00
223 **Concrete core drilling, core, reinforced concrete slab, 1" diameter, up to 6" thick slab, includes bit cost, layout and set up time, for each additional**	**1,130** Ea.	15	$734	$45	$111	$0	$9	$899	$241	$0	**$1,140**
		0.014	0.65	0.04	0.10		0.01	0.80	0.21		1.01
224 **Demolition in asbestos contaminated area, popcorn ceiling**	**1,412** S.F.	108	$8,440	$282	$0	$0	$17	$8,739	$2,341	$0	**$11,080**
		0.077	5.98	0.20			0.01	6.19	1.66		7.85
225 **Asbestos encapsulation with sealants, ceilings & walls, max**	**1,412** S.F.	15	$1,187	$734	$0	$0	$44	$1,965	$526	$0	**$2,492**
		0.011	0.84	0.52			0.03	1.39	0.37		1.76
226 **Asbestos abat equip, disposable fiber drums, 55 Gal**	**210** Ea.		$0	$3,822	$0	$0	$229	$4,051	$1,085	$0	**$5,137**
				18.20			1.09	19.29	5.17		24.46
227 **Asbestos abatement equipment, pressure sensitive caution labels, 3" x 5"**	**210** Ea.		$0	$685	$0	$0	$41	$726	$194	$0	**$920**
				3.26			0.20	3.46	0.93		4.38

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)												
$13,211,416 CONCEPT 1												
$1,001,697 F SPECIAL CONSTRUCTION & DEMOLITION												
$1,001,697 F20 SELECTIVE BUILDING DEMOLITION												
F2020 HAZARDOUS COMPONENTS ABATEMENT												
228 Decontamination of asbestos containment area, bag polyethylene sheeting	**260**	Ea.	51	$3,982	$369	$0	$0	$22	$4,374	$1,172	$0	**$5,545**
			0.197	15.32	1.42			0.09	16.82	4.51		21.33
Memo: Assume 3 bags per drum												
229 Asbestos abatement equipment & supplies, buy, shower unit, incl. pump & filters	**5**	Ea.		$0	$4,825	$0	$0	$290	$5,115	$1,370	$0	**$6,485**
					965.00			57.90	1,022.90	274.01		1,296.91
Memo: 1 shower unit to be move to different floors												
230 Preparation of asbestos containment area, set up and remove portable shower unit	**5**	Ea.	25	$1,913	$0	$0	$0	$0	$1,913	$512	$0	**$2,426**
			4.92	382.61					382.61	102.49		485.10
Memo: 1 shower unit to be move to different floors												
231 Asbestos abatement equipment & supplies, buy, vacuum cleaner, HEPA, stainless steel, wet/dry, 16 gal.	**4**	Ea.		$0	$5,800	$0	$0	$348	$6,148	$1,647	$0	**$7,795**
					1,450.00			87.00	1,537.00	411.72		1,948.72
Memo: Assuming 4 workers working in 4 locations at the same												
232 Decontamination of asbestos containment area, spray exposed substrate with surfactant (bridging), flat surfaces	**1,412**	S.F.	19	$1,451	$635	$0	$0	$38	$2,124	$569	$0	**$2,693**
			0.013	1.03	0.45			0.03	1.50	0.40		1.91
Memo: If assuming floor abatement use 100 sf area												
233 Decontamination of asbestos containment area, final cleaning of protected surfaces	**4,424**	S.F.	16	$1,241	$0	$0	$0	$0	$1,241	$332	$0	**$1,574**
			0.004	0.28					0.28	0.07		0.36
Memo: Includes abatement area and immediate area (wall or												
234 Preparation of asbestos containment area, personnel decontamination chamber, 2"x 4" @ 16", 3/4" plywood each side	**50**	S.F.	3	$187	$298	$0	$0	$18	$502	$135	$0	**$637**
			0.068	3.74	5.95			0.36	10.05	2.69		12.74

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)											
$13,211,416 CONCEPT 1											
$1,001,697 F SPECIAL CONSTRUCTION & DEMOLITION											
$1,001,697 F20 SELECTIVE BUILDING DEMOLITION											
F2020 HAZARDOUS COMPONENTS ABATEMENT											
235 **Asbestos waste packaging, handling & disposal, disposal charges, excl. haul, min**	**132** C.Y		$0 61.00	$8,052	$0	$0	$483 3.66	$8,535 64.66	$2,286 17.32	$0	**$10,821** 81.98
Subtotal			$318,483	$80,222	$5,857	$0	$5,165	$409,727	$109,756	$0	**$519,483**
Taxes			$0	$4,813	$351	$0					
Subcontractor Markups			$85,314	$22,779	$1,663	$0					
TOTAL F2020 HAZARDOUS COMPONENTS ABATEMENT **1.00 LS**	**4,772**		**$403,797**	**$107,814**	**$7,871**	**$0**	**$5,165**	**$409,727**	**$109,756**	**$0**	**$519,483**
Estimate Tree Structure Rollups											
$11,055,884 CONCEPT 2											
$470,972 C INTERIORS											
$452,704 C10 INTERIOR CONSTRUCTION											
$279,926 C1010 PARTITIONS											
C1010145A PARTITION W1											
236 **Firestopping, construction joints, floor slab to drywall partition**	**84** L.F.	8 0.098	$452 5.38	$1,243 14.80	$0	$0	$75 0.89	$1,770 21.07	$572 6.81	$0	**$2,342** 27.88
237 **Gypsum wallboard, on walls, fire resistant, 5/8" thick, finish excluded**	**218** S.F.	2 0.01	$117 0.54	$89 0.41	$0	$0	$5 0.03	$212 0.97	$69 0.31	$0	**$281** 1.29
238 **Sound attenuation blanket, 3" thick**	**109** S.F.	1 0.011	$66 0.61	$82 0.75	$0	$0	$5 0.04	$153 1.40	$49 0.45	$0	**$202** 1.85
239 **Metal stud partition, non-load bearing, galvanized, 3-5/8" wide, 20 gauge, 16" OC, includes top & bottom track**	**109** S.F.	3 0.026	$154 1.41	$146 1.34	$0	$0	$9 0.08	$309 2.83	$100 0.92	$0	**$409** 3.75

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$11,055,884 CONCEPT 2											
$470,972 C INTERIORS											
$452,704 C10 INTERIOR CONSTRUCTION											
$279,926 C1010 PARTITIONS											
C1010145A PARTITION W1											
240 **Channels, cold rolled, galvanized, 16 ga., 3/4" deep**	**10.90** C.L.		$0	$545	$0	$0	$33	$578	$187	$0	**$764**
				50.00			3.00	53.00	17.12		70.12
Subtotal			$790	$2,105	$0	$0	$126	$3,021	$976	$0	$3,997
Taxes			$0	$126	$0	$0					
Subcontractor Markups			$255	$721	$0	$0					
TOTAL C1010145A PARTITION W1	**14**		**$1,045**	**$2,953**	**$0**	**$0**	**$126**	**$3,021**	**$976**	**$0**	$3,997
109.00 SF		*Level Unit Cost-->*	*$9.58*	*$27.09*			*$1.16*	*$27.72*	*$8.95*		*$36.67*
Estimate Tree Structure Rollups											
$11,055,884 CONCEPT 2											
$470,972 C INTERIORS											
$452,704 C10 INTERIOR CONSTRUCTION											
$279,926 C1010 PARTITIONS											
C1010145B PARTITION W2											
241 **Firestopping, construction joints, floor slab to drywall partition**	**80** L.F.	8	$431	$1,184	$0	$0	$71	$1,686	$544	$0	**$2,230**
		0.098	5.38	14.80			0.89	21.07	6.81		27.88
242 **Gypsum wallboard, on walls, fire resistant, 5/8" thick, finish excluded**	**198** S.F.	2	$107	$81	$0	$0	$5	$193	$62	$0	**$255**
		0.01	0.54	0.41			0.03	0.97	0.31		1.29
243 **Sound attenuation blanket, 3" thick**	**99** S.F.	1	$60	$74	$0	$0	$4	$139	$45	$0	**$183**
		0.011	0.61	0.75			0.04	1.40	0.45		1.85
244 **Metal stud partition, non-load bearing, galvanized, 3-5/8" wide, 20 gauge, 16" OC, includes top & bottom track**	**99** S.F.	3	$140	$133	$0	$0	$8	$281	$91	$0	**$371**
		0.026	1.41	1.34			0.08	2.83	0.92		3.75

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$11,055,884 CONCEPT 2												
$470,972 C INTERIORS												
$452,704 C10 INTERIOR CONSTRUCTION												
$279,926 C1010 PARTITIONS												
C1010145B PARTITION W2												
245 **Channels, cold rolled, galvanized, 16 ga., 3/4" deep**	**9.90**	C.L.		$0	$495	$0	$0	$30	$525	$169	$0	**$694**
					50.00			3.00	53.00	17.12		70.12
Subtotal				$737	$1,967	$0	$0	$118	$2,822	$912	$0	$3,734
Taxes				$0	$118	$0	$0					
Subcontractor Markups				$238	$673	$0	$0					
TOTAL C1010145B PARTITION W2	**13**			**$975**	**$2,759**	**$0**	**$0**	**$118**	**$2,822**	**$912**	**$0**	$3,734
99.00 SF			*Level Unit Cost-->*	*$9.85*	*$27.86*			*$1.19*	*$28.51*	*$9.21*		*$37.72*
Estimate Tree Structure Rollups												
$11,055,884 CONCEPT 2												
$470,972 C INTERIORS												
$452,704 C10 INTERIOR CONSTRUCTION												
$279,926 C1010 PARTITIONS												
C1010145C PILASTER												
246 **U-Shield 6"h x 12"w x 6"h (00" Perimeter) @ 10' ht, 20 Gauge material**	**572**	EA	1,055	$74,176	$113,771	$0	$0	$6,826	$194,773	$62,912	$0	**$257,685**
			1.845	129.68	198.90			11.93	340.51	109.99		450.50
247 **Laser Cut holes for installation of electrical boxes**	**919.73**	EA		$0	$10,347	$0	$0	$621	$10,968	$3,543	$0	**$14,510**
					11.25			0.68	11.93	3.85		15.78
Subtotal				$74,176	$124,118	$0	$0	$7,447	$205,741	$66,454	$0	$272,195
Taxes				$0	$7,447	$0	$0					
Subcontractor Markups				$23,959	$42,495	$0	$0					
TOTAL C1010145C PILASTER	**1,055**			**$98,135**	**$174,060**	**$0**	**$0**	**$7,447**	**$205,741**	**$66,454**	**$0**	$272,195
572.00 EA			*Level Unit Cost-->*	*$171.56*	*$304.30*			*$13.02*	*$359.69*	*$116.18*		*$475.87*

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$11,055,884 CONCEPT 2												
$470,972 C INTERIORS												
$452,704 C10 INTERIOR CONSTRUCTION												
$3,592 C1020 INTERIOR DOORS												
C1020300 INTERIOR DOORS AND FRAMES												
248 **Doors, fire, flush, "B" label, 90 minutes, composite, 20 ga., 3'-0" x 7'-0"**	1	Ea.	1	$67	$1,025	$0	$0	$62	$1,154	$373	$0	**$1,526**
			1.23	67.29	1,025.00			61.50	1,153.79	372.68		1,526.46
249 **Frames, steel, knock down, hollow metal, single, 90 minutes, 14 ga., up to 3-7/8" deep, 3'-0" x 7'-0"**	1	Ea.	1	$67	$465	$0	$0	$28	$560	$181	$0	**$741**
			1.23	67.29	465.00			27.90	560.19	180.94		741.13
Subtotal				$135	$1,490	$0	$0	$89	$1,714	$554	$0	**$2,268**
Taxes				$0	$89	$0	$0					
Subcontractor Markups				$43	$510	$0	$0					
TOTAL C1020300 INTERIOR DOORS AND FRAMES	**2**			**$178**	**$2,090**	**$0**	**$0**	**$89**	**$1,714**	**$554**	**$0**	**$2,268**
1.00 EA												
Estimate Tree Structure Rollups												
$11,055,884 CONCEPT 2												
$470,972 C INTERIORS												
$452,704 C10 INTERIOR CONSTRUCTION												
$3,592 C1020 INTERIOR DOORS												
C1020400 DOOR HARDWARE												
250 **Door hardware, single, interior, regular use, incl. lever handle**	1	Door	3	$179	$775	$0	$0	$47	$1,001	$323	$0	**$1,324**
			3.28	179.47	775.00			46.50	1,000.97	323.31		1,324.28
Subtotal				$179	$775	$0	$0	$47	$1,001	$323	$0	**$1,324**
Taxes				$0	$47	$0	$0					
Subcontractor Markups				$58	$265	$0	$0					
TOTAL C1020400 DOOR HARDWARE	**3**			**$237**	**$1,087**	**$0**	**$0**	**$47**	**$1,001**	**$323**	**$0**	**$1,324**
1.00 EA												

