Fire Station Needs Assessment and Location Analysis

for the

BST&G Joint Fire District

by

The Ohio Fire Chiefs' Association Consulting Services

PREMIER • PROFESSIONAL • PROACTIVE

May 2022

EXECUTIVE SUMMARY

The Ohio Fire Chiefs' Association was contracted to conduct a fire station location analysis for the BST&G Joint Fire District. The analysis included a community risk assessment and review of the fire district's service delivery and demands for service.

The BST&G Joint Fire District is located approximately 27 miles north of the Columbus, Ohio metropolitan area in eastern Delaware County. The fire district provides fire protection to the following governmental entities: Berkshire Township (Twp.), City of Sunbury, Trenton Twp., and the Village of Galena. The fire district encompasses an area of approximately 54.1 square miles with an estimated population of 15,291. The fire district is characterized as a "rapidly developing" suburban and rural region; consisting of a mix of residential, educational, mercantile, factory and industrial, and agricultural farmland development.

The BST&G Joint Fire District is a "combination" staffed agency which employs 15 full-time personnel, 21 part-time personnel, and a fiscal officer. There are seven personnel assigned to each of the three 24-hour shifts, with a minimum daily staffing of five personnel. The fire district was evaluated by the Insurance Services Office (ISO), and currently possesses a Public Protection Classification rating of 04/4Y. The fire district operates from one fire station: Station 350 located at 350 West Cherry Street in Sunbury. The fire district provides fire protection, community risk reduction (i.e., fire and life safety inspections, prevention, and education), as well as technical rescue, and other forms of aid to the residents, businesses, and visitors of the above-mentioned four communities. The fire district does not provide primary ambulance services or emergency medical transportation to hospital facilities as provisions of its overall services. However, the fire district responds to emergency medical incidents to provide aid and assistance before and after Delaware County Emergency Medical Services paramedics arrive on-scene. During the period 2011 - 2020, the fire district experienced a 28.9% increase in demand or calls for service. In 2020, the fire district responded to 1,147 incidents.

A community risk assessment was conducted on each "target" hazard in the fire district. The assessment consisted of evaluating each property on various elements of fire risk and the potential impact on the community. There were 66 properties in the fire district identified as a significant risk and three properties identified as a maximum risk.

The fire district's response performance data for 2018 - 2020 was analyzed as part of the study. The analysis revealed that performance gaps exist in the fire district for fire and EMS assist turnout time, travel time, and total response time, which were all greater than the response time criteria established by the National Fire Protection Association. The primary explanation for the travel time deficiency is the sizeable area covered by the fire district from one fire station.

Travel time maps utilizing GIS mapping and the ArcGIS9 Fire Analysis Tool Software™ were developed. Using the existing Station 350 on West Cherry Street, a second fire station located near the intersection of Romes Corner Road (Rd.) south of Cheshire Rd. was identified as "optimal" or the best location to improve travel times and ultimately overall response performance to the southwestern, southern, and western areas of the fire district. However, several characteristics of the area and other factors did not support this location as viable for consideration. As an alternative, a second fire station was proposed on Wilson Rd. [north of U.S. Route 36 (U.S. 36) / Ohio (OH) State Route (SR)-37]. This location significantly improves the travel times to the northwestern and western areas of the fire district. In addition, the southwestern area will achieve some improvement as well. This location betters travel times to multiple significant risk properties located near the I-71 and U.S. 36 / OH SR-37 interchange and on South Wilson Rd. This location also will improve travel time to areas currently undergoing residential and commercial development.

For future planning purposes, a three-station configuration was developed. Using the existing Station 350, a new second fire station located on Wilson Rd. (north of U.S. 36 / OH SR-37), and a new third fire station located in the area near North County Rd. 605 and Murphy Rd., also identified as optimal improves travel times and response performance in the southern, southwestern, northeastern, eastern, and southeastern areas. The three-fire station configuration significantly improves travel times to almost all areas of the fire district and positions the fire district to meet service delivery challenges as all four communities continue to prosper, and potentially positively impact future ISO ratings.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

The Ohio Fire Chiefs' Association (OFCA) recognizes Fire Chief Christopher Kovach, Assistant Chief Rob Stambaugh, and personnel of the BST&G Joint Fire District for their cooperation and effort during this project. They were prompt, courteous, and professional in providing the background information and data necessary to conduct this analysis. Fire district personnel serve with pride and are committed to delivering quality service to the communities of Berkshire Township, the City of Sunbury, Trenton Township, and the Village of Galena. The OFCA also recognizes the Fire District Board of Trustees for their commitment to the project.

INTRODUCTION

At the request of the BST&G Joint Fire District, the Ohio Fire Chiefs' Association (OFCA) was contracted to perform a fire station needs assessment and location analysis to determine optimum locations for future fire station facility construction and improved service delivery. Community growth and development throughout Berkshire Township (Twp.), the City of Sunbury, Trenton Twp., and the Village of Galena, especially in the Sunbury and Berkshire areas has raised concern of existing and future response times and deployment of the fire district's resources. This analysis included a risk assessment of the community as well as a review of the service delivery and response performance of the BST&G Joint Fire District. The project was limited to these specific areas of study.

The OFCA assessment team conducted an "in-person" conference and site visit with Chief Kovach, Assistant Chief Stambaugh, Lieutenant Chad Cavinee, Lieutenant Kyle Stelzer, Lieutenant David Potts, and Fiscal Officer Greg Roy on September 9, 2021. The purpose of the meeting was to collect data, clarify information and data compiled by the BST&G Joint Fire District prior to the visit, and further identify additional fire district resources related to the study. During the site visit, the current station facilities and equipment were inspected. The assessment team viewed areas and other significant risk properties within each community. Several potential growth areas identified by Chief Kovach were also viewed.

OVERVIEW

The BST&G Joint Fire District, which will also be referred to as the "fire district", was formed to provide fire protection to the communities located in the eastern half of Delaware County including Berkshire Twp., City of Sunbury, Trenton Twp., and Village of Galena. Prior to October 2021, the City of Sunbury was recognized as the Village of Sunbury. The status change from a village to a city was made based on the 2020 U.S. Census data that reflected Sunbury's population that exceeded the 5,000-populace threshold.

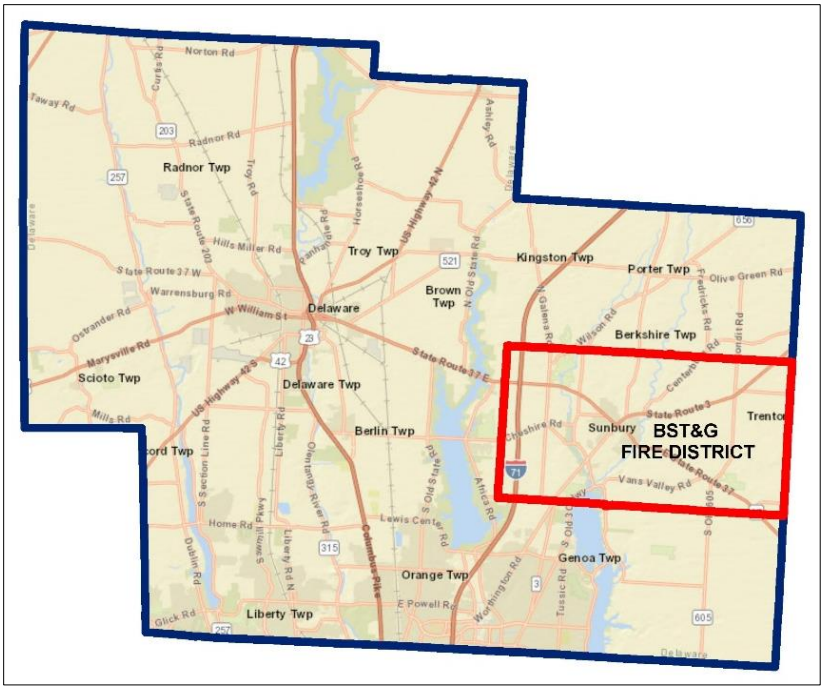


Figure 1: Map of BST&G fire district's coverage area and surrounding jurisdictions.

The fire district protects approximately 54.1 square miles (sq. mi.) and a population of 15,291 that grows significantly during daytime hours from one fire station facility.[1] Within the fire district's area is the greatest amount of US highway, interstate highway, and state roadways in Delaware County. These highways and roadways include U.S. Route 36 (U.S. 36), Interstate 71 (I-71), Ohio (OH) State Route (SR)-3, OH SR-37, OH SR-61, and OH SR-605. Of note: the reader will observe that U.S. 36 and OH SR-37 are used jointly (i.e., U.S. 36 / OH SR-37), as both roadways' two-digit designations are used interchangeably, as they follow the same route through most of the fire district. At OH SR-3, U.S. 36 then proceeds northeast along OH SR-3. While there are no railroad lines or major waterways within the fire district's response area, there are two streams, the "Big Walnut Creek" and the "Little Walnut Creek" that are tributaries to the Hoover Reservoir in Galena. At the most northern end of the reservoir are the "mudflats" and boardwalk, an area recreational attraction.

The fire district is a "combination" staffed agency which employs 15 full-time personnel, 21 part-time personnel, and a fiscal officer. They deliver fire protection, community risk reduction (i.e., fire and life safety inspections, prevention, and education), as well as technical rescue and other forms of aid to the residents, businesses, and visitors. It must be noted that the fire district does not provide primary ambulance services or emergency medical transportation to hospital facilities as provisions of its overall services. However, the fire district responds to emergency

[1] U.S. Census: 2020 Decennial Census Data.

medical incidents to provide aid and assistance before and after paramedics arrive on-scene. After paramedics arrive, fire district personnel will assist with treatment and packaging, and in extreme cases, assisting until the patient is handed-off to the receiving emergency room.

Shift personnel work a standard three-platoon system with what is referred to as a 53-hour workweek. With this type of schedule, personnel on each of the three shifts work 24 hours on duty followed by 48 hours off duty.

There are seven personnel assigned to each of the three shifts. Each shift has one lieutenant, three full-time and three part-time firefighters. All personnel are dual certified as a firefighter and emergency medical technician or paramedic. The lieutenant serves as the shift commander and the initial incident commander (IC) during most incidents. The minimum daily staffing is five personnel (i.e., three full-time and two part-time).

The governing body of the BST&G Joint Fire District is a four-member board comprised of one elected representative from each township board of trustees and one council person from the village and city councils in the fire district. They are appointed annually by their respective boards or councils and are responsible to attend monthly meetings to provide oversight of the fire district.

Berkshire Township

Berkshire Twp. is located primarily in the western area of the fire district, but expands to the north and south. It borders the following townships:

- Kingston Twp. – north,
- Porter Twp. - northeast corner,
- Trenton Twp. – east,
- Harlem Twp. - southeast corner,
- Genoa Twp. – south,
- Orange Twp. - southwest corner,
- Berlin Twp. – west, and
- Brown Twp. - northwest corner.

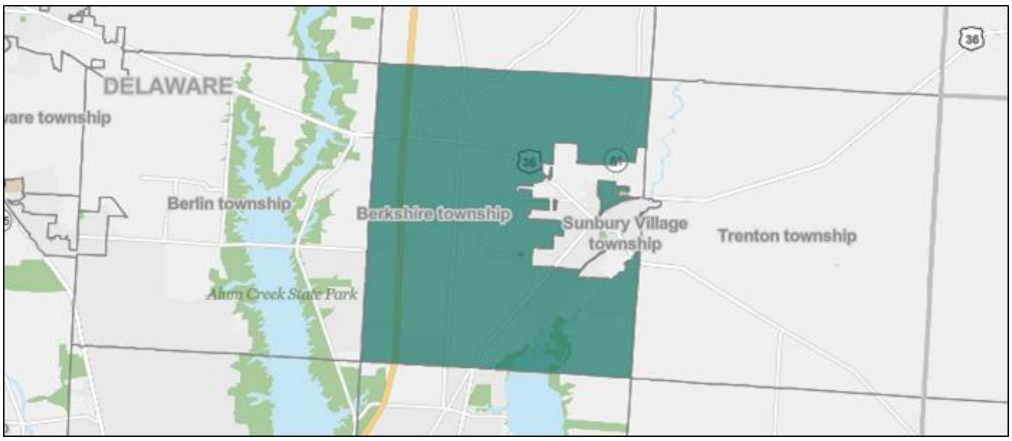


Figure 2: Map of Berkshire Township's boundaries.

One city and one village are located in Berkshire Twp.: the Village of Galena in the south, and most of the City of Sunbury in the east. Berkshire Twp. has an approximate population of 5,477 and is 21 sq. mi. in area. The township consists of 1,951 housing units and 1,146 households with a median income of $114,375.[2]

The township is governed by a three-member elected board of trustees and a fiscal officer. A township administrator is appointed by the trustees, and functions as the administrative head of the township under the direction and supervision of the trustees.

Founded in 1806, Berkshire Twp. is conveniently located along I-71 at exit U.S. 36 / OH SR-37. Township residents enjoy rural living yet are only 25 minutes away from downtown Columbus. Its location also sits directly between Alum Creek State Park and Hoover Reservoir, giving residents excellent recreational opportunities such as boating, camping, fishing, hiking, and more. Berkshire Twp. is home to numerous restaurants, outlet mall shopping, and job centers as well as estate, suburban, and multi-family housing. There are extensive, well planned land development opportunities. The township has the following three Olentangy Local School District (OLSD) facilities located within its borders: Johnnycake Corners Elementary School, Berkshire Middle School, and OLSD East Transportation Center.

City of Sunbury

Sunbury is located near the center area of the fire district. The city has an approximate total area of 4.8 sq. mi. Established in 1816, as a "stagecoach" town, the city nearly has doubled in size over the past 21 years. Sunbury began transitioning from being a village to a city in October 2021. The city has an estimated population of 6,614 residents, 2,476 housing units, 1,960

[2] U.S. Census: 2020 Decennial Census Data.

households, and a median income of $80,663.[3]

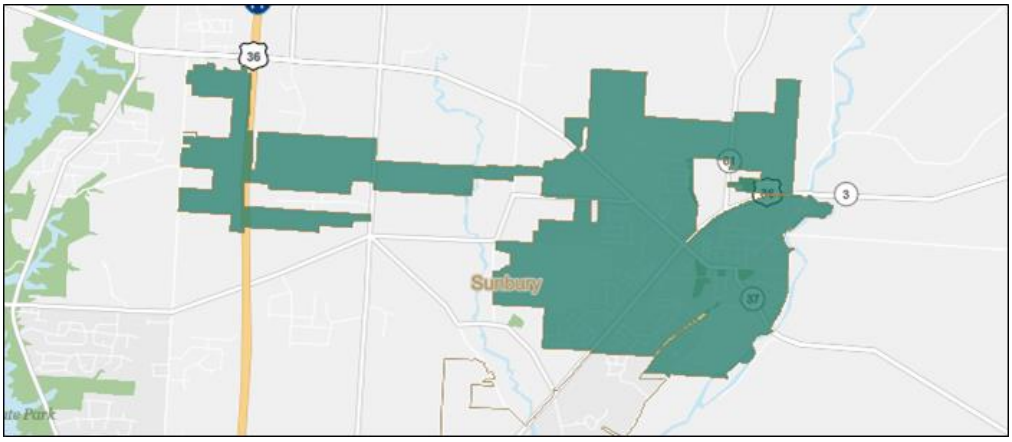


Figure 3: Map of the City of Sunbury's boundaries.

Sunbury continues to rapidly grow, having recently annexed over 300 acres with plans to annex an additional 255 acres, which will take the boundary out to Africa Road (Rd.). A major manufacturing facility owned and operated by Hitachi Astemo is located in the city, producing automobile parts for Honda of America.

The city is home to a K-12 public school district, the Big Walnut Local School District. The district consists of the following schools: Big Walnut High School, Big Walnut Middle School, Big Walnut 'Intermediate' School (grades 5-6), Harrison Street Elementary, General Rosecrans Elementary, Big Walnut Elementary, and finally the Early Learning Center at Harrison Street. The school campuses are located throughout the fire district.

Trenton Township

Trenton is primarily an agricultural community and characterized as rural. Located in the eastern part of the fire district, it borders the following townships:

- Porter Twp. – north,
- Hilliar Twp., Knox County – northeast corner,
- Hartford Twp., Licking County – east,
- Monroe Twp., Licking County – southeast corner,
- Harlem Twp. – south,
- Genoa Twp. – southwest corner,

[3] U.S. Census: 2020 Decennial Census Data.

- Berkshire Twp. – west, and
- Kingston Twp. – northwest corner.