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$11,055,884 CONCEPT 2											
$470,972 C INTERIORS											
$452,704 C10 INTERIOR CONSTRUCTION											
$169,186 C1030 SPECIALTIES											
C1030A IDENTIFYING DEVICES											
251 **Signs, flexible door sign, adhesive back, w/Braille, 5/8" letters, 8" x 4"**	**2** Ea.	1	$20	$126	$0	$0	$8	$153	$0	$0	**$153**
		0.308	9.76	63.00			3.78	76.54			76.54
Taxes			$0	$8	$0	$0					
TOTAL C1030A IDENTIFYING DEVICES	**1**		**$20**	**$134**	**$0**	**$0**	**$8**	**$153**	**$0**	**$0**	**$153**
2.00 EA	*Level Unit Cost-->*		*$9.76*	*$66.78*			*$3.78*	*$76.54*			*$76.54*
Estimate Tree Structure Rollups											
$11,055,884 CONCEPT 2											
$470,972 C INTERIORS											
$452,704 C10 INTERIOR CONSTRUCTION											
$169,186 C1030 SPECIALTIES											
C1030B RAILING											
252 **Railing, pipe, aluminum, 2 rails, 3'-6" high, posts @ 4' OC, 1-1/2" diameter, shop fabricated**	**54** L.F.	13	$940	$3,942	$59	$0	$240	$5,181	$1,674	$0	**$6,855**
		0.246	17.41	73.00	1.09		4.45	95.95	30.99		126.94
253 **Prime railingwith Rustoleum Primer**	**54** L.F.	1	$37	$3	$0	$0	$0	$40	$13	$0	**$52**
		0.015	0.68	0.05				0.73	0.24		0.97
254 **Paints & coatings, pipe railing, paint 2 coats, spray**	**54** S.F.	1	$40	$21	$0	$0	$1	$62	$20	$0	**$82**
		0.016	0.74	0.39			0.02	1.15	0.37		1.52
Subtotal			$1,017	$3,966	$59	$0	$241	$5,283	$1,706	$0	$6,989
Taxes			$0	$238	$4	$0					
Subcontractor Markups			$328	$1,358	$20	$0					
TOTAL C1030B RAILING	**15**		**$1,345**	**$5,562**	**$83**	**$0**	**$241**	**$5,283**	**$1,706**	**$0**	**$6,989**
54.00 LF	*Level Unit Cost-->*		*$24.91*	*$102.99*	*$1.53*		*$4.47*	*$97.83*	*$31.60*		*$129.43*

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$11,055,884 CONCEPT 2											
$470,972 C INTERIORS											
$452,704 C10 INTERIOR CONSTRUCTION											
$169,186 C1030 SPECIALTIES											
C1030C INTERIOR SOFFIT											
255 **Add soffit in the unit**	**2,286** L.F.	562	$30,766	$36,667	$0	$0	$2,200	$69,633	$22,491	$0	**$92,124**
		0.246	13.46	16.04			0.96	30.46	9.84		40.30
256 **Add soffit in the hallway**	**1,735** L.F.	427	$23,350	$27,829	$0	$0	$1,670	$52,849	$17,070	$0	**$69,919**
		0.246	13.46	16.04			0.96	30.46	9.84		40.30
Subtotal			$54,116	$64,497	$0	$0	$3,870	$122,482	$39,562	$0	**$162,044**
Taxes			$0	$3,870	$0	$0					
Subcontractor Markups			$17,479	$22,082	$0	$0					
TOTAL C1030C INTERIOR SOFFIT	**989**		**$71,595**	**$90,449**	**$0**	**$0**	**$3,870**	**$122,482**	**$39,562**	**$0**	**$162,044**
4,021.00 LF	*Level Unit Cost-->*		*$17.81*	*$22.49*			*$0.96*	*$30.46*	*$9.84*		*$40.30*
Estimate Tree Structure Rollups											
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)											
$11,055,884 CONCEPT 2											
$470,972 C INTERIORS											
$18,268 C30 INTERIOR FINISHES											
C3010 WALL FINISHES											
257 **Painting walls, complete, on drywall or plaster, primer and 2 finish coats, with roller, including surface preparation**	**4,493** S.F.	135	$6,204	$1,977	$0	$0	$119	$8,300	$2,681	$0	**$10,980**
		0.03	1.38	0.44			0.03	1.85	0.60		2.44
Subtotal			$6,204	$1,977	$0	$0	$119	$8,300	$2,681	$0	**$10,980**
Taxes			$0	$119	$0	$0					
Subcontractor Markups			$2,004	$677	$0	$0					
TOTAL C3010 WALL FINISHES	**135**		**$8,208**	**$2,772**	**$0**	**$0**	**$119**	**$8,300**	**$2,681**	**$0**	**$10,980**
4,493.00 SF	*Level Unit Cost-->*		*$1.83*	*$0.62*			*$0.03*	*$1.85*	*$0.60*		*$2.44*

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)											
$11,055,884 CONCEPT 2											
$470,972 C INTERIORS											
$18,268 C30 INTERIOR FINISHES											
C3030 CEILING FINISHES											
258 **Patch & Repair existing ceiling nearwall demo**	**30** S.F.	4	$202	$120	$0	$0	$7	$329	$106	$0	**$435**
		0.123	6.73	4.00			0.24	10.97	3.54		14.51
259 **Surface preparation, interior, ceiling, Patch & Prep for new finish**	**1,412** S.F.	52	$2,398	$635	$0	$0	$38	$3,072	$992	$0	**$4,064**
		0.037	1.70	0.45			0.03	2.17	0.70		2.88
260 **Paints & coatings, walls & ceilings, interior, concrete, drywall or plaster, zero voc latex, 3 coats, smooth finish, spray**	**1,412** S.F.	35	$1,599	$480	$0	$0	$29	$2,108	$681	$0	**$2,788**
		0.025	1.13	0.34			0.02	1.49	0.48		1.98
Subtotal			$4,199	$1,235	$0	$0	$74	$5,508	$1,779	$0	$7,288
Taxes			$0	$74	$0	$0					
Subcontractor Markups			$1,356	$423	$0	$0					
TOTAL C3030 CEILING FINISHES	**91**		**$5,555**	**$1,733**	**$0**	**$0**	**$74**	**$5,508**	**$1,779**	**$0**	**$7,288**
1,442.00 SF	*Level Unit Cost-->*		*$3.85*	*$1.20*			*$0.05*	*$3.82*	*$1.23*		*$5.05*
Estimate Tree Structure Rollups											
$11,055,884 CONCEPT 2											
$9,583,215 D SERVICES											
$500,656 D30 HVAC											
$312,736 D3040 DISTRIBUTION SYSTEMS											
D304007 EXHAUST SYSTEMS											
261 **Garage Exhaust Fans (Vaneaxial to 17,000 CFM 7.5 HP)**	**7** Ea.	52	$3,812	$129,500	$0	$0	$7,770	$141,082	$38,163	$0	**$179,244**
		7.38	544.50	18,500.00			1,110.00	20,154.50	5,451.79		25,606.30
262 **Stairwell and Elevator Pressurization (Centrifugal Backward Curved to 10 HP)**	**7** Ea.	69	$4,901	$94,500	$0	$0	$5,670	$105,071	$28,422	$0	**$133,492**
		9.84	700.08	13,500.00			810.00	15,010.08	4,060.22		19,070.30
Subtotal			$8,712	$224,000	$0	$0	$13,440	$246,152	$66,584	$0	$312,736
Taxes			$0	$13,440	$0	$0					
Subcontractor Markups			$2,357	$64,228	$0	$0					
TOTAL D304007 EXHAUST SYSTEMS	**121**		**$11,069**	**$301,668**	**$0**	**$0**	**$13,440**	**$246,152**	**$66,584**	**$0**	**$312,736**
1.00 EA											

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$11,055,884 CONCEPT 2											
$9,583,215 D SERVICES											
$500,656 D30 HVAC											
$160,993 D3060 CONTROLS & INSTRUMENTATION											
D306001 HVAC CONTROLS											
263 **Exhaust Fan Control**	**14** Ea.	172	$14,746	$23,800	$0	$0	$1,428	$39,974	$10,813	$0	**$50,787**
		12.3	1,053.31	1,700.00			102.00	2,855.31	772.36		3,627.67
264 **Tie-into Existing Operator Station**	**24** Hrs.	30	$2,528	$0	$0	$0	$0	$2,528	$684	$0	**$3,212**
		1.23	105.33					105.33	28.49		133.82
265 **System Check-out & Programming**	**120** Hrs.	148	$10,873	$0	$0	$0	$0	$10,873	$2,941	$0	**$13,814**
		1.23	90.61					90.61	24.51		115.12
266 **Electric metallic tubing (EMT), 3/4" diameter, to 15' high, incl 2 terminations, 2 field bend elbows, 11 beam clamps, and 11 couplings per 100 LF**	**50** C.L.	381	$32,615	$4,800	$0	$0	$288	$37,703	$10,199	$0	**$47,901**
		7.626	652.29	96.00			5.76	754.05	203.97		958.02
267 **Control Wiring**	**50** C.L.	93	$7,947	$1,250	$0	$0	$75	$9,272	$2,508	$0	**$11,780**
		1.856	158.94	25.00			1.50	185.44	50.16		235.61
268 **Interface wtih Fire Protection Alarm System**	**1** Ea.	246	$21,066	$5,000	$0	$0	$300	$26,366	$7,132	$0	**$33,498**
		246	21,066.21	5,000.00			300.00	26,366.21	7,132.06		33,498.27
Subtotal			$89,775	$34,850	$0	$0	$2,091	$126,716	$34,277	$0	**$160,993**
Taxes			$0	$2,091	$0	$0					
Subcontractor Markups			$24,284	$9,993	$0	$0					
TOTAL D306001 HVAC CONTROLS	**1,069**		**$114,060**	**$46,934**	**$0**	**$0**	**$2,091**	**$126,716**	**$34,277**	**$0**	**$160,993**
1.00 EA											
Estimate Tree Structure Rollups											
$11,055,884 CONCEPT 2											
$9,583,215 D SERVICES											
$500,656 D30 HVAC											
$26,926 D3070 SYSTEMS TESTING & BALANCING											
D307001 TESTING & BALANCING											
269 **System Testing & Balance**	**60** Hrs.	74	$3,757	$0	$0	$0	$0	$3,757	$1,016	$0	**$4,773**
		1.23	62.61					62.61	16.94		79.55

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$11,055,884 CONCEPT 2											
$9,583,215 D SERVICES											
$500,656 D30 HVAC											
$26,926 D3070 SYSTEMS TESTING & BALANCING											
D307001 TESTING & BALANCING											
270 **System Commissioning & Assist in T & B**	**120** Hrs.	148	$11,077	$6,000	$0	$0	$360	$17,437	$4,717	$0	**$22,154**
		1.23	92.31	50.00			3.00	145.31	39.31		184.61
Subtotal			$14,834	$6,000	$0	$0	$360	$21,194	$5,733	$0	**$26,926**
Taxes			$0	$360	$0	$0					
Subcontractor Markups			$4,012	$1,720	$0	$0					
TOTAL D307001 TESTING & BALANCING	**221**		**$18,846**	**$8,080**	**$0**	**$0**	**$360**	**$21,194**	**$5,733**	**$0**	**$26,926**
1.00 EA											
Estimate Tree Structure Rollups											
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)											
$11,055,884 CONCEPT 2											
$9,583,215 D SERVICES											
$6,940,740 D40 FIRE PROTECTION											
TENANT TOWER											
271 **Pipe, plastic, CPVC fire suppression, C-UL-S, FM, NFPA 13, 13R & 13D, SDR 13.5,1" diameter, socket joint, no couplings or hangers**	**30,040** L.F.	1,737	$110,676	$98,892	$0	$0	$5,934	$215,501	$58,293	$0	**$273,794**
		0.058	3.68	3.29			0.20	7.17	1.94		9.11
272 **Pipe, plastic, CPVC fire suppression, C-UL-S, FM, NFPA 13, 13R & 13D, SDR 13.5,1-1/4" diameter, socket joint, no couplings or hangers**	**6,880** L.F.	525	$33,438	$32,126	$0	$0	$1,928	$67,491	$18,256	$0	**$85,748**
		0.076	4.86	4.67			0.28	9.81	2.65		12.46
273 **Pipe, plastic, CPVC fire suppression, C-UL-S, FM, NFPA 13, 13R & 13D, SDR 13.5,1-1/2" diameter, socket joint, no couplings or hangers**	**3,940** L.F.	407	$25,944	$25,537	$0	$0	$1,532	$53,013	$14,340	$0	**$67,353**
		0.103	6.59	6.48			0.39	13.46	3.64		17.09
274 **Pipe, plastic, CPVC fire suppression, C-UL-S, FM, NFPA 13, 13R & 13D, SDR 13.5,2" diameter, socket joint, no couplings or hangers**	**7,060** L.F.	990	$63,091	$66,332	$0	$0	$3,980	$133,403	$36,085	$0	**$169,488**
		0.14	8.94	9.40			0.56	18.90	5.11		24.01
275 **Pipe, fittings & valves, steel, black, grooved joint, 2-1/2" diameter, schedule10, incl coupling & clevis type hanger 10' OC**	**18,640** L.F.	6,007	$449,762	$225,544	$0	$0	$13,533	$688,839	$186,331	$0	**$875,169**
		0.322	24.13	12.10			0.73	36.95	10.00		46.95
276 **Pipe, fittings & valves, steel, black, grooved joint, 6" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**14,660** L.F.	9,413	$730,860	$447,130	$0	$0	$26,828	$1,204,818	$325,903	$0	**$1,530,721**
		0.642	49.85	30.50			1.83	82.18	22.23		104.42