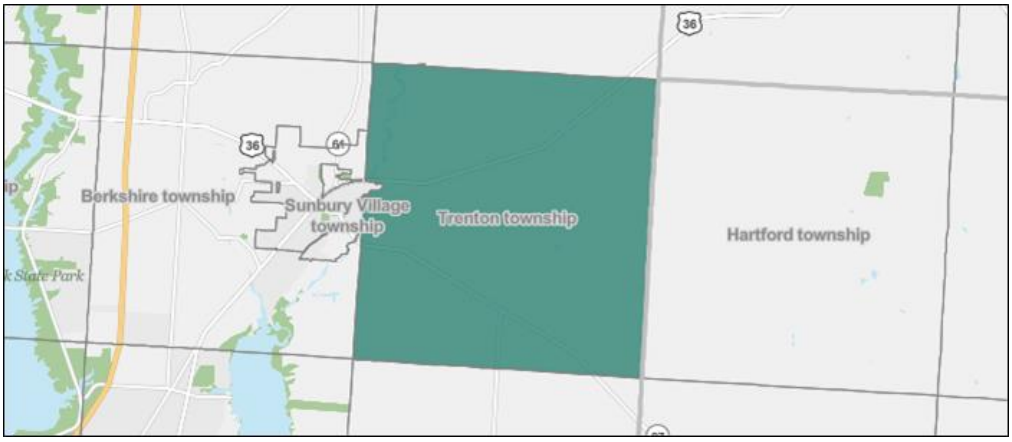


Figure 4: Map of Trenton Township's boundaries.

A small part of the City of Sunbury is located in the western part of the township. Trenton has a population of 2,276, 851 housing units, and 898 households within its 26.6 sq. mi. area.[4] The median income in the township is $110,385.[5]

Village of Galena

The Village of Galena is located in the southern area of the fire district. The village sits at the convergence of the Little and Big Walnut Creeks, the headwaters of Hoover Reservoir encompassing an approximate total area of 1.7 sq. mi. Established in 1809 as a milling center, the village is best known for the Galena Shale Tile and Brick Company, which operated from the 1890s until 1983. Galena's historic New England style downtown still claims buildings constructed in the 1820s and bustles with restaurant and tavern activity today. Galena's 2020 U.S. Census population was 924, an estimated increase of 41.5% compared to 2010 data. Much of the original village includes older homes, while newer subdivisions began being built in 2005. The most recent census data indicates there are 315 housing units and 328 households within the village.[6]

[4] U.S. Census: 2020 Decennial Census Data.
[5] U.S. Census: 2020 Decennial Census Data.
[6] U.S. Census: 2020 Decennial Census Data.

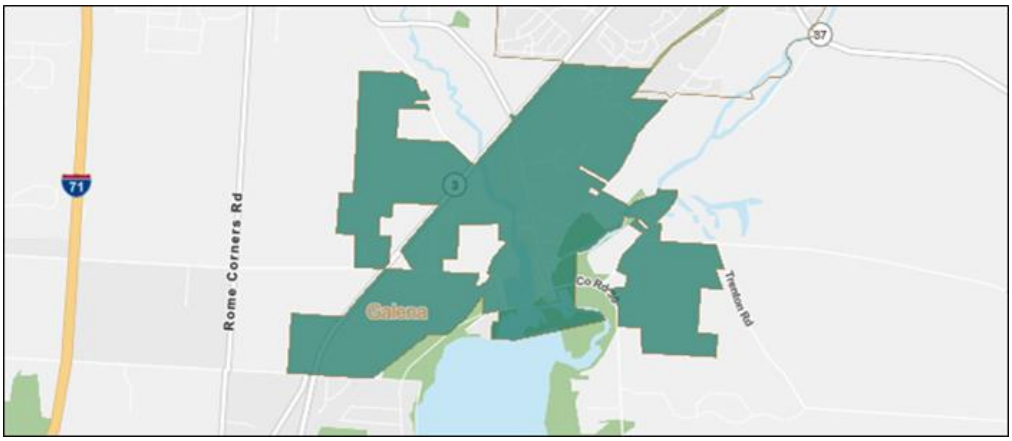


Figure 5: Map of the Village of Galena's boundaries.

The village is governed by a mayor and council comprised of six members who are elected by the voters of the village on an at-large, non-partisan basis. The mayor serves as the "chief conservator of the peace" within the village and as the president of the village council. As the governing body, council passes local laws, makes appointments to various boards and committees, and awards various contracts for purchases of goods and services used by the village. They also review, amend, and adopt the annual budget for the village prepared by the village administrator and the fiscal officer.

A volunteer fire department was created to provide fire protection services in 1939. In 1973, the village's fire department became part of the fire district.

Much of the housing stock in Galena was built relatively recently. The construction of new real estate can often be taken as an indication that the local Galena economy is robust, and that jobs or other amenities are attracting an influx of new residents. This seems to be the case in Galena, where the median household income is estimated at $102,083.[7]

Because of many things, Galena is considered a great place for families with children and a destination area for visitors. As previously discussed, Galena is situated between Big Walnut Creek and Little Walnut Creek on a peninsula at the north end of Hoover Reservoir, which is the City of Columbus' drinking water supply. The Galena area offers all sorts of opportunities for nature lovers, hikers, bicyclist, anglers, and boaters depending on the water levels of the creeks and of the reservoir.

[7] U.S. Census: 2020 Decennial Census Data.

DEMOGRAPHICS

The BST&G Fire District provides services to a residential population estimated at 15,291. The population served is 88.6% White, 2.8% Hispanic or Latino, 2.3% Asian, 2.0% African-American, and other ethnicities makeup the other 7.1% of the population.[8] Six percent of the population is under five years of age and 12.8% is over 65 years of age and the median income is $106,234. There are 5,593 housing units in the four communities.[9] Since 1970, the fire district has experienced an overall 110% increase in population as displayed in Figure 6.[10]

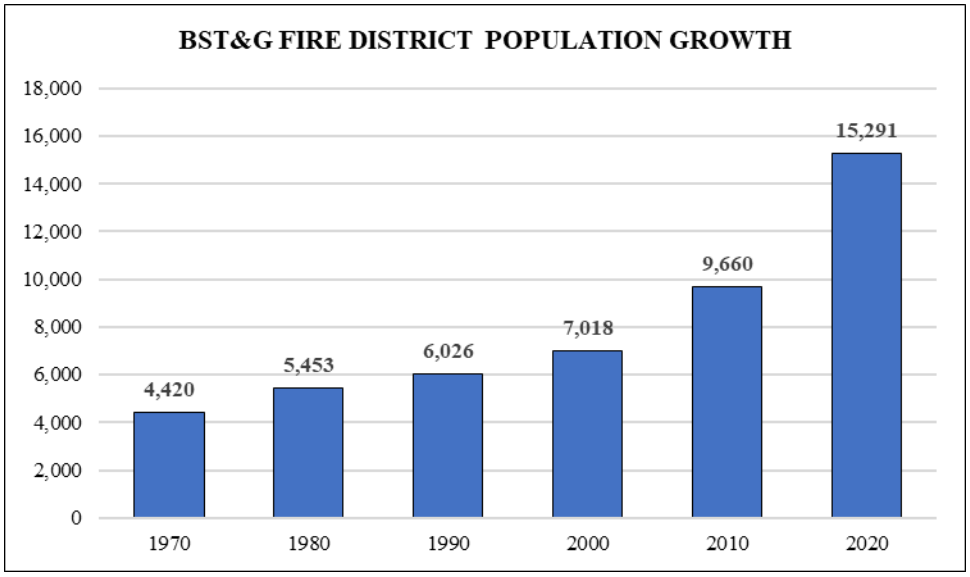


Figure 6: BST&G fire district's 50-year population growth.

A detailed summary of 2020 U.S. Census demographic data as it relates to BST&G Joint Fire District is provided in Appendix B.

Population Growth Estimates

BST&G Joint Fire District has provided fire protection services to the residents of the fire district since 1953. Over the years, the fire district experienced exponential growth in the number of residents served, the area of coverage, and the complexity of emergency responses, while the number of fire stations and personnel have not maintained the pace. Figure 7 shows the projected population growth numbers of the fire district through 2040.[11]

[8] U.S. Census: 2020 Decennial Census Data.
[9] U.S. Census: 2020 Decennial Census Data.
[10] Delaware County Regional Planning Data.
[11] Delaware County Regional Planning Data.