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)												
$11,055,884 CONCEPT 2												
$9,583,215 D SERVICES												
$6,940,740 D40 FIRE PROTECTION												
TENANT TOWER												
277 **Sprinkler Head, Sidewall, K4.4, Tyco 4334**	**5,977**	Ea.	3,676	$275,226	$145,719	$0	$0	$8,743	$429,688	$116,231	$0	**$545,919**
			0.615	46.05	24.38			1.46	71.89	19.45		91.34
278 **Sprinkler Head, Pendent Conceal include trim plate, K4.9, Tyco 3586**	**365**	Ea.		$0	$13,925	$0	$0	$835	$14,760	$3,993	$0	**$18,753**
					38.15			2.29	40.44	10.94		51.38
279 **Wet Pipe Alarm Valve Set 6"**	**6**	Ea.	59	$4,421	$18,600	$0	$0	$1,116	$24,137	$6,529	$0	**$30,665**
			9.84	736.76	3,100.00			186.00	4,022.76	1,088.16		5,110.92
280 **Floor Control Valve Set 2-1/2"**	**111**	Ea.	1,092	$81,780	$102,120	$0	$0	$6,127	$190,027	$51,402	$0	**$241,430**
			9.84	736.76	920.00			55.20	1,711.96	463.08		2,175.04
281 **Fire Hose Valve**	**111**	Ea.	1,092	$81,780	$55,500	$0	$0	$3,330	$140,610	$38,035	$0	**$178,645**
			9.84	736.76	500.00			30.00	1,266.76	342.66		1,609.42
282 **Fire Department Connection**	**6**	Ea.	15	$1,105	$9,000	$0	$0	$540	$10,645	$2,880	$0	**$13,525**
			2.46	184.19	1,500.00			90.00	1,774.19	479.92		2,254.11
283 **Seal / Fire Stop Wall Openings**	**4,699**	Ea.	1,445	$55,901	$3,524	$0	$0	$211	$59,637	$16,132	$0	**$75,769**
			0.307	11.90	0.75			0.04	12.69	3.43		16.12
Subtotal				$1,913,983	$1,243,949	$0	$0	$74,637	$3,232,569	$874,410	$0	**$4,106,979**
Taxes				$0	$74,637	$0	$0					
Subcontractor Markups				$517,732	$356,678	$0	$0					
TOTAL TENANT TOWER	**26,457**			**$2,431,715**	**$1,675,264**	**$0**	**$0**	**$74,637**	**$3,232,569**	**$874,410**	**$0**	**$4,106,979**
969,696.00 SF			*Level Unit Cost-->*	*$2.51*	*$1.73*			*$0.08*	*$3.33*	*$0.90*		*$4.24*

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)											
$11,055,884 CONCEPT 2											
$9,583,215 D SERVICES											
$6,940,740 D40 FIRE PROTECTION											
BOH, PUBLIC & ADMINISTRATION AREAS											
284 **Pipe, steel, black, threaded, 1" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**4,340** L.F.	806 0.186	$67,059 15.45	$42,098 9.70	$0	$0	$2,526 0.58	$111,683 25.73	$30,210 6.96	$0	**$141,894** 32.69
285 **Pipe, steel, black, threaded, 1-1/4" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**1,320** L.F.	292 0.221	$21,882 16.58	$16,896 12.80	$0	$0	$1,014 0.77	$39,792 30.15	$10,764 8.15	$0	**$50,555** 38.30
286 **Pipe, steel, black, threaded, 1-1/2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**880** L.F.	216 0.246	$16,209 18.42	$13,420 15.25	$0	$0	$805 0.92	$30,434 34.58	$8,232 9.36	$0	**$38,666** 43.94
287 **Pipe, steel, black, threaded, 2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**540** L.F.	166 0.308	$12,433 23.02	$11,070 20.50	$0	$0	$664 1.23	$24,167 44.75	$6,537 12.11	$0	**$30,704** 56.86
288 **Pipe, fittings & valves, steel, black, grooved joint, 3" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**440** L.F.	157 0.358	$11,792 26.80	$6,138 13.95	$0	$0	$368 0.84	$18,298 41.59	$4,950 11.25	$0	**$23,248** 52.84
289 **Pipe, fittings & valves, steel, black, grooved joint, 5" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**1,040** L.F.	512 0.492	$38,311 36.84	$24,960 24.00	$0	$0	$1,498 1.44	$64,769 62.28	$17,520 16.85	$0	**$82,289** 79.12
290 **Floor Control Valve Assembly 4**	**6** Ea.	22 3.69	$1,658 276.29	$6,654 1,109.00	$0	$0	$399 66.54	$8,711 1,451.83	$2,356 392.72	$0	**$11,067** 1,844.54
291 **Floor Control Valve Assembly 6**	**1** Ea.	4 3.69	$276 276.28	$1,379 1,379.00	$0	$0	$83 82.74	$1,738 1,738.02	$470 470.14	$0	**$2,208** 2,208.16
292 **Sprinkler Head, Pendent Conceal include trim plate, K4.9, Tyco 3586**	**470** Ea.		$0	$17,931 38.15	$0	$0	$1,076 2.29	$19,006 40.44	$5,141 10.94	$0	**$24,148** 51.38
293 **Fire Hose Valve**	**28** Ea.	276 9.84	$20,629 736.76	$14,000 500.00	$0	$0	$840 30.00	$35,469 1,266.76	$9,594 342.66	$0	**$45,064** 1,609.42

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)												
$11,055,884 CONCEPT 2												
$9,583,215 D SERVICES												
$6,940,740 D40 FIRE PROTECTION												
BOH, PUBLIC & ADMINISTRATION AREAS												
294 **Seal / Fire Stop Wall Openings**	**200**	Ea.	62	$2,379	$150	$0	$0	$9	$2,538	$687	$0	**$3,225**
			0.308	11.90	0.75			0.04	12.69	3.43		16.12
Subtotal				$192,628	$154,696	$0	$0	$9,282	$356,606	$96,462	$0	$453,068
Taxes				$0	$9,282	$0	$0					
Subcontractor Markups				$52,106	$44,356	$0	$0					
TOTAL BOH, PUBLIC & ADMINISTRATION AREAS	**2,513**			**$244,734**	**$208,333**	**$0**	**$0**	**$9,282**	**$356,606**	**$96,462**	**$0**	**$453,068**
65,117.00 SF		*Level Unit Cost–>*		*$3.76*	*$3.20*			*$0.14*	*$5.48*	*$1.48*		*$6.96*
Estimate Tree Structure Rollups												
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)												
$11,055,884 CONCEPT 2												
$9,583,215 D SERVICES												
$6,940,740 D40 FIRE PROTECTION												
GARAGE												
295 **Pipe, steel, black, threaded, 1" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**19,720**	L.F.	3,663	$304,703	$191,284	$0	$0	$11,477	$507,464	$137,269	$0	**$644,733**
			0.186	15.45	9.70			0.58	25.73	6.96		32.69
296 **Pipe, steel, black, threaded, 1-1/4" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**120**	L.F.	27	$1,989	$1,536	$0	$0	$92	$3,617	$979	$0	**$4,596**
			0.221	16.58	12.80			0.77	30.15	8.15		38.30
297 **Pipe, steel, black, threaded, 1-1/2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**160**	L.F.	39	$2,947	$2,440	$0	$0	$146	$5,533	$1,497	$0	**$7,030**
			0.246	18.42	15.25			0.92	34.58	9.36		43.94
298 **Pipe, steel, black, threaded, 2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**220**	L.F.	68	$5,065	$4,510	$0	$0	$271	$9,846	$2,663	$0	**$12,509**
			0.308	23.02	20.50			1.23	44.75	12.11		56.86
299 **Pipe, fittings & valves, steel, black, grooved joint, 2-1/2" diameter, schedule10, incl coupling & clevis type hanger 10' OC**	**6,340**	L.F.	2,043	$152,977	$76,714	$0	$0	$4,603	$234,294	$63,376	$0	**$297,670**
			0.322	24.13	12.10			0.73	36.95	10.00		46.95
300 **Pipe, fittings & valves, steel, black, grooved joint, 4" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**5,500**	L.F.	2,212	$165,633	$104,775	$0	$0	$6,287	$276,694	$74,846	$0	**$351,540**
			0.402	30.11	19.05			1.14	50.31	13.61		63.92

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)											
$11,055,884 CONCEPT 2											
$9,583,215 D SERVICES											
$6,940,740 D40 FIRE PROTECTION											
GARAGE											
301 **Pipe, fittings & valves, steel, black, grooved joint, 5" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**1,620** L.F.	797	$59,677	$38,880	$0	$0	$2,333	$100,890	$27,291	$0	**$128,181**
		0.492	36.84	24.00			1.44	62.28	16.85		79.12
302 **Pipe, fittings & valves, steel, black, grooved joint, 6" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**3,000** L.F.	1,926	$149,562	$91,500	$0	$0	$5,490	$246,552	$66,692	$0	**$313,244**
		0.642	49.85	30.50			1.83	82.18	22.23		104.42
303 **Dry Sprinkler Head - Pendant**	**1,498** Ea.	921	$68,979	$104,860	$0	$0	$6,292	$180,131	$48,725	$0	**$228,856**
		0.615	46.05	70.00			4.20	120.25	32.53		152.77
304 **Dry System Valve Set and Controller 4"**	**2** Ea.	39	$2,947	$24,000	$0	$0	$1,440	$28,387	$7,679	$0	**$36,066**
		19.68	1,473.52	12,000.00			720.00	14,193.52	3,839.35		18,032.87
305 **Dry System Valve Set and Controller 6"**	**5** Ea.	98	$7,368	$70,000	$0	$0	$4,200	$81,568	$22,064	$0	**$103,632**
		19.68	1,473.52	14,000.00			840.00	16,313.52	4,412.81		20,726.33
Subtotal			$921,847	$710,499	$0	$0	$42,630	$1,674,976	$453,081	$0	**$2,128,057**
Taxes			$0	$42,630	$0	$0					
Subcontractor Markups			$249,360	$203,721	$0	$0					
TOTAL GARAGE	**11,834**		**$1,171,207**	**$956,850**	**$0**	**$0**	**$42,630**	**$1,674,976**	**$453,081**	**$0**	**$2,128,057**
318,322.00 SF	*Level Unit Cost-->*		*$3.68*	*$3.01*			*$0.13*	*$5.26*	*$1.42*		*$6.69*
Estimate Tree Structure Rollups											
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)											
$11,055,884 CONCEPT 2											
$9,583,215 D SERVICES											
$6,940,740 D40 FIRE PROTECTION											
MECHANICAL ROOM SPACES											
306 **Pipe, steel, black, threaded, 1" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**800** L.F.	149	$12,361	$7,760	$0	$0	$466	$20,587	$5,569	$0	**$26,156**
		0.186	15.45	9.70			0.58	25.73	6.96		32.69
307 **Pipe, steel, black, threaded, 1-1/4" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**160** L.F.	35	$2,652	$2,048	$0	$0	$123	$4,823	$1,305	$0	**$6,128**
		0.221	16.58	12.80			0.77	30.15	8.15		38.30

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)											
$11,055,884 CONCEPT 2											
$9,583,215 D SERVICES											
$6,940,740 D40 FIRE PROTECTION											
MECHANICAL ROOM SPACES											
308 **Pipe, steel, black, threaded, 1-1/2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**100** L.F.	25 0.246	$1,842 18.42	$1,525 15.25	$0	$0	$92 0.92	$3,458 34.58	$935 9.36	$0	**$4,394** 43.94
309 **Pipe, steel, black, threaded, 2" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC**	**120** L.F.	37 0.308	$2,763 23.02	$2,460 20.50	$0	$0	$148 1.23	$5,370 44.75	$1,453 12.11	$0	**$6,823** 56.86
310 **Pipe, fittings & valves, steel, black, grooved joint, 2-1/2" diameter, schedule10, incl coupling & clevis type hanger 10' OC**	**140** L.F.	45 0.322	$3,378 24.13	$1,694 12.10	$0	$0	$102 0.73	$5,174 36.95	$1,399 10.00	$0	**$6,573** 46.95
311 **Pipe, fittings & valves, steel, black, grooved joint, 3" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**140** L.F.	50 0.358	$3,752 26.80	$1,953 13.95	$0	$0	$117 0.84	$5,822 41.59	$1,575 11.25	$0	**$7,397** 52.84
312 **Pipe, fittings & valves, steel, black, grooved joint, 4" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**200** L.F.	80 0.402	$6,023 30.11	$3,810 19.05	$0	$0	$229 1.14	$10,062 50.31	$2,722 13.61	$0	**$12,783** 63.92
313 **Pipe, fittings & valves, steel, black, grooved joint, 6" diameter, schedule 10,incl coupling & clevis type hanger 10' OC**	**60** L.F.	39 0.642	$2,991 49.85	$1,830 30.50	$0	$0	$110 1.83	$4,931 82.18	$1,334 22.23	$0	**$6,265** 104.42
314 **Floor Control Valve Assembly 6**	**1** Ea.	4 3.69	$276 276.28	$1,379 1,379.00	$0	$0	$83 82.74	$1,738 1,738.02	$470 470.14	$0	**$2,208** 2,208.16
315 **Sprinkler Head - standard coverage quick response, upright K=8.0 (Tyco 4131)**	**110** Ea.	162 1.476	$12,157 110.51	$2,640 24.00	$0	$0	$158 1.44	$14,955 135.95	$3,141 28.55	$0	**$18,095** 164.50
Subtotal			$48,195	$27,099	$0	$0	$1,626	$76,920	$19,902	$0	**$96,822**
Taxes			$0	$1,626	$0	$0					
Subcontractor Markups			$12,301	$7,601	$0	$0					
TOTAL MECHANICAL ROOM SPACES	**626**		**$60,497**	**$36,326**	**$0**	**$0**	**$1,626**	**$76,920**	**$19,902**	**$0**	**$96,822**
15,138.00 SF	*Level Unit Cost-->*		*$4.00*	*$2.40*			*$0.11*	*$5.08*	*$1.31*		*$6.40*

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)												
$11,055,884 CONCEPT 2												
$9,583,215 D SERVICES												
$6,940,740 D40 FIRE PROTECTION												
FIRE PUMPS & PUMP ROOM PIPING												
316 **Fire pumps, electric, 750 GPM, 150 psi, 75 HP, 3550 RPM, 5" pump, including controller, fittings and relief valve**	**1**	Ea.	79	$5,305	$28,500	$0	$0	$1,710	$35,515	$9,607	$0	**$45,122**
			78.72	5,305.45	28,500.00			1,710.00	35,515.45	9,606.93		45,122.38
317 **Jockey Pump**	**1**	Ea.	30	$1,990	$2,500	$0	$0	$150	$4,640	$1,255	$0	**$5,895**
			29.52	1,989.55	2,500.00			150.00	4,639.55	1,255.00		5,894.55
318 **Fire Pump Room Piping**	**1**	L.S.	369	$28,652	$40,000	$1,195	$0	$2,472	$72,319	$19,562	$0	**$91,881**
			369	28,651.74	40,000.00	1,195.41		2,471.72	72,318.87	19,562.25		91,881.13
319 **Backflow preventer, RPZ, 8" pipe size**	**1**	Ea.	15	$1,146	$8,509	$0	$0	$511	$10,166	$2,750	$0	**$12,915**
			14.76	1,146.07	8,509.00			510.54	10,165.61	2,749.80		12,915.41
Subtotal				$37,093	$79,509	$1,195	$0	$4,842	$122,639	$33,174	$0	$155,813
Taxes				$0	$4,771	$72	$0					
Subcontractor Markups				$10,034	$22,798	$343	$0					
TOTAL FIRE PUMPS & PUMP ROOM PIPING	**492**			**$47,126**	**$107,077**	**$1,610**	**$0**	**$4,842**	**$122,639**	**$33,174**	**$0**	**$155,813**
1.00 EA												
Estimate Tree Structure Rollups												
$11,055,884 CONCEPT 2												
$9,583,215 D SERVICES												
$2,141,819 D50 ELECTRICAL												
$126,212 D5010 ELECTRICAL SERVICE & DISTRIBUTION												
D501099 OTHER SERVICE AND DISTRIBUTION												
320 **Generator set, diesel, 3 phase 4 wire, 277/480 V, 350 kW, incl battery, charger, muffler, & day tank, excl conduit, wiring, & concrete**	**1**	Ea.	123	$9,930	$79,000	$796	$0	$4,788	$94,514	$22,192	$0	**$116,706**
			123	9,929.78	79,000.00	796.42		4,787.78	94,513.99	22,191.89		116,705.87

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$11,055,884 CONCEPT 2											
$9,583,215 D SERVICES											
$2,141,819 D50 ELECTRICAL											
$126,212 D5010 ELECTRICAL SERVICE & DISTRIBUTION											
D501099 OTHER SERVICE AND DISTRIBUTION											
321 **Automatic transfer switches, enclosed, 3 pole, 480 volt, 600 amp**	**1** Ea.	20	$1,683	$5,675	$0	$0	$341	$7,699	$1,808	$0	**$9,507**
		19.68	1,683.33	5,675.00			340.50	7,698.83	1,807.68		9,506.51
Subtotal			$11,613	$84,675	$796	$0	$5,128	$102,213	$24,000	$0	**$126,212**
Taxes			$0	$5,081	$48	$0					
Subcontractor Markups			$2,727	$21,075	$198	$0					
TOTAL D501099 OTHER SERVICE AND DISTRIBUTION	**143**		**$14,340**	**$110,830**	**$1,042**	**$0**	**$5,128**	**$102,213**	**$24,000**	**$0**	**$126,212**
350.00 kW	*Level Unit Cost-->*		*$40.97*	*$316.66*	*$2.98*		*$14.65*	*$292.04*	*$68.57*		*$360.61*
Estimate Tree Structure Rollups											
$11,055,884 CONCEPT 2											
$9,583,215 D SERVICES											
$2,141,819 D50 ELECTRICAL											
$60,165 D5020 LIGHTING & BRANCH WIRING											
D502099 OTHER LIGHTING AND BRANCH WIRING											
322 **Motor connections 'Fire Pump', flexible conduit and fittings, 3 phase, 460 volt, 150 HP motor**	**1** Ea.	5	$468	$78	$0	$0	$5	$550	$129	$0	**$679**
		5.466	467.54	77.50			4.65	549.69	129.07		678.76
323 **Rigid galvanized steel conduit, 2-1/2" diameter, to 10' H, incl 2 terminations,2 elbows, 11 beam clamps, and 11 couplings per 100 LF**	**600** L.F.	169	$14,456	$18,300	$0	$0	$1,098	$33,854	$7,949	$0	**$41,802**
		0.282	24.09	30.50			1.83	56.42	13.25		69.67
324 **Rigid galvanized steel conduit elbows, 2-1/2" diameter, to 10' high**	**6** Ea.	7	$631	$387	$0	$0	$23	$1,041	$245	$0	**$1,286**
		1.23	105.21	64.50			3.87	173.58	40.76		214.34
325 **Conduit fittings for rigid galvanized steel, standard, locknuts, 2-1/2" diameter**	**8** Ea.		$0	$56	$0	$0	$3	$59	$14	$0	**$73**
				6.95			0.42	7.37	1.73		9.10
326 **Conduit fittings for rigid galvanized steel, bushings, plastic, 2-1/2" diameter**	**4** Ea.	3	$259	$10	$0	$0	$1	$269	$63	$0	**$332**
		0.757	64.70	2.39			0.14	67.24	15.79		83.02
327 **Wire, aluminum, stranded, 600 volt, 250 kcmil, type THHN, normal installation conditions in wireway, conduit, cable tray**	**19.80** C.L.	67	$5,747	$4,792	$0	$0	$287	$10,826	$2,542	$0	**$13,368**
		3.394	290.27	242.00			14.52	546.79	128.39		675.17

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$11,055,884 CONCEPT 2												
$9,583,215 D SERVICES												
$2,141,819 D50 ELECTRICAL												
$60,165 D5020 LIGHTING & BRANCH WIRING												
D502099 OTHER LIGHTING AND BRANCH WIRING												
328 **Insulated ground wire, copper, stranded, #4**	**6.60**	C.L.	12	$1,048	$1,016	$0	$0	$61	$2,125	$499	$0	**$2,624**
			1.856	158.76	154.00			9.24	322.00	75.61		397.61
Subtotal				$22,608	$24,638	$0	$0	$1,478	$48,724	$11,440	$0	**$60,165**
Taxes				$0	$1,478	$0	$0					
Subcontractor Markups				$5,308	$6,132	$0	$0					
TOTAL D502099 OTHER LIGHTING AND BRANCH WIRING	**264**			**$27,917**	**$32,248**	**$0**	**$0**	**$1,478**	**$48,724**	**$11,440**	**$0**	**$60,165**
1.00 EA												
Estimate Tree Structure Rollups												
$9,583,215 D SERVICES												
$2,141,819 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
TENANT TOWER												
329 **Detection system, break glass station, addressable, excluding wires & conduits**	**145**	Ea.	197	$16,826	$24,070	$0	$0	$1,444	$42,341	$9,942	$0	**$52,282**
			1.357	116.04	166.00			9.96	292.00	68.56		360.57
330 **Detection system, strobe & horn, ADA type, excluding wires & conduits**	**308**	Ea.	572	$48,898	$40,656	$0	$0	$2,439	$91,993	$21,600	$0	**$113,593**
			1.856	158.76	132.00			7.92	298.68	70.13		368.81
331 **Detection system, visual alarm, ADA type, excluding wires & conduits**	**61**	Ea.	90	$7,663	$7,076	$0	$0	$425	$15,163	$3,560	$0	**$18,724**
			1.469	125.62	116.00			6.96	248.58	58.37		306.94
332 **Detection system, smoke detector, addressable type, excl. wires & conduit**	**526**	Ea.	862	$73,767	$126,766	$0	$0	$7,606	$208,139	$48,871	$0	**$257,011**
			1.64	140.24	241.00			14.46	395.70	92.91		488.61
333 **'MM' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**4**	Ea.	5	$464	$234	$0	$0	$14	$713	$167	$0	**$880**
			1.357	116.05	58.60			3.52	178.16	41.83		219.99