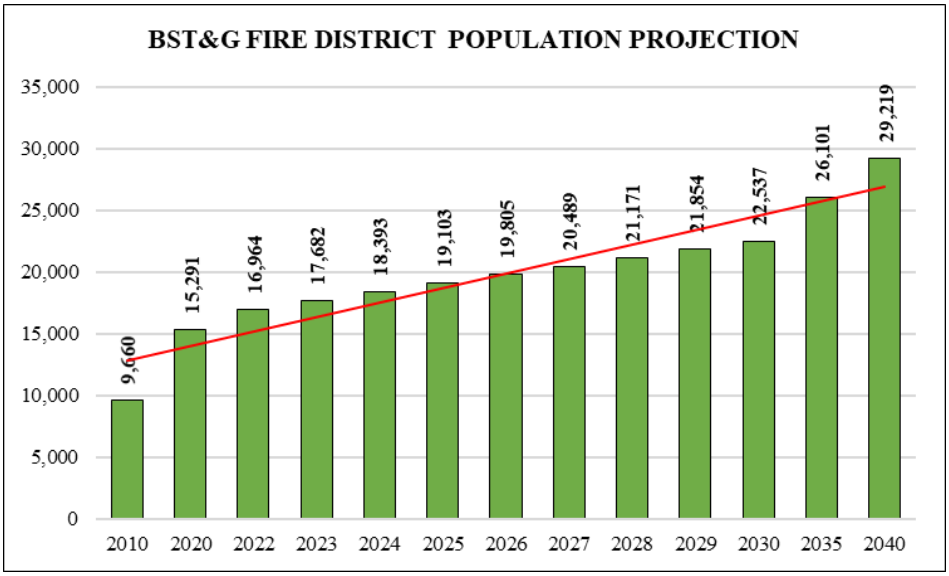


Figure 7: BST&G fire district's population growth estimates to 2040.

ECONOMIC DEVELOPMENT AND GROWTH

The continual changing landscape of the fire district discloses rapid growth and resulting development patterns – demographics, commercial and residential real estate, mobility, infrastructure enhancements, and more have shifted in a big way compared to even just five years ago. Residential and commercial development in the fire district means the construction of buildings, with the structures themselves being vulnerable to all hazards, as well as the building's occupants within. This risk creates the potential for major loss to the areas served in terms of life safety, economic impact, and loss of tax revenue.

Planned (approved) and in-progress development projects are concentrated to the south, southwest, west, and northwest of the current fire station and Sunbury's core area. The map displayed in Figure 8 plots the locations of all of the fire district's planned and currently in progress residential, commercial, and industrial new construction.

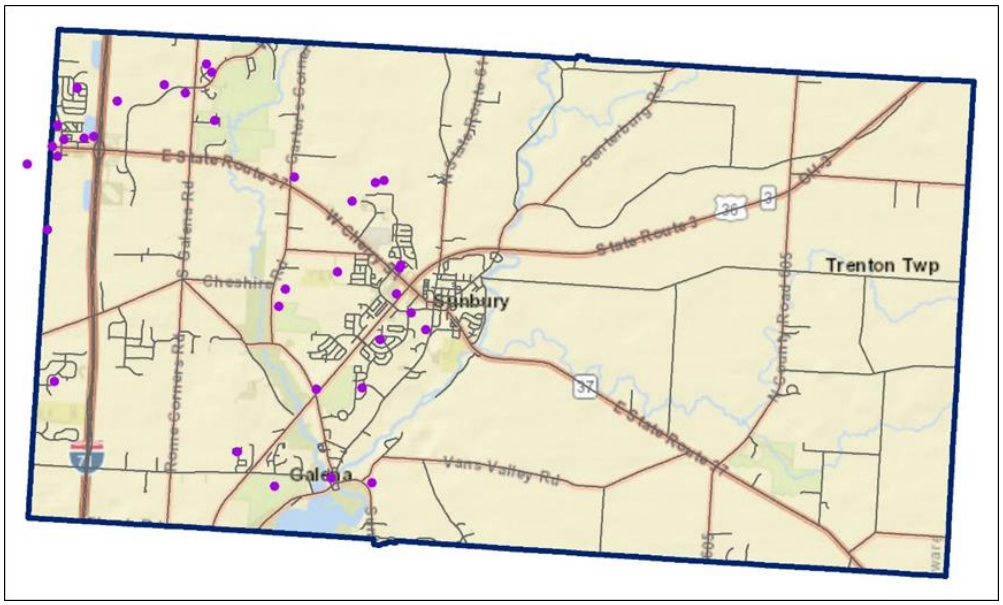


Figure 8: BST&G's plotted new construction and development projects.

Within the fire district, investment in the communities has continued at a relatively steady pace in the form of new residential, retail, office, and industrial projects. There was a significant increase in the number of residential building permits and an increase in commercial building permits from 2016 to 2021 as exhibited in Figure 9.[12]

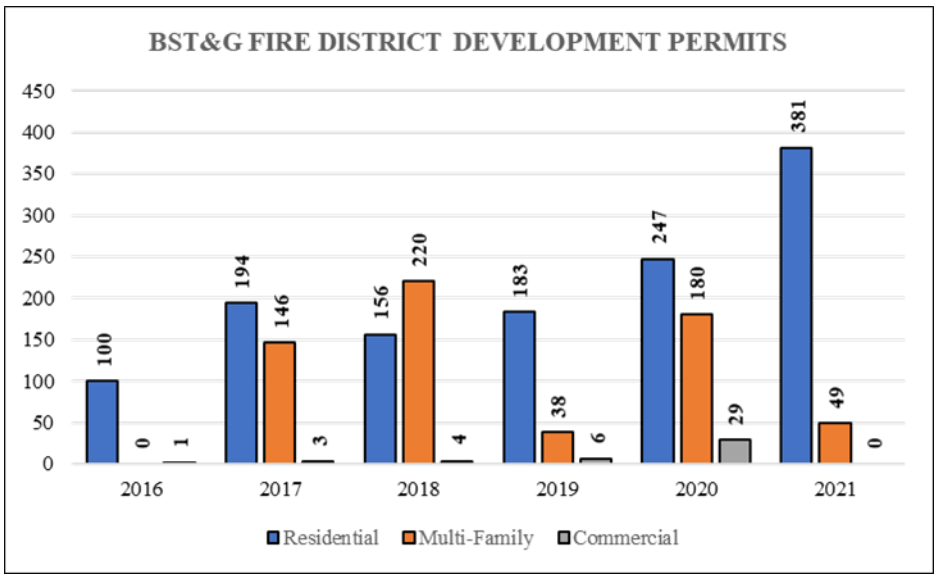


Figure 9: 2016 - 2021 building development permits issued within the fire district.

[12] BST&G Fire District and Delaware County Regional Planning Data.

Residential projects, which include single-family, duplexes and three- or four-family buildings, increased 124.5% over the past six years span of time in the fire district, while commercial projects increased 187%. Future developments include:

Figure 10: Northlake Preserve single-family homes development in Sunbury.

- Rolling Hills, a planned residential development will be constructed upon the grounds of the closed Sunbury Golf Course. It will consist of 150 single-family homes on 67.58 acres, with 14.68 acres retained as common open space owned and maintained by the homeowners' association.
- Price Ponds, a planned residential development that will be constructed on 183.97 acres of the Price Farm. The development will consist of 336 single-family homes.
- Eagle Creek, a planned 253-lot residential subdivision development will be constructed on approximately 85 acres as part of a Planned Residential District in the City of Sunbury. The subdivision will be located to the west of Interstate 71, south of U.S. 36 / OH SR-37 and east of Three B's and K Rd.
- Ravines at Meadow Ridge, planned development that will be constructed on 63 acres west of I-71 on property recently annexed by the City of Sunbury. The development will consist of 792 multi-family units, and extend the western boundary of the fire district to Africa Rd.

Figure 11: Rendering of the Ravines at Meadow Ridge development.

Proposed development along the I-71 corridor in the area of U.S. 36 and OH SR-37 has predominantly taken the form of retail and commercial services. In 2016, Berkshire Township welcomed Tanger Outlets; a popular retail outlet destination that features a mix of designer outlet stores and brand-name shops in a spacious, pedestrian-friendly setting. Future development projects include two four-story hotels and a recreational-vehicle dealership and service center. The 33,000-square feet (sq. ft.) facility will be on approximately 16 acres and have two entrance sites. Future development has also been proposed at Fourwinds Dr. and Fourwinds Court. Sunbury Fourwinds retail sites, a 54-acre commercial development location is situated in the southwest quadrant of the I-71 and U.S. 36 and OH SR-37 interchange. The entire property is zoned Planned Commerce District, which allows a wide variety of commercial and retail uses, as well as multi-family residential. Two 300-unit apartment complexes are also in the proposal planning phases in the area of Tanger Outlets.

Transportation

Highway interstate interchanges can create opportunities and challenges for communities with respect to land use and economic development. The development of an effective highway system, designed to carry large numbers of vehicles rapidly and safely over long distances, requires smooth functioning of the interchanges that connect the main highway to the intersecting roadways.

Recent economic and housing development in the area will also impact transportation. The Ohio Department of Transportation announced a new highway interchange construction project that will start in late 2022. The project is planned along I-71 between Cheshire Rd. and U.S. 36 / OH SR-37 (Delaware Sunbury Rd.) in Sunbury. The interchange will connect I-71 to Sunbury Parkway, a proposed roadway that is to be built by developers and connect to U.S. 36 / OH SR-37. Figure 12 displays the new highway interchange project.[13]

Project benefits include:

- Maintains competitive infrastructure by relieving traffic congestion at I-71 and U.S. 36 / OH SR-37, a regional commercial center and truck route;
- Adds value to the transportation system by improving access to area businesses, such as Hitachi Astemo, Kroger Midwest Distribution, and Tanger Outlet Mall;
- Leverages significant private contributions, including tax increment financing and New Community Authority revenues from the Tanger and Northgate developments;
- Increases safety by addressing exit ramp queuing back-ups onto the I-71 mainline; and

[13] Ohio Department of Transportation.

- Aligns with existing planning documents, including the *City of Sunbury's 2016 Thoroughfare Plan*.[14]

Figure 12: New planned I-71 interchange construction project south of U.S. 36 / OH SR-37.

Big Walnut Local School District

The Big Walnut Local School District (BWLSD) was established in 1950. The BWLSD encompasses approximately 109 sq. mi. in Delaware County. Along with the communities of Sunbury and Galena, the BWLSD serves students from the townships of Berkshire, Genoa, Harlem, Kingston, Porter and Trenton. These students are accommodated in one early learning center (preschool), four elementary schools (grades kindergarten through four), one intermediate school (grades five and six), one middle school (grades seven and eight), and one high school (grades nine through 12). The ages of the buildings vary, with the oldest built in 1926 and the latest opening in the fall of 2020. The school district also operates an administrative office building, a transportation building, and a maintenance facility. The opening of a new high school was planned to occur in January of the 2021-22 school year. Recently constructed Prairie Elementary and Big Walnut High School share a campus as shown in Figure 13.

[14] Mid-Ohio Regional Planning Commission.

Figure 13: BWLSD Prairie Elementary and Big Walnut High Schools.

The school district has experienced a significant increase in enrollment over the past 10 years. Based on a most recent enrollment study by FutureThink, Inc. (a national planning firm based in Columbus, Ohio that specializes in educational facility planning) completed in June 2019, the school district's enrollment was trending close to the 150 new homes per year projection, which are 4,404 and 4,673 for fiscal years 2025 and 2029, respectively.

FIRE DISTRICT HISTORY

The BST&G Joint Fire District came into existence in 1953 to increase the level of fire protection in the service areas. During its first 20 years, the fire district provided protection to the areas of Berkshire, Sunbury, and Trenton. Galena joined the fire district in 1973. The fire district was staffed by an all-volunteer force and one part-time firefighter apparatus driver until 2008. A full-time fire safety inspector was added in 2014 and three full-time lieutenants in 2015. Currently, the department averages a daily staffing of five to seven personnel, not including the fire chief and assistant chief.

BST&G JOINT FIRE DISTRICT MISSION AND VISION

All organizations should have a mission statement. A carefully crafted mission statement describes an organization's purpose, function, and services provided. This provides the foundation for the organization's direction and service goals. A mission statement often informs the vision statement, which describes where the organization aspires to be in the future. BST&G Joint Fire District has a clearly developed mission and vision, along with defined core values that identify the organization's culture and belief system.

Mission Statement

We, the men and women of the BST&G Fire District commit to providing a superior service to the citizens we serve through training, education, and willingness to exhaust all options to protect life and property while honoring our vision and core values while reaching our goal of incident stabilization.

Vision Statement

We will provide education, respond to emergencies, as well as provide service to our community to the best of our ability. We will give the highest level of service possible, given our available resources, and do in the most proficient and responsible means. We will continue to provide the highest level of service expected from our citizens and continue to pro-actively evaluate our citizen's needs to shape the future of our fire district.

Core Values

"The Big Four"

Treat People Right
Do Your Job
All in Attitude
All Out Effort

Passion
Dedication
Integrity
Courage

SERVICE AREA

The fire district provides fire suppression and protocol-based first responder and support emergency medical service (EMS) to all areas within the fire district. Emergency medical transport is provided by Delaware County EMS (DCEMS), which will be discussed later in this section. The fire district operates from one fire station facility located at 350 West Cherry Street (St.), near the intersection of OH SR-3 and U.S. 36 / OH SR-37 in Sunbury.

The fire district provides and receives mutual-aid assistance to and from other fire agencies throughout Delaware County under the Delaware County Mutual Aid Agreement, which is under

revision at the time of this report. Automatic mutual-aid response (AMR) is provided to and received from Genoa, Harlem, Berlin, and Tri Twp. Fire Departments, Porter Kingston Joint Fire District, Central Ohio Joint Fire District, and Hartford Joint Fire District. Mutual aid is assistance that is dispatched, upon request, by a responding fire department. AMR is assistance that is dispatched automatically by a contractual agreement between two fire departments, communities, or fire districts. Figure 14 is a map of the Delaware County and surrounding service area.[15]

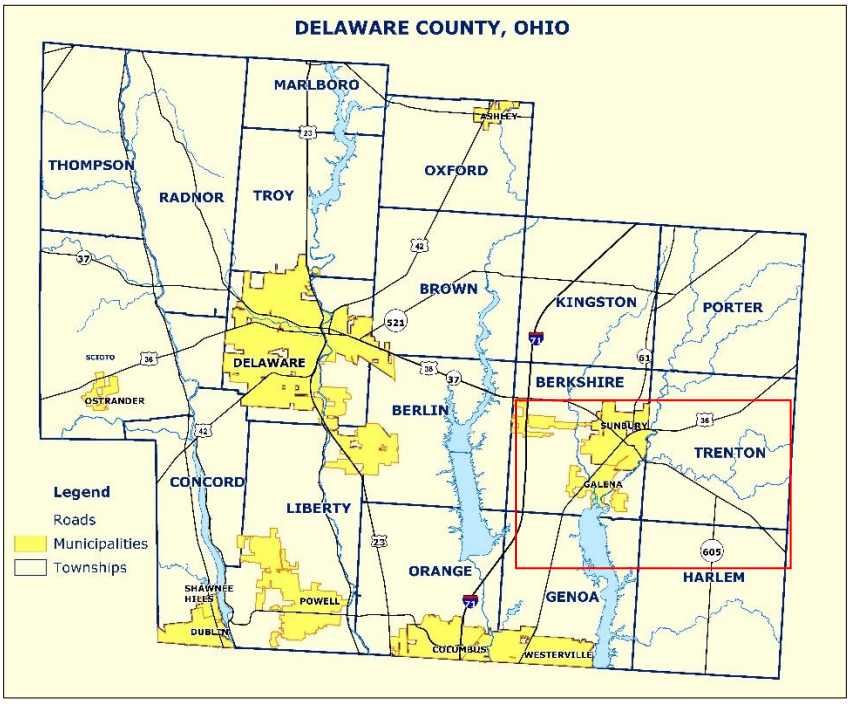


Figure 14: Map of Delaware County and the fire district's surrounding jurisdictions.

DCEMS is an independent agency that has responsibility to provide emergency medical care for the residents of Delaware County. DCEMS is a dedicated partner to the fire district and the residents and visitors of the communities served by the fire district and their health. The agency provides Advanced Life Support (ALS) medical care and transportation to hospital emergency departments. DCEMS is operated by the

Figure 15: DCEMS Station 2 facility in Sunbury.

[15] Preservation Parks Delaware County.

Delaware County Board of Commissioners and is funded through a 0.5% sales tax.

DCEMS has 11 strategically located stations throughout the county with the goal of arriving at an incident location within five to eight minutes after a call for assistance. The agency staffs each station around-the-clock. The fire district is primarily served by DCEMS Medics 2 and 11 assigned to Station 2 located 283 West Granville St. in Sunbury.

FUNDING

Voter approved fire or EMS levies of millage against real property within the fire district's boundaries is the method of funding permitted by the Ohio Revised Code. The fire district has existing millage for operations totaling 4.85 mills, which generated approximately $2,586,311 in 2020. A fire levy renewal has been approved for the ballot in May 2022. Other revenue sources (i.e., plans review; fire protection systems, fire prevention and life safety permitting; and daycare facility inspections) were estimated at $14,000. The fire district has been historically supported by the communities as evidenced by the support at the ballot box.

Expenditures for fire district operations in 2020 were $2.49 million. There were significant expenditures of $30,000 for the acquisition of a utility terrain vehicle, $40,000 for the replacement of technical rescue equipment, and matching funds for awarded grants for self-contained breathing apparatus (SCBA), SCBA cylinder filling compressor and fill station, and personal protective firefighting gear. Due to good management, the fire district started 2021 with an estimated $2,978,000 carryover.