Memo: https://thefirealarmsupplier.us/products/fmm-1-

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$9,583,215 D SERVICES												
$2,141,819 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
TENANT TOWER												
334 **'REL/CR' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**2**	Ea.	3 1.357	$232 116.05	$292 145.83	$0	$0	$18 8.75	$541 270.63	$127 63.54	$0	**$668** 334.17
Memo: https://thefirealarmsupplier.us/products/mix-m500rap-												
335 **Door closer, electric automatic operators, surface mounted, universal heavy duty, regular arm**	**2**	Ea.	3 1.64	$179 89.70	$700 350.00	$0	$0	$42 21.00	$921 460.70	$216 108.17	$0	**$1,138** 568.87
336 **Detection system, strobe, weatherproof, excluding wires & conduits**	**1**	Ea.	1 1.469	$126 125.62	$149 148.74	$0	$0	$9 8.92	$283 283.28	$67 66.52	$0	**$350** 349.80
Memo: https://thefirealarmsupplier.us/products/simplex-49av-												
337 **Smoke alarm photoelectric - battery powered**	**1,087**	Ea.	445 0.41	$38,082 35.03	$52,176 48.00	$0	$0	$3,131 2.88	$93,389 85.91	$21,928 20.17	$0	**$115,317** 106.09
338 **Smoke alarm photoelectric -120V wired**	**785**	Ea.	643 0.819	$55,004 70.07	$50,570 64.42	$0	$0	$3,034 3.87	$108,608 138.35	$25,501 32.48	$0	**$134,109** 170.84
Memo: https://www.gsaadvantage.gov/advantage/ws/catalog/prod												
339 **Speaker - battery powered**	**1,442**	Ea.	591 0.41	$50,519 35.03	$69,216 48.00	$0	$0	$4,153 2.88	$123,888 85.91	$29,089 20.17	$0	**$152,977** 106.09
340 **Outlet boxes, pressed steel, 4" octagon**	**470**	Ea.	231 0.492	$19,779 42.08	$620 1.32	$0	$0	$37 0.08	$20,437 43.48	$4,799 10.21	$0	**$25,235** 53.69
341 **Outlet boxes, pressed steel, 4" square**	**521**	Ea.	256 0.492	$21,925 42.08	$1,073 2.06	$0	$0	$64 0.12	$23,063 44.27	$5,415 10.39	$0	**$28,478** 54.66
342 **Outlet boxes, pressed steel, plaster rings, 4" square, concealed**	**497**	Ea.	76 0.154	$6,536 13.15	$850 1.71	$0	$0	$51 0.10	$7,437 14.96	$1,746 3.51	$0	**$9,183** 18.48
343 **Outlet boxes, pressed steel, covers, blank, 4" square**	**6**	Ea.	1 0.154	$79 13.15	$9 1.42	$0	$0	$1 0.09	$88 14.66	$21 3.44	$0	**$109** 18.10

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$9,583,215 D SERVICES												
$2,141,819 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
TENANT TOWER												
344 **Fire alarm cable,#18, 1 pair**	**204.93**	C.L.	252	$21,560	$6,966	$0	$0	$418	$28,944	$6,796	$0	**$35,740**
			1.23	105.21	33.99			2.04	141.24	33.16		174.40
Memo: https://www.showmecables.com/1-pair-18-awg-solid-												
345 **Fire alarm cable,#14, 1 pair**	**223.74**	C.L.	339	$28,977	$10,874	$0	$0	$652	$40,503	$9,510	$0	**$50,013**
			1.514	129.51	48.60			2.92	181.03	42.51		223.53
Memo: https://www.showmecables.com/fire-alarm-cable-2-												
346 **Testing & Commisioning**	**1,049**		774	$66,218	$0	$0	$0	$0	$66,218	$15,548	$0	**$81,766**
			0.738	63.13					63.13	14.82		77.95
Subtotal				$456,836	$392,296	$0	$0	$23,538	$872,669	$204,903	$0	**$1,077,572**
Taxes				$0	$23,538	$0	$0					
Subcontractor Markups				$107,265	$97,638	$0	$0					
TOTAL TENANT TOWER	**5,342**			**$564,101**	**$513,471**	**$0**	**$0**	**$23,538**	**$872,669**	**$204,903**	**$0**	**$1,077,572**
969,696.00 SF			*Level Unit Cost–>*	*$0.58*	*$0.53*			*$0.02*	*$0.90*	*$0.21*		*$1.11*
Estimate Tree Structure Rollups												
$9,583,215 D SERVICES												
$2,141,819 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
BOH, PUBLIC & ADMINISTRATION AREAS												
347 **Detection system, break glass station, addressable, excluding wires & conduits**	**21**	Ea.	28	$2,437	$3,486	$0	$0	$209	$6,132	$1,440	$0	**$7,572**
			1.357	116.04	166.00			9.96	292.00	68.56		360.57
348 **Detection system, strobe & horn, ADA type, excluding wires & conduits**	**72**	Ea.	134	$11,431	$9,504	$0	$0	$570	$21,505	$5,049	$0	**$26,554**
			1.856	158.76	132.00			7.92	298.68	70.13		368.81
349 **Detection system, visual alarm, ADA type, excluding wires & conduits**	**52**	Ea.	76	$6,532	$6,032	$0	$0	$362	$12,926	$3,035	$0	**$15,961**
			1.469	125.62	116.00			6.96	248.58	58.37		306.94

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$9,583,215 D SERVICES												
$2,141,819 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
BOH, PUBLIC & ADMINISTRATION AREAS												
350 **Detection system, smoke detector, addressable type, excl. wires & conduit**	**29**	Ea.	48 1.64	$4,067 140.24	$6,989 241.00	$0	$0	$419 14.46	$11,475 395.70	$2,694 92.91	$0	**$14,170** 488.61
351 **'MM' Detection system, fire alarm control panel,relay module, excluding wires & conduits** Memo: https://thefirealarmsupplier.us/products/fmm-1-	**1**	Ea.	1 1.357	$116 116.04	$59 58.60	$0	$0	$4 3.52	$178 178.16	$42 41.83	$0	**$220** 219.99
352 **'REL/CR' Detection system, fire alarm control panel,relay module, excluding wires & conduits** Memo: https://thefirealarmsupplier.us/products/mix-m500rap-	**9**	Ea.	12 1.357	$1,044 116.04	$1,312 145.83	$0	$0	$79 8.75	$2,436 270.62	$572 63.54	$0	**$3,008** 334.17
353 **Detection system, strobe, weatherproof, excluding wires & conduits** Memo: https://thefirealarmsupplier.us/products/simplex-49av-	**1**	Ea.	1 1.469	$126 125.62	$149 148.74	$0	$0	$9 8.92	$283 283.28	$67 66.52	$0	**$350** 349.80
354 **Notification Appliance Power Extender Panel** Memo: https://thefirealarmsupplier.us/products/hpff8-	**1**	Ea.	7 7.289	$623 623.46	$963 963.28	$0	$0	$58 57.80	$1,645 1,644.54	$386 386.14	$0	**$2,031** 2,030.68
355 **Detection system, smoke detector, duct type, addressable, excl. wires & conduit**	**16**	Ea.	49 3.075	$4,208 263.02	$3,232 202.00	$0	$0	$194 12.12	$7,634 477.14	$1,793 112.03	$0	**$9,427** 589.17
356 **LCD Textual Sign** Memo: https://www.gsaadvantage.gov/advantage/ws/catalog/prod	**4**	Ea.	7 1.856	$635 158.76	$1,391 347.74	$0	$0	$83 20.86	$2,109 527.37	$495 123.83	$0	**$2,605** 651.19
357 **Outlet boxes, pressed steel, 4" octagon**	**10**	Ea.	5 0.492	$421 42.08	$13 1.32	$0	$0	$1 0.08	$435 43.48	$102 10.21	$0	**$537** 53.69
358 **Outlet boxes, pressed steel, 4" square**	**180**	Ea.	89 0.492	$7,575 42.08	$371 2.06	$0	$0	$22 0.12	$7,968 44.27	$1,871 10.39	$0	**$9,839** 54.66

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$9,583,215 D SERVICES												
$2,141,819 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
BOH, PUBLIC & ADMINISTRATION AREAS												
359 **Outlet boxes, pressed steel, plaster rings, 4" square, concealed**	**21**	Ea.	3	$276	$36	$0	$0	$2	$314	$74	$0	**$388**
			0.154	13.15	1.71			0.10	14.96	3.51		18.48
360 **Outlet boxes, pressed steel, covers, blank, 4" square**	**18**	Ea.	3	$237	$26	$0	$0	$2	$264	$62	$0	**$326**
			0.154	13.15	1.42			0.09	14.66	3.44		18.10
361 **Electric metallic tubing (EMT), 3/4" diameter, to 10' high, incl 2 terminations, 2 field bend elbows, 11 beam clamps, and 11 couplings per 100 LF**	**5,580**	L.F.	426	$36,398	$10,825	$0	$0	$650	$47,872	$11,240	$0	**$59,113**
			0.076	6.52	1.94			0.12	8.58	2.01		10.59
362 **EMT boxes connectors, compression, steel, 3/4" diameter, to 15' H**	**380**	Ea.	34	$2,918	$186	$0	$0	$11	$3,116	$732	$0	**$3,847**
			0.09	7.68	0.49			0.03	8.20	1.93		10.13
363 **Fire alarm cable,#18, 1 pair**	**21.45**	C.L.	26	$2,257	$729	$0	$0	$44	$3,030	$711	$0	**$3,741**
			1.23	105.21	33.99			2.04	141.24	33.16		174.40
Memo: https://www.showmecables.com/1-pair-18-awg-solid-												
364 **Fire alarm cable,#14, 1 pair**	**65.34**	C.L.	99	$8,462	$3,175	$0	$0	$191	$11,828	$2,777	$0	**$14,606**
			1.514	129.51	48.60			2.92	181.03	42.51		223.53
Memo: https://www.showmecables.com/fire-alarm-cable-2-												
365 **Testing & Commisioning**	**206**		152	$13,004	$0	$0	$0	$0	$13,004	$3,053	$0	**$16,057**
			0.738	63.13					63.13	14.82		77.95
Subtotal				$102,767	$48,478	$0	$0	$2,909	$154,154	$36,195	$0	**$190,350**
Taxes				$0	$2,909	$0	$0					
Subcontractor Markups				$24,130	$12,066	$0	$0					
TOTAL BOH, PUBLIC & ADMINISTRATION AREAS	**1,201**			**$126,897**	**$63,453**	**$0**	**$0**	**$2,909**	**$154,154**	**$36,195**	**$0**	**$190,350**
65,117.00 SF	*Level Unit Cost-->*			*$1.95*	*$0.97*			*$0.04*	*$2.37*	*$0.56*		*$2.92*

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$9,583,215 D SERVICES												
$2,141,819 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
GARAGE												
366 **Detection system, break glass station, addressable, excluding wires & conduits**	**8**	Ea.	11	$928	$1,328	$0	$0	$80	$2,336	$549	$0	**$2,885**
			1.357	116.05	166.00			9.96	292.01	68.56		360.57
367 **Detection system, strobe & horn, ADA type, excluding wires & conduits**	**10**	Ea.	19	$1,588	$1,320	$0	$0	$79	$2,987	$701	$0	**$3,688**
			1.856	158.76	132.00			7.92	298.68	70.13		368.81
368 **Detection system, visual alarm, ADA type, excluding wires & conduits**	**7**	Ea.	10	$879	$812	$0	$0	$49	$1,740	$409	$0	**$2,149**
			1.469	125.62	116.00			6.96	248.58	58.37		306.94
369 **Detection system, smoke detector, addressable type, excl. wires & conduit**	**2**	Ea.	3	$280	$482	$0	$0	$29	$791	$186	$0	**$977**
			1.64	140.24	241.00			14.46	395.70	92.91		488.61
370 **'MM' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**6**	Ea.	8	$696	$352	$0	$0	$21	$1,069	$251	$0	**$1,320**
			1.357	116.05	58.60			3.52	178.16	41.83		219.99
Memo: https://thefirealarmsupplier.us/products/fmm-1-												
371 **'REL/CR' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**2**	Ea.	3	$232	$292	$0	$0	$18	$541	$127	$0	**$668**
			1.357	116.05	145.83			8.75	270.63	63.54		334.17
Memo: https://thefirealarmsupplier.us/products/mix-m500rap-												
372 **Notification Appliance Power Extender Panel**	**2**	Ea.	15	$1,247	$1,927	$0	$0	$116	$3,289	$772	$0	**$4,061**
			7.289	623.47	963.28			57.80	1,644.54	386.14		2,030.68
Memo: https://thefirealarmsupplier.us/products/hpff8-												
373 **Detection system, fire alarm signal bell 10" red 20-24 V P**	**6**	Ea.	7	$631	$1,230	$0	$0	$74	$1,935	$454	$0	**$2,389**
			1.23	105.21	205.00			12.30	322.51	75.72		398.23
374 **Detection system, strobe, weatherproof, excluding wires & conduits**	**50**	Ea.	73	$6,281	$7,437	$0	$0	$446	$14,164	$3,326	$0	**$17,490**
			1.469	125.62	148.74			8.92	283.28	66.52		349.80
Memo: https://thefirealarmsupplier.us/products/simplex-49av-												