SERVICE DEMANDS

As stated previously, the fire district provides fire suppression response and protocol-based first responder and support EMS. The fire suppression response includes responses to incidents that are non-fire such as carbon monoxide detector activation, a person stuck in a stalled elevator, gas or fuel leaks, or a rescue situation. While the fire district does not provide transport ambulance service, all firefighters are trained in pre-hospital emergency medical care at a minimum of the emergency medical technician (EMT)-Basic level. The agency also has six paramedics trained in ALS. The agency currently responds on all ALS level EMS incidents jointly with DCEMS, which is the provider of ALS and transport services. The agency also provides a variety of community outreach and risk reduction services such as fire prevention, fire safety education, and fire investigation.

The fire district has experienced a general increase in calls for service over the past 10 years. In 2011, the fire district responded to 867 calls for service. By 2020, this number had increased to 1,147, which is a 28.9% increase. Note that an "incident" is actually a "call for service" or a

"response" to a call for service, which is reflected in an incident count. If multiple companies or units respond to a fire, it counts as one incident or call for service. Mutual-aid responses also are included in the total service demands. For example, there were 149 mutual-aid responses "given" to other fire departments in 2020. The fire district's calls for service over the past 10 years are displayed graphically in Figure 16.[16]

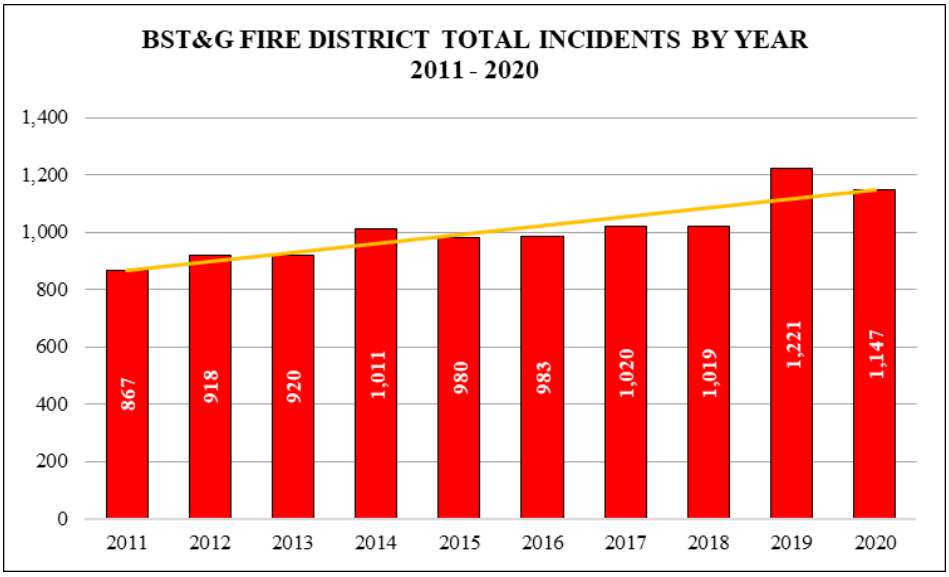


Figure 16: BST&G's 10-year incident response totals by year.

EMS assist responses increased 37% while fire responses increased 32% over the same 10-year period. In addition to building and vehicle fires, this number includes fire alarms, rescues, carbon monoxide calls, service calls, and other non-EMS responses. EMS responses include motor vehicle accidents. Figure 17 shows a comparison of all fire and EMS responses over the past 10 years.[17]

[16] BST&G Fire District Data.
[17] BST&G Fire District Data.

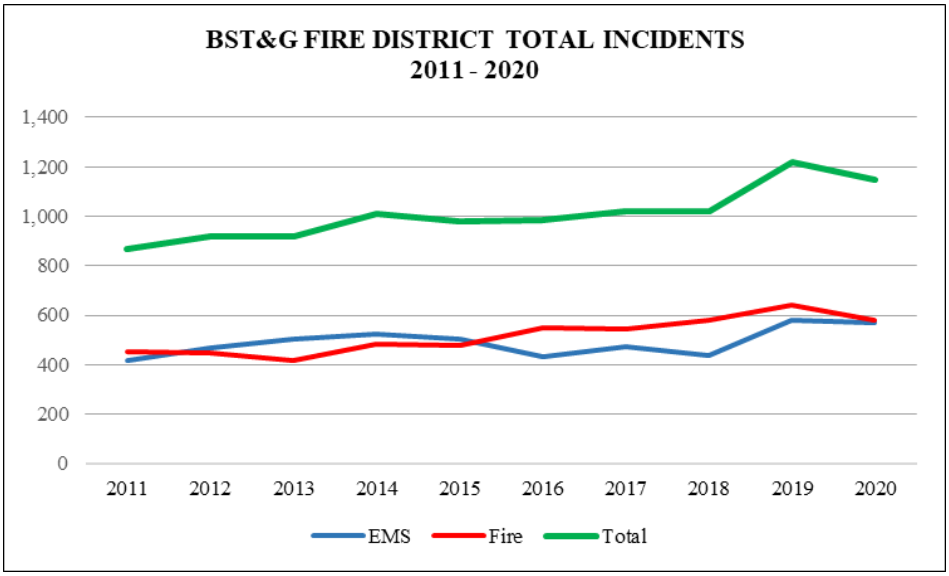


Figure 17: BST&G's 10-year incident response trends.

Incident Response Workload Analysis by Community

Areas experiencing increased development, whether expansion or in-fill, cause the need for consideration of how the development will impact current response system performance. One of the ways to monitor the impact is to monitor the response workload for each community in the fire district. In Figure 18, each community's number of incidents, with a comparison to the overall percentage is presented.[18]

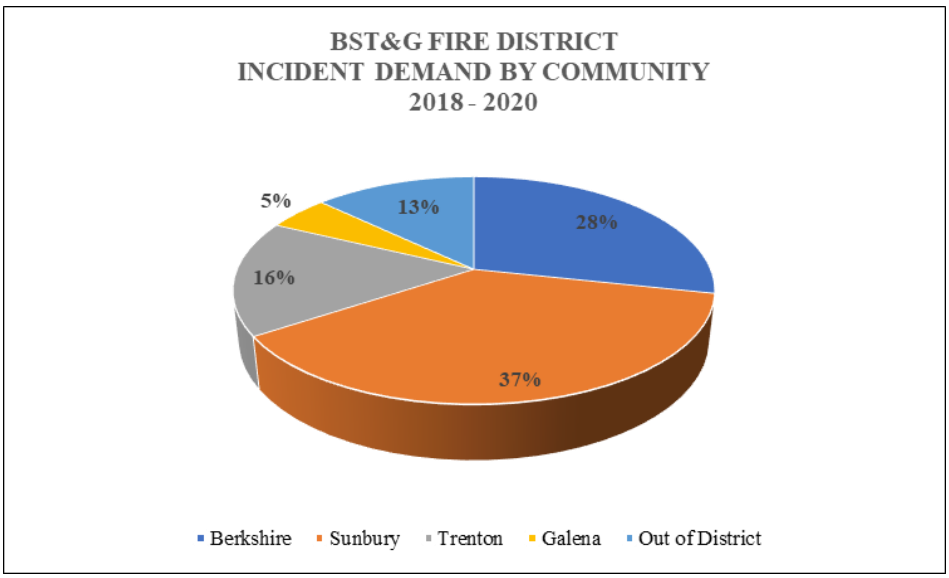


Figure 18: Incident demand comparison by community (2018-2020).

[18] BST&G Fire District Data.

During the period of 2018 – 2020, Sunbury experienced 37% percent (1,267 incidents) of the overall emergency responses (3,401); followed by Berkshire Twp. at 28% (963), Trenton Twp. at 16% (557), Galena at five-percent (167), and out of district responses at 13% (439). For comparison, the density of population in Sunbury is relatively high as compared to the rest of the fire district. As discussed in the Growth and Development Section, areas of the fire district considered to experience significant growth due to the intensity of the proposed development are predicted to have significant impact on response totals as the developments progress.

Service Demand to Population Ratio

In addition to population growth, the total number of emergency incidents increased since 2011. Another analysis can be derived by determining the ratio of emergency incidents to the overall population growth to see if the call volume is changing in proportion to the population growth, or if the population is using the services at a greater rate.

As depicted in Figure 19,[19] the percentage of calls to population in 2011 was approximately 8.2%. The ratio continued to climb or fall gradually over 10 years period, but the long-term trend shows overall growth in the percentage of emergency incidents to the fire district's population. By 2019, the percentage of calls to the overall population grew to 9.2%. Therefore, as the population of the fire district grew (risk to be managed), the total number of emergency incidents grew (demand for services), and the ratio of emergency incidents to population increased (consumption rate).

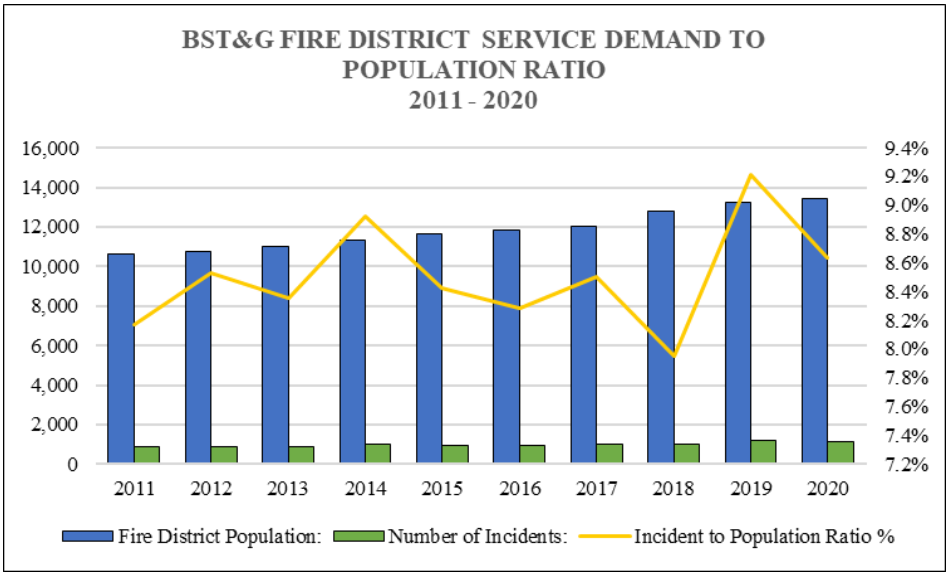


Figure 19: BST&G fire district service demand to population ratio (2011-2020).

[19] BST&G Fire District and Delaware County Data.

The annual recorded fire loss has fluctuated over the past five-years (2016-2020). Fire loss is an estimation of the total loss to property and contents in terms of replacement in like kind and quantity. This estimation of fire loss includes contents damaged by fire, smoke, water, and overhaul (the process of searching for hidden fire extension on a fire scene). It does not include indirect loss such as business interruption. Fire loss is difficult to predict and one large-loss event can skew any statistical analysis. The fire loss was $240,600 in 2016 and $2,211,613 in 2020. There was a decrease in fire loss in 2019 with a total recorded loss of $82,250. The total fire loss is a combination of all fires including those classified as commercial, residential, vehicle, dumpster, and miscellaneous small fires. Commercial occupancies (e.g., business, mercantile, utility, etc.) accounted for half of the recorded fire loss (50%) during the five-year period.

The fire district experienced zero civilian fire fatalities over the past five years. During the same period, there were two civilian injuries as a result of exposure to fire by-products such as smoke or heat, received while attempting to control or escape from a fire.

Temporal Analysis

In addition to evaluating the types and frequency of emergency incidents that produce the service demand, the timing of these events is critical to understanding when service demand will most likely be at its greatest. Knowing when to predict high demand periods enables administrators to alter staffing plans to ensure staffing levels are sufficient, and aids in scheduling additional duties such as training, fire safety inspections, and vehicle maintenance. Note that in each of the temporal analysis categories, the data presented is the sum of three consecutive years (2018-2020).

<u>Service Demand – Month of the Year</u>

In Figure 20, the temporal analysis begins with an examination of service demand by month of the year.[20] The service demand is slightly unique in the fact that the incident volume is higher in June and July, as opposed to the fall and early months. Often, communities with significant retail and commercial businesses existence see increases in visitors in the months preceding and during the winter holiday season, adding to service demand. But, the four-month period of late fall and winter months (September-December) only account for 33.44% of the annual incidents.

[20] BST&G Fire District Data.

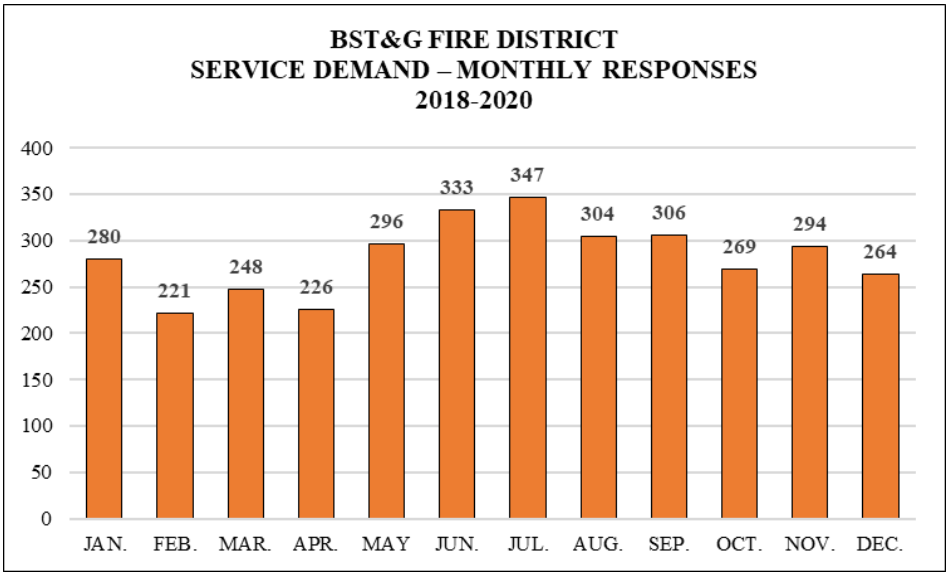


Figure 20: Service demand by month (2018-2020).

The busiest two months are June and July, and together they account for 20.07% of the annual incidents, whereas the average would be 16.67% for two months of the year.

Service Demand – Day of the Week

Next in Figure 21, the temporal analysis continues with an examination of service demand by day of the week.[21] In some areas, such as retail centers and areas with large employment centers, populations fluctuate by the day of the week. When these significant fluctuations occur, often the emergency incident call volume fluctuates similarly.

[21] BST&G Fire District Data.

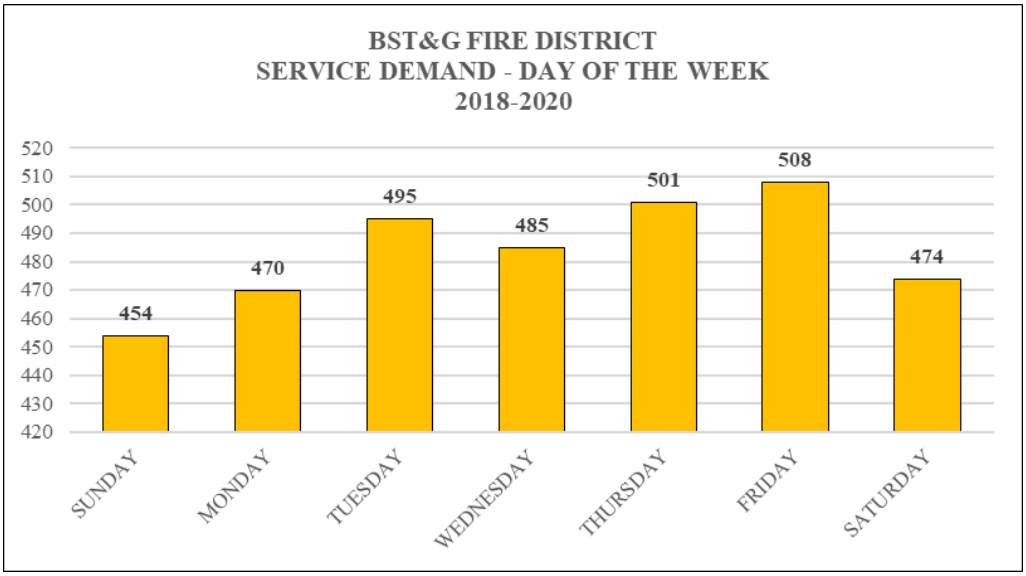


Figure 21: Service demand by day of the week (2018-2020).

In evaluating the annual emergency calls for service by their corresponding day of the week (the sum for three consecutive years) it is interesting to see the gap between the busiest day (Friday) and the slowest day (Sunday). The difference in the two days is approximately seven incidents per day, annualized. This may be common, as most communities see an increase in incident volume during the workweek due to an increase in transient population, either due to retail or education opportunities, healthcare options, or simply the commercial workforce.