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$9,583,215 D SERVICES												
$2,141,819 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
GARAGE												
375 **Detection system, strobe & horn, weather proof, ADA type, excluding wires & conduits**	**115**	Ea.	213	$18,257	$44,400	$0	$0	$2,664	$65,322	$15,338	$0	**$80,659**
			1.856	158.76	386.09			23.16	568.01	133.37		701.38
Memo: https://www.gordonelectricsupply.com/p/Edwards-												
376 **Detection system, Manual pull station, weather proof, excluding wires & conduits**	**27**	Ea.	37	$3,133	$3,901	$0	$0	$234	$7,269	$1,707	$0	**$8,975**
			1.357	116.04	144.49			8.67	269.20	63.21		332.41
Memo: https://www.gordonelectricsupply.com/p/Edwards-Mpsr1-												
377 **Outlet boxes, pressed steel, 4" octagon**	**1**	Ea.		$42	$1	$0	$0	$0	$43	$10	$0	**$54**
			0.492	42.08	1.32			0.08	43.48	10.21		53.69
378 **Outlet boxes, pressed steel, 4" square**	**225**	Ea.	111	$9,469	$464	$0	$0	$28	$9,960	$2,339	$0	**$12,299**
			0.492	42.08	2.06			0.12	44.27	10.39		54.66
379 **Outlet boxes, pressed steel, plaster rings, 4" square, concealed**	**47**	Ea.	7	$618	$80	$0	$0	$5	$703	$165	$0	**$868**
			0.154	13.15	1.71			0.10	14.96	3.51		18.48
380 **Outlet boxes, pressed steel, covers, blank, 4" square**	**8**	Ea.	1	$105	$11	$0	$0	$1	$117	$28	$0	**$145**
			0.154	13.15	1.42			0.09	14.66	3.44		18.10
381 **Rigid galvanized steel conduit, 3/4" diameter, to 10' H, incl 2 terminations, 2elbows, 11 beam clamps, and 11 couplings per 100 LF**	**13,920**	L.F.	1,712	$146,450	$67,373	$0	$0	$4,042	$217,865	$51,155	$0	**$269,019**
			0.123	10.52	4.84			0.29	15.65	3.67		19.33
382 **Conduit fittings for rigid galvanized steel, standard, locknuts, 3/4" diameter**	**936**	Ea.		$0	$534	$0	$0	$32	$566	$133	$0	**$698**
					0.57			0.03	0.60	0.14		0.75
383 **Conduit fittings for rigid galvanized steel, bushings, plastic, 3/4" diameter**	**468**	Ea.	144	$12,309	$112	$0	$0	$7	$12,428	$2,918	$0	**$15,347**
			0.308	26.30	0.24			0.01	26.56	6.24		32.79
384 **Fire alarm cable,#18, 1 pair**	**28.38**	C.L.	35	$2,986	$965	$0	$0	$58	$4,008	$941	$0	**$4,949**
			1.23	105.21	33.99			2.04	141.24	33.16		174.40
Memo: https://www.showmecables.com/1-pair-18-awg-solid-												

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$9,583,215 D SERVICES												
$2,141,819 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
GARAGE												
385 **Fire alarm cable,#14, 1 pair**	**207.24**	C.L.	314	$26,840	$10,072	$0	$0	$604	$37,516	$8,809	$0	**$46,325**
			1.514	129.51	48.60			2.92	181.03	42.51		223.53
Memo: https://www.showmecables.com/fire-alarm-cable-2-												
386 **Testing & Commisioning**	**235**		173	$14,834	$0	$0	$0	$0	$14,834	$3,483	$0	**$18,317**
			0.738	63.13					63.13	14.82		77.95
Subtotal				$247,807	$143,092	$0	$0	$8,586	$399,484	$93,799	$0	$493,283
Taxes				$0	$8,586	$0	$0					
Subcontractor Markups				$58,185	$35,614	$0	$0					
TOTAL GARAGE	**2,897**			**$305,992**	**$187,291**	**$0**	**$0**	**$8,586**	**$399,484**	**$93,799**	**$0**	$493,283
318,322.00 SF		*Level Unit Cost-->*		*$0.96*	*$0.59*			*$0.03*	*$1.25*	*$0.29*		*$1.55*
Estimate Tree Structure Rollups												
$9,583,215 D SERVICES												
$2,141,819 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
MECHANICAL ROOM SPACES												
387 **Detection system, break glass station, addressable, excluding wires & conduits**	**6**	Ea.	8	$696	$996	$0	$0	$60	$1,752	$411	$0	**$2,163**
			1.357	116.05	166.00			9.96	292.01	68.56		360.57
388 **Detection system, strobe & horn, ADA type, excluding wires & conduits**	**18**	Ea.	33	$2,858	$2,376	$0	$0	$143	$5,376	$1,262	$0	**$6,639**
			1.856	158.76	132.00			7.92	298.68	70.13		368.81
389 **Detection system, visual alarm, ADA type, excluding wires & conduits**	**3**	Ea.	4	$377	$348	$0	$0	$21	$746	$175	$0	**$921**
			1.469	125.62	116.00			6.96	248.58	58.37		306.95
390 **Detection system, smoke detector, addressable type, excl. wires & conduit**	**6**	Ea.	10	$841	$1,446	$0	$0	$87	$2,374	$557	$0	**$2,932**
			1.64	140.24	241.00			14.46	395.70	92.91		488.61

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$9,583,215 D SERVICES												
$2,141,819 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
MECHANICAL ROOM SPACES												
391 **'MM' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**27**	Ea.	37	$3,133	$1,582	$0	$0	$95	$4,810	$1,129	$0	**$5,940**
			1.357	116.04	58.60			3.52	178.16	41.83		219.99
Memo: https://thefirealarmsupplier.us/products/fmm-1-												
392 **'REL/CR' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**23**	Ea.	31	$2,669	$3,354	$0	$0	$201	$6,224	$1,461	$0	**$7,686**
			1.357	116.04	145.83			8.75	270.62	63.54		334.17
Memo: https://thefirealarmsupplier.us/products/mix-m500rap-												
393 **Detection system, smoke detector, duct type, addressable, excl. wires & conduit**	**2**	Ea.	6	$526	$404	$0	$0	$24	$954	$224	$0	**$1,178**
			3.075	263.02	202.00			12.12	477.14	112.03		589.17
394 **Notification Appliance Power Extender Panel**	**8**	Ea.	58	$4,988	$7,706	$0	$0	$462	$13,156	$3,089	$0	**$16,245**
			7.289	623.46	963.28			57.80	1,644.54	386.14		2,030.68
Memo: https://thefirealarmsupplier.us/products/hpff8-												
395 **Detection system, strobe & horn, weather proof, ADA type, excluding wires & conduits**	**5**	Ea.	9	$794	$1,930	$0	$0	$116	$2,840	$667	$0	**$3,507**
			1.856	158.76	386.09			23.16	568.01	133.37		701.38
Memo: https://www.gordonelectricsupply.com/p/Edwards-												
396 **'FACP' Detection system, fire alarm control panel, addressable with voice, up to 400 points, excluding wires & conduits**	**3**	Ea.	81	$6,946	$34,200	$0	$0	$2,052	$43,198	$10,143	$0	**$53,341**
			27.07	2,315.42	11,400.00			684.00	14,399.42	3,380.98		17,780.40
397 **Mass notification system, wireless command center, PC based, 10,000 devices database**	**1**	Ea.	15	$1,266	$3,175	$0	$0	$191	$4,631	$1,087	$0	**$5,719**
			14.797	1,265.65	3,175.00			190.50	4,631.15	1,087.39		5,718.54
398 **Mass notification system, transmitter, 100 watt**	**1**	Ea.	7	$633	$6,475	$0	$0	$389	$7,496	$1,760	$0	**$9,256**
			7.398	632.83	6,475.00			388.50	7,496.33	1,760.14		9,256.47
399 **Detection system, fire alarm control panel, battery & rack, automatic charger, excluding wires & conduits**	**3**	Ea.	4	$316	$1,770	$0	$0	$106	$2,192	$515	$0	**$2,706**
			1.23	105.21	590.00			35.40	730.61	171.55		902.15

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$9,583,215 D SERVICES												
$2,141,819 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
MECHANICAL ROOM SPACES												
400 **'FAAP' Detection system, annunciator panel**	**3**	Ea.	27	$2,296	$2,700	$0	$0	$162	$5,158	$1,211	$0	**$6,369**
			8.946	765.18	900.00			54.00	1,719.18	403.66		2,122.84
Memo: https://www.buyfirealarmparts.com/shop/lcd280.html												
401 **Outlet boxes, pressed steel, 4" octagon**	**3**	Ea.	1	$126	$4	$0	$0	$0	$130	$31	$0	**$161**
			0.492	42.08	1.32			0.08	43.48	10.21		53.69
402 **Outlet boxes, pressed steel, 4" square**	**84**	Ea.	41	$3,535	$173	$0	$0	$10	$3,718	$873	$0	**$4,591**
			0.492	42.08	2.06			0.12	44.27	10.39		54.66
403 **Outlet boxes, pressed steel, plaster rings, 4" square, concealed**	**25**	Ea.	4	$329	$43	$0	$0	$3	$374	$88	$0	**$462**
			0.154	13.15	1.71			0.10	14.96	3.51		18.48
404 **Outlet boxes, pressed steel, covers, blank, 4" square**	**35**	Ea.	5	$460	$50	$0	$0	$3	$513	$120	$0	**$633**
			0.154	13.15	1.42			0.09	14.66	3.44		18.10
405 **Electric metallic tubing (EMT), 3/4" diameter, to 10' high, incl 2 terminations, 2 field bend elbows, 11 beam clamps, and 11 couplings per 100 LF**	**2,610**	L.F.	199	$17,025	$5,063	$0	$0	$304	$22,392	$5,258	$0	**$27,650**
			0.076	6.52	1.94			0.12	8.58	2.01		10.59
406 **EMT boxes connectors, compression, steel, 3/4" diameter, to 15' H**	**174**	Ea.	16	$1,336	$85	$0	$0	$5	$1,427	$335	$0	**$1,762**
			0.09	7.68	0.49			0.03	8.20	1.93		10.13
407 **Fire alarm cable,#18, 1 pair**	**20.13**	C.L.	25	$2,118	$684	$0	$0	$41	$2,843	$668	$0	**$3,511**
			1.23	105.21	33.99			2.04	141.24	33.16		174.40
Memo: https://www.showmecables.com/1-pair-18-awg-solid-												
408 **Fire alarm cable,#14, 1 pair**	**16.17**	C.L.	24	$2,094	$786	$0	$0	$47	$2,927	$687	$0	**$3,614**
			1.514	129.51	48.60			2.92	181.03	42.51		223.53
Memo: https://www.showmecables.com/fire-alarm-cable-2-												

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$9,583,215 D SERVICES												
$2,141,819 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
MECHANICAL ROOM SPACES												
409 **Testing & Commisioning**	**98**		72	$6,186	$0	$0	$0	$0	$6,186	$1,453	$0	**$7,639**
			0.738	63.13					63.13	14.82		77.95
Subtotal				$61,548	$75,351	$0	$0	$4,521	$141,420	$33,205	$0	**$174,625**
Taxes				$0	$4,521	$0	$0					
Subcontractor Markups				$14,451	$18,754	$0	$0					
TOTAL MECHANICAL ROOM SPACES	**720**			**$75,999**	**$98,626**	**$0**	**$0**	**$4,521**	**$141,420**	**$33,205**	**$0**	**$174,625**
15,138.00 SF			*Level Unit Cost-->*	*$5.02*	*$6.52*			*$0.30*	*$9.34*	*$2.19*		*$11.54*
Estimate Tree Structure Rollups												
$9,583,215 D SERVICES												
$2,141,819 D50 ELECTRICAL												
$1,955,442 D5030 COMMUNICATIONS & SECURITY												
$1,955,442 D503001 FIRE ALARM SYSTEMS												
FIRE PUMPS & PUMP ROOM PIPING												
410 **'MM' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**21**	Ea.	28	$2,437	$1,231	$0	$0	$74	$3,741	$878	$0	**$4,620**
			1.357	116.04	58.60			3.52	178.16	41.83		219.99
Memo: https://thefirealarmsupplier.us/products/fmm-1-												
411 **'REL/CR' Detection system, fire alarm control panel,relay module, excluding wires & conduits**	**1**	Ea.	1	$116	$146	$0	$0	$9	$271	$64	$0	**$334**
			1.357	116.04	145.83			8.75	270.62	63.54		334.16
Memo: https://thefirealarmsupplier.us/products/mix-m500rap-												
412 **Detection system, strobe & horn, weather proof, ADA type, excluding wires & conduits**	**2**	Ea.	4	$318	$772	$0	$0	$46	$1,136	$267	$0	**$1,403**
			1.856	158.76	386.09			23.17	568.02	133.37		701.38
Memo: https://www.gordonelectricsupply.com/p/Edwards-												
413 **Outlet boxes, pressed steel, 4" square**	**24**	Ea.	12	$1,010	$49	$0	$0	$3	$1,062	$249	$0	**$1,312**
			0.492	42.08	2.06			0.12	44.27	10.39		54.66
414 **Outlet boxes, pressed steel, covers, blank, 4" square**	**22**	Ea.	3	$289	$31	$0	$0	$2	$322	$76	$0	**$398**
			0.154	13.15	1.42			0.09	14.66	3.44		18.10

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$9,583,215 D SERVICES											
$2,141,819 D50 ELECTRICAL											
$1,955,442 D5030 COMMUNICATIONS & SECURITY											
$1,955,442 D503001 FIRE ALARM SYSTEMS											
FIRE PUMPS & PUMP ROOM PIPING											
415 **Electric metallic tubing (EMT), 3/4" diameter, to 10' high, incl 2 terminations, 2 field bend elbows, 11 beam clamps, and 11 couplings per 100 LF**	**720** L.F.	55 0.076	$4,696 6.52	$1,397 1.94	$0	$0	$84 0.12	$6,177 8.58	$1,450 2.01	$0	**$7,627** 10.59
416 **EMT boxes connectors, compression, steel, 3/4" diameter, to 15' H**	**48** Ea.	4 0.09	$369 7.68	$24 0.49	$0	$0	$1 0.03	$394 8.20	$92 1.93	$0	**$486** 10.13
417 **Fire alarm cable,#18, 1 pair**	**7.26** C.L.	9 1.23	$764 105.21	$247 33.99	$0	$0	$15 2.04	$1,025 141.24	$241 33.16	$0	**$1,266** 174.40
Memo: https://www.showmecables.com/1-pair-18-awg-solid-											
418 **Fire alarm cable,#14, 1 pair**	**1.32** C.L.	2 1.514	$171 129.51	$64 48.60	$0	$0	$4 2.92	$239 181.02	$56 42.51	$0	**$295** 223.53
Memo: https://www.showmecables.com/fire-alarm-cable-2-											
419 **Testing & Commisioning**	**24**	18 0.738	$1,515 63.13	$0	$0	$0	$0	$1,515 63.13	$356 14.82	$0	**$1,871** 77.95
Subtotal			$11,685	$3,961	$0	$0	$238	$15,883	$3,729	$0	$19,612
Taxes			$0	$238	$0	$0					
Subcontractor Markups			$2,744	$986	$0	$0					
TOTAL FIRE PUMPS & PUMP ROOM PIPING **1.00 EA**	**137**		**$14,428**	**$5,184**	**$0**	**$0**	**$238**	**$15,883**	**$3,729**	**$0**	**$19,612**
Estimate Tree Structure Rollups											
$11,055,884 CONCEPT 2											
$1,001,697 F SPECIAL CONSTRUCTION & DEMOLITION											
$1,001,697 F20 SELECTIVE BUILDING DEMOLITION											
$482,214 F2010 BUILDING ELEMENTS DEMOLITION											
F201004 INTERIOR CONSTRUCTION & FINISHES											
420 **Walls and partitions demolition, metal or wood studs, finish two sides, plasterboard (gypsum wallboard)**	**96** S.F.	5 0.055	$172 1.79	$0	$0	$0	$0	$172 1.79	$55 0.58	$0	**$227** 2.37

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$11,055,884 CONCEPT 2											
$1,001,697 F SPECIAL CONSTRUCTION & DEMOLITION											
$1,001,697 F20 SELECTIVE BUILDING DEMOLITION											
$482,214 F2010 BUILDING ELEMENTS DEMOLITION											
F201004 INTERIOR CONSTRUCTION & FINISHES											
Subtotal			$172	$0	$0	$0	$0	$172	$55	$0	**$227**
Subcontractor Markups			$55	$0	$0	$0					
TOTAL F201004 INTERIOR CONSTRUCTION & FINISHES	**5**		**$227**	**$0**	**$0**	**$0**	**$0**	**$172**	**$55**	**$0**	**$227**
1.00 LS											
Estimate Tree Structure Rollups											
$11,055,884 CONCEPT 2											
$1,001,697 F SPECIAL CONSTRUCTION & DEMOLITION											
$1,001,697 F20 SELECTIVE BUILDING DEMOLITION											
$482,214 F2010 BUILDING ELEMENTS DEMOLITION											
F201006 MECHANICAL SYSTEMS											
421 **Pipe, metal pipe, to 1-1/2" diam., selective demolition**	**27,600** L.F.	1,358	$112,970	$0	$0	$0	$0	$112,970	$30,558	$0	**$143,528**
		0.049	4.09					4.09	1.11		5.20
422 **Pipe, metal pipe, 2" to 3-1/2" diam., selective demolition**	**7,940** L.F.	518	$43,062	$0	$0	$0	$0	$43,062	$11,648	$0	**$54,710**
		0.065	5.42					5.42	1.47		6.89
423 **Pipe, metal pipe, 4" to 6" diam., selective demolition**	**8,420** L.F.	1,657	$137,856	$0	$0	$0	$0	$137,856	$37,290	$0	**$175,146**
		0.197	16.37					16.37	4.43		20.80
424 **Fans, 1-1/2 thru 10 HP or 20,000 CFM, selective demolition**	**14** Ea.	276	$19,602	$0	$0	$0	$0	$19,602	$5,302	$0	**$24,904**
		19.68	1,400.15					1,400.15	378.74		1,778.89
Subtotal			$313,489	$0	$0	$0	$0	$313,489	$84,799	$0	**$398,288**
Subcontractor Markups			$84,799	$0	$0	$0					
TOTAL F201006 MECHANICAL SYSTEMS	**3,808**		**$398,288**	**$0**	**$0**	**$0**	**$0**	**$313,489**	**$84,799**	**$0**	**$398,288**
1.00 LS											

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$11,055,884 CONCEPT 2												
$1,001,697 F SPECIAL CONSTRUCTION & DEMOLITION												
$1,001,697 F20 SELECTIVE BUILDING DEMOLITION												
$482,214 F2010 BUILDING ELEMENTS DEMOLITION												
F201007 ELECTRICAL SYSTEMS												
425 **Fire alarm control panel, 12 to 16 zone, electrical demolition, remove**	**3**	Ea.	22 7.371	$1,892 630.51	$0	$0	$0	$0	$1,892 630.51	$444 148.04	$0	**$2,336** 778.56
426 **Fire alarm bell, electrical demolition, remove**	**207**	Ea.	127 0.615	$10,889 52.60	$0	$0	$0	$0	$10,889 52.60	$2,557 12.35	$0	**$13,446** 64.95
427 **Fire alarm pull station, electrical demolition, remove**	**206**	Ea.	88 0.428	$7,542 36.61	$0	$0	$0	$0	$7,542 36.61	$1,771 8.60	$0	**$9,313** 45.21
428 **Smoke detector, electrical demolition, remove**	**595**	Ea.	255 0.428	$21,784 36.61	$0	$0	$0	$0	$21,784 36.61	$5,115 8.60	$0	**$26,899** 45.21
429 **Junction boxes, 4" square & octagon, electrical demolition, remove, including removal of supports and terminations**	**415**	Ea.	51 0.123	$4,366 10.52	$0	$0	$0	$0	$4,366 10.52	$1,025 2.47	$0	**$5,391** 12.99
430 **Conduit, electric metallic tubing (EMT), 1/2" to 1" diameter, electrical demolition, remove conduit to 10' high, including fittings & hangers**	**960**	L.F.	24 0.025	$2,020 2.10	$0	$0	$0	$0	$2,020 2.10	$474 0.49	$0	**$2,494** 2.60
431 **Conduit, rigid galvanized steel, 1/2" to 1" diameter, electrical demolition, remove conduit to 10' high, including fittings & hangers**	**3,030**	L.F.	123 0.041	$10,520 3.47	$0	$0	$0	$0	$10,520 3.47	$2,470 0.81	$0	**$12,990** 4.29
432 **Fire Alarm Cable, electrical demolition, remove**	**13,695**	L.F.	51 0.004	$4,322 0.32	$0	$0	$0	$0	$4,322 0.32	$1,015 0.07	$0	**$5,337** 0.39
433 **Generator set, 3 phase 4 wire, 277/480 V, 200 kW, electrical demolition, remove, incl accessories**	**1**	Ea.	50 50.034	$4,280 4,279.65	$0	$0	$0	$0	$4,280 4,279.65	$1,005 1,004.86	$0	**$5,285** 5,284.51

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$11,055,884 CONCEPT 2												
$1,001,697 F SPECIAL CONSTRUCTION & DEMOLITION												
$1,001,697 F20 SELECTIVE BUILDING DEMOLITION												
$482,214 F2010 BUILDING ELEMENTS DEMOLITION												
F201007 ELECTRICAL SYSTEMS												
434 **Transfer switches, enclosed, 260 A, electrical demolition, remove**	**1**	Ea.	2	$168	$0	$0	$0	$0	$168	$40	$0	**$208**
			1.968	168.33					168.33	39.52		207.85
Subtotal				$67,783	$0	$0	$0	$0	$67,783	$15,916	$0	$83,699
Subcontractor Markups				$15,916	$0	$0	$0					
TOTAL F201007 ELECTRICAL SYSTEMS	**792**			**$83,699**	**$0**	**$0**	**$0**	**$0**	**$67,783**	**$15,916**	**$0**	**$83,699**
1.00 LS												
Estimate Tree Structure Rollups												
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)												
$11,055,884 CONCEPT 2												
$1,001,697 F SPECIAL CONSTRUCTION & DEMOLITION												
$1,001,697 F20 SELECTIVE BUILDING DEMOLITION												
F2020 HAZARDOUS COMPONENTS ABATEMENT												
435 **Asbestos abatement equipment, respirator, single use**	**88**	Ea.		$0	$176	$0	$0	$11	$187	$50	$0	**$237**
					2.00			0.12	2.12	0.57		2.69
Memo: 4 workers for 22 days												
436 **Asbestos abatement equipment, respirator, single use, cartridge**	**88**	Ea.		$0	$1,276	$0	$0	$77	$1,353	$362	$0	**$1,715**
					14.50			0.87	15.37	4.12		19.49
Memo: 4 workers for 20 days												
437 **Asbestos abatement equipment, worker protection, whole body, foot, head cover &gloves, plastic**	**176**	Ea.		$0	$1,866	$0	$0	$112	$1,978	$530	$0	**$2,507**
					10.60			0.64	11.24	3.01		14.25
Memo: 4 workers for 20 days x 2												
438 **Preparation of asbestos containment area, cover surfaces with polyethylene sheeting, floors, each layer, 4 mil, incl. glue & tape**	**35,918**	S.F.	309	$24,069	$2,155	$0	$0	$129	$26,353	$7,059	$0	**$33,413**
			0.009	0.67	0.06				0.73	0.20		0.93
439 **Preparation of asbestos containment area, cover surfaces with polyethylene sheeting, walls, each layer, 4 mil, incl. glue & tape**	**190,684**	S.F.	2,111	$164,287	$11,441	$0	$0	$686	$176,415	$47,257	$0	**$223,672**
			0.011	0.86	0.06				0.93	0.25		1.17

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups											
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)											
$11,055,884 CONCEPT 2											
$1,001,697 F SPECIAL CONSTRUCTION & DEMOLITION											
$1,001,697 F20 SELECTIVE BUILDING DEMOLITION											
F2020 HAZARDOUS COMPONENTS ABATEMENT											
440 **Preparation of asbestos containment area, caulk seams with latex**	**24,153** L.F.	1,040	$56,885	$5,072	$0	$0	$304	$62,261	$16,678	$0	**$78,940**
		0.043	2.36	0.21			0.01	2.58	0.69		3.27
Memo: =(680)/32=22*12=264*5=13200lf											
441 **Preparation of asbestos containment area, separation barrier, 2" x 4" @ 16", 1/2" plywood each side, 12' high**	**5,920** S.F.	364	$19,918	$28,712	$0	$0	$1,723	$50,353	$13,488	$0	**$63,841**
		0.062	3.37	4.85			0.29	8.51	2.28		10.78
442 **Cover floor surface with tarpaulins, polyvinyl coated nylon, 14 oz. to 18 oz., min**	**2,824** S.F.	27	$2,110	$3,841	$0	$0	$230	$6,181	$1,656	$0	**$7,837**
		0.01	0.75	1.36			0.08	2.19	0.59		2.77
Memo: 2 layer x floor area											
443 **Selective demolition, saw cutting, masonry walls, brick, per inch of depth, hydraulic saw**	**33** EA	14	$703	$12	$997	$0	$61	$1,772	$475	$0	**$2,247**
		0.435	21.31	0.36	30.20		1.83	53.70	14.38		68.08
444 **Concrete core drilling, core, reinforced concrete slab, 1" diameter, up to 6" thick slab, includes bit cost, layout and set up time**	**565** Ea.	654	$31,376	$124	$4,749	$0	$292	$36,542	$9,789	$0	**$46,331**
		1.157	55.53	0.22	8.41		0.52	64.68	17.32		82.00
445 **Concrete core drilling, core, reinforced concrete slab, 1" diameter, up to 6" thick slab, includes bit cost, layout and set up time, for each additional**	**1,130** Ea.	15	$734	$45	$111	$0	$9	$899	$241	$0	**$1,140**
		0.014	0.65	0.04	0.10		0.01	0.80	0.21		1.01
446 **Demolition in asbestos contaminated area, popcorn ceiling**	**1,412** S.F.	108	$8,440	$282	$0	$0	$17	$8,739	$2,341	$0	**$11,080**
		0.077	5.98	0.20			0.01	6.19	1.66		7.85
447 **Asbestos encapsulation with sealants, ceilings & walls, max**	**1,412** S.F.	15	$1,187	$734	$0	$0	$44	$1,965	$526	$0	**$2,492**
		0.011	0.84	0.52			0.03	1.39	0.37		1.76
448 **Asbestos abat equip, disposable fiber drums, 55 Gal**	**210** Ea.		$0	$3,822	$0	$0	$229	$4,051	$1,085	$0	**$5,137**
				18.20			1.09	19.29	5.17		24.46
449 **Asbestos abatement equipment, pressure sensitive caution labels, 3" x 5"**	**210** Ea.		$0	$685	$0	$0	$41	$726	$194	$0	**$920**
				3.26			0.20	3.46	0.93		4.38

LEVEL	QTY	UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
Estimate Tree Structure Rollups												
$24,267,300 FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)												
$11,055,884 CONCEPT 2												
$1,001,697 F SPECIAL CONSTRUCTION & DEMOLITION												
$1,001,697 F20 SELECTIVE BUILDING DEMOLITION												
F2020 HAZARDOUS COMPONENTS ABATEMENT												
450 **Decontamination of asbestos containment area, bag polyethylene sheeting**	**260**	Ea.	51	$3,982	$369	$0	$0	$22	$4,374	$1,172	$0	**$5,545**
			0.197	15.32	1.42			0.09	16.82	4.51		21.33
Memo: Assume 3 bags per drum												
451 **Asbestos abatement equipment & supplies, buy, shower unit, incl. pump & filters**	**5**	Ea.		$0	$4,825	$0	$0	$290	$5,115	$1,370	$0	**$6,485**
					965.00			57.90	1,022.90	274.01		1,296.91
Memo: 1 shower unit to be move to different floors												
452 **Preparation of asbestos containment area, set up and remove portable shower unit**	**5**	Ea.	25	$1,913	$0	$0	$0	$0	$1,913	$512	$0	**$2,426**
			4.92	382.61					382.61	102.49		485.10
Memo: 1 shower unit to be move to different floors												
453 **Asbestos abatement equipment & supplies, buy, vacuum cleaner, HEPA, stainless steel, wet/dry, 16 gal.**	**4**	Ea.		$0	$5,800	$0	$0	$348	$6,148	$1,647	$0	**$7,795**
					1,450.00			87.00	1,537.00	411.72		1,948.72
Memo: Assuming 4 workers working in 4 locations at the same												
454 **Decontamination of asbestos containment area, spray exposed substrate with surfactant (bridging), flat surfaces**	**1,412**	S.F.	19	$1,451	$635	$0	$0	$38	$2,124	$569	$0	**$2,693**
			0.013	1.03	0.45			0.03	1.50	0.40		1.91
Memo: If assuming floor abatement use 100 sf area												
455 **Decontamination of asbestos containment area, final cleaning of protected surfaces**	**4,424**	S.F.	16	$1,241	$0	$0	$0	$0	$1,241	$332	$0	**$1,574**
			0.004	0.28					0.28	0.07		0.36
Memo: Includes abatement area and immediate area (wall or												
456 **Preparation of asbestos containment area, personnel decontamination chamber, 2"x 4" @ 16", 3/4" plywood each side**	**50**	S.F.	3	$187	$298	$0	$0	$18	$502	$135	$0	**$637**
			0.068	3.74	5.95			0.36	10.05	2.69		12.74

Estimate Tree Structure Rollups

$24,267,300 *FIRE ALARM & FIRE SUPPRESSION - CONCURRENT START 3/1/24)*
$11,055,884 *CONCEPT 2*
$1,001,697 *F SPECIAL CONSTRUCTION & DEMOLITION*
$1,001,697 *F20 SELECTIVE BUILDING DEMOLITION*

F2020 HAZARDOUS COMPONENTS ABATEMENT

LEVEL	QTY UM	HRS	LABOR	MAT	EQUIP	OTHERS	MAT TAXES	DIRECT COST	SUB M/UPS	PRIME M/UPS	TOTAL
457 **Asbestos waste packaging, handling & disposal, disposal charges, excl. haul, min**	**132** C.Y		$0	$8,052	$0	$0	$483	$8,535	$2,286	$0	**$10,821**
				61.00			3.66	64.66	17.32		81.98
Subtotal			$318,483	$80,222	$5,857	$0	$5,165	$409,727	$109,756	$0	**$519,483**
Taxes			$0	$4,813	$351	$0					
Subcontractor Markups			$85,314	$22,779	$1,663	$0					
TOTAL F2020 HAZARDOUS COMPONENTS ABATEMENT	**1.00 LS**	**4,772**	**$403,797**	**$107,814**	**$7,871**	**$0**	**$5,165**	**$409,727**	**$109,756**	**$0**	**$519,483**

End of Report

Castle Sprinkler & Alarm, Inc.
5114 College Ave.
College Park, MD 20740
Ph # 301-927-7300 Fax 240-487-0120
www.csafire.com
Your Friend in Fire Protection!

February 12, 2025

Southern Management Companies
9658 Baltimore Ave Ste 105
College Park Md 20740
443-226-7677

Re: Ritchie Park

Dear Estimating,

Castle Sprinkler and Alarm, Inc. (CSA) is pleased to submit our Budget price in the amount **One Million Three Hundred Sixty Thousand Dollars ($1,360,000)** the design, installation and testing of a new fire pump, wet and dry pipe sprinkler system, for the above referenced project.

This proposal includes the following:

1. Prepare shop drawings, hydraulic calculations, and equipment catalogs for submittal to the owner/owner's agent and the Authority Having Jurisdiction (AHJ) for approval.
2. System design to meet **NFPA 13**, 20 14 and local sprinkler codes
3. CSA work will start inside the sprinkler room from a flange on the discharge side of the backflow preventer that is connected to a reliable and certified water supply.
4. Some areas of sprinkler pipe to be exposed.
5. CSA will cut/drill the penetrations needed for our specific installation and install fire stopping of those penetrations.
6. CSA will provide necessary fire sprinkler system permits and final testing of the fire sprinkler system.
7. Presence of one sprinkler mechanic at one fire alarm test per building to operate water flow switches and valve monitor switches during normal CSA business hours.
8. At conclusion of job CSA will provide as-built drawings and operation and maintenance manuals for our associated work
9. This proposal is based upon all work being performed during normal working hours, 7:00 a.m. – 3:30 p.m., Monday through Friday. No overtime labor is included in this proposal.
10. Fire Sprinkler drawings sealed by a sprinkler NICET III.
11. One year warranty on materials and labor for CSA installed system.
12. A **1.4%** bond rate (if required) to be added to final contract amount.
13. CSA will be responsible for all material and equipment handling.
14. Price is based on using CPVC piping
15. All black pipe to sch 40 thread and sch 10 grooved
16. Fire pump

  Initial _____

17. Pipe concealment by others
18. Existing standpipe to remain and be reused for zone controls
19. Existing standpipe booster pump to remove and replaced
20. New fire pump room to be located in garage, built by others
21. Demolition of existing garage dry system by CSA, dumpster provided by others
22. All core drilling by CSA
23. Coordination of occupied areas for systems install by building management
24. Moving or relocation of building or tenants' material, furniture, etc by others

The following are excluded from this proposal:

1. Electrical wiring.
2. Underground work of any kind.
3. Provision or installation of a backflow prevention device and associated valves.
4. Water shields for electrical equipment.
5. Freeze protection of wet piping. The owner is responsible to maintain a minimum temperature of 40 degrees Fahrenheit in the conditioned areas of the building at all times. CSA will assume no responsibility for damages associated with frozen piping.
6. Seismic or earthquake bracing.
7. Pipe identification that exceeds local AHJ and NFPA
8. Special insurance requirements (i.e. Factory Mutual, etc.) not specified.
9. Provision or installation of fire extinguishers or any other fire suppression system work other than that specifically itemized above.
10. Trash Chutes connection only, sprinkler installed by others
11. Elevator sprinklers to be located by elevator contactor
12. Painting of all piping.
13. Heat Tracing
14. Pipe insulation.
15. Cad File Fees
16. Wage Scale
17. Bond
18. Galvanized pipe
19. Any fire alarm systems

We trust that all of the above will meet with your satisfaction and that we may have the opportunity of performing this installation for you.

Sincerely,

Lee Cerino
Project Estimator

Initial _____

Castle Sprinkler & Alarm, Inc.
5114 College Ave.
College Park, MD 20740
Ph # 301-927-7300 Fax 240-487-0120
www.csafire.com
Your Friend in Fire Protection!

March 28, 2025

Southern Management Companies
9658 Baltimore Ave Ste 105
College Park Md 20740
443-226-7677

Re: Horizon Apts

Dear Estimating,

Castle Sprinkler and Alarm, Inc. (CSA) is pleased to submit our Budget price in the amount **One Million Four Hundred Fifty Thousand Dollars ($1,450,000)** the design, installation and testing of a new fire pump, wet and dry pipe sprinkler system, for the above referenced project.

This proposal includes the following:

1. Prepare shop drawings, hydraulic calculations, and equipment catalogs for submittal to the owner/owner's agent and the Authority Having Jurisdiction (AHJ) for approval.
2. System design to meet **NFPA 13**, 20 14 and local sprinkler codes
3. CSA work will start inside the sprinkler room from a flange on the discharge side of the backflow preventer that is connected to a reliable and certified water supply.
4. Some areas of sprinkler pipe to be exposed.
5. CSA will cut/drill the penetrations needed for our specific installation and install fire stopping of those penetrations.
6. CSA will provide necessary fire sprinkler system permits and final testing of the fire sprinkler system.
7. Presence of one sprinkler mechanic at one fire alarm test per building to operate water flow switches and valve monitor switches during normal CSA business hours.
8. At conclusion of job CSA will provide as-built drawings and operation and maintenance manuals for our associated work
9. This proposal is based upon all work being performed during normal working hours, 7:00 a.m. – 3:30 p.m., Monday through Friday. No overtime labor is included in this proposal.
10. Fire Sprinkler drawings sealed by a sprinkler NICET III.
11. One year warranty on materials and labor for CSA installed system.
12. A **1.4%** bond rate (if required) to be added to final contract amount.
13. CSA will be responsible for all material and equipment handling.
14. Price is based on using CPVC piping
15. All black pipe to sch 40 thread and sch 10 grooved
16. Fire pump
17. Pipe concealment by others
18. Existing standpipe to remain and be reused for zone controls

  Initial _____

19. Existing standpipe booster pump to remove and replaced
20. New fire pump room to be located in garage, built by others
21. Demolition of existing garage dry system by CSA, dumpster provided by others
22. All core drilling by CSA
23. Coordination of occupied areas for systems install by building management
24. Moving or relocation of building or tenants' material, furniture, etc by others

The following are excluded from this proposal:

1. Electrical wiring.
2. Underground work of any kind.
3. Provision or installation of a backflow prevention device and associated valves.
4. Water shields for electrical equipment.
5. Freeze protection of wet piping. The owner is responsible to maintain a minimum temperature of 40 degrees Fahrenheit in the conditioned areas of the building at all times. CSA will assume no responsibility for damages associated with frozen piping.
6. Seismic or earthquake bracing.
7. Pipe identification that exceeds local AHJ and NFPA
8. Special insurance requirements (i.e. Factory Mutual, etc.) not specified.
9. Provision or installation of fire extinguishers or any other fire suppression system work other than that specifically itemized above.
10. Trash Chutes connection only, sprinkler installed by others
11. Elevator sprinklers to be located by elevator contactor
12. Painting of all piping.
13. Heat Tracing
14. Pipe insulation.
15. Cad File Fees
16. Wage Scale
17. Bond
18. Galvanized pipe
19. Any fire alarm systems

We trust that all of the above will meet with your satisfaction and that we may have the opportunity of performing this installation for you.

Sincerely,

Lee Cerino
Project Estimator

Initial _____