Service Demand – Hour of the Day

The final temporal analysis of service demand examines service demand by hour of day, as displayed in Figure 22.[22] Data from these analyses are designed to identify trends, abnormalities, and baseline support for evidence derived.

[22] BST&G Fire District Data.

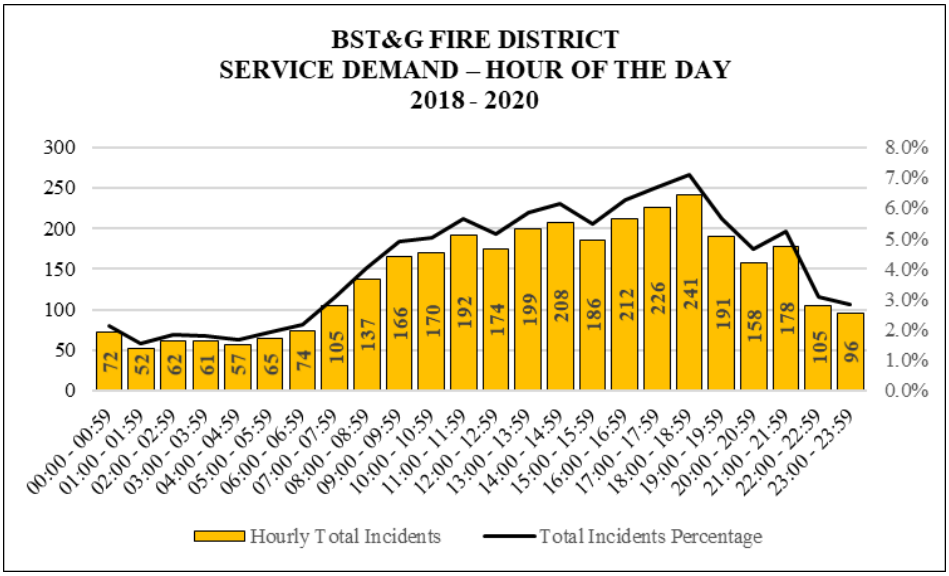


Figure 22: Service demand by hour of day (2018-2020).

The analysis of service demand by hour of day is related to the activities within the community where demand for service is higher during regular working hours and declines during the nighttime and overnight hours.

As presented by the data in Figure 23, 48.36% of the incidents occur between the eight-hour period of 11:00 AM and 7:00 PM.[23] The busiest single hour (6:00 – 7:00 PM) and the busiest eight hours of the overall day are within this period. These consecutive hours of the day account for slightly less than one-half of the emergency incident responses of the entire 24-hour day.

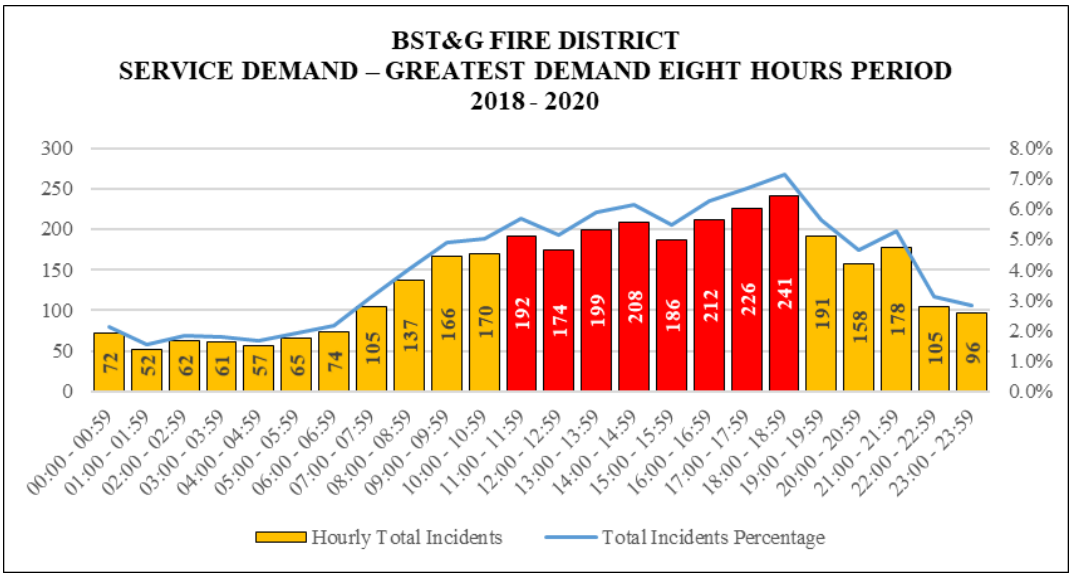


Figure 23: Greatest service demand by hour of day, 8 hours period.

[23] BST&G Fire District Data.

Finally, in Figure 24, the busiest service demand 12-hour period is the continuous hours of 10:00 AM to 10:00 PM where 68.94% of the overall emergency calls occur.[24]

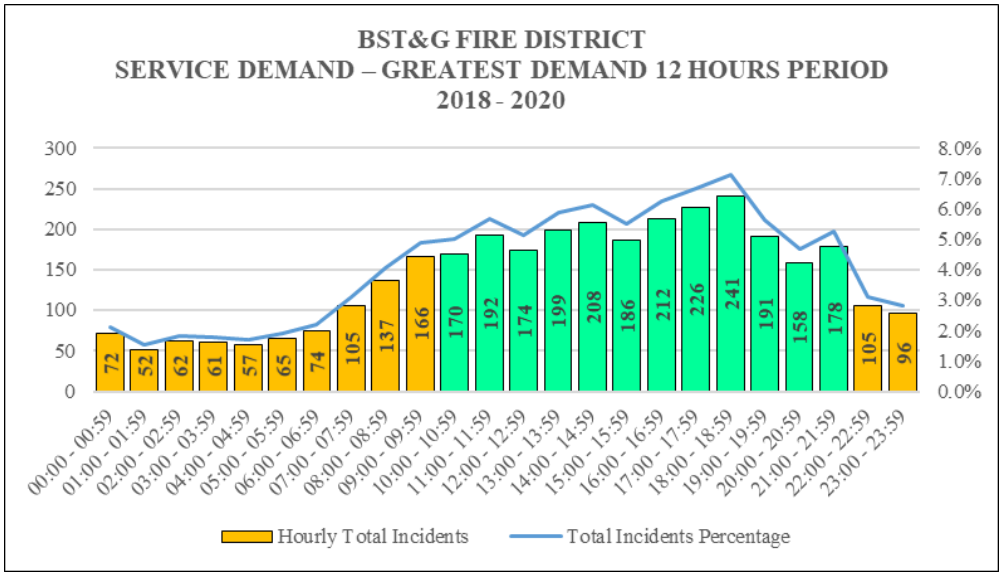


Figure 24: Greatest service demand by hour of day, 12 hours period.

It is important to also note that while service demand is lower in the early morning hours, fire statistics gathered by the United States Fire Administration consistently show that residential fire fatalities occur most frequently late at night or in the early morning hours.

Technical Rescue

Technical rescue is a term used to describe special response situations including vehicle and machinery extrication rescue, confined space rescue, rope rescue, trench rescue, fast-water rescue, static-water and ice rescue, structural collapse, and hazardous materials (haz-mat) response. Technical rescue incidents are referred to as high-risk, low-frequency events, which are dangerous to mitigate and involve a special set of skills, procedures, and equipment for each particular rescue situation. It is often very costly to implement and maintain proficiency in each technical response capability. While a formal technical rescue assessment of the fire district was not performed, the fire district's response capability in each technical rescue response area was reviewed.

Vehicle and Machinery Rescue – these types of incidents involve removing a vehicle or machinery equipment from around individuals who have been involved in a motor vehicle, industrial, or agricultural related accident, when conventional means of exit are impossible or inadvisable. A skilled and coordinated approach is needed to minimize further injury to a victim

[24] BST&G Fire District Data.

during the extrication process. These operations are usually accomplished by using cribbing and bracing for stabilization and hydraulic or battery-powered tools (sometimes generically referred to as the "Jaws of Life") and high-pressure air bags. The agency has the equipment and personnel are trained to respond and handle these types of incidents.

Confined Space Rescue – includes incidents in which a victim(s) is trapped within an area that qualifies as a confined space. A confined space may be found in agricultural (i.e., grain bin or silo accidents), industrial, and other settings as defined by the Occupational Safety and Health Administration (OSHA). The agency has limited equipment and training for this type of response. If an incident occurs, the Porter Kingston Joint Fire District, which has confined space rescue capability can be called for assistance.

Rope Rescue – includes incidents that are above grade (elevated) or below grade and require the use of rope rescue systems to reach and rescue victims. A rope rescue incident could be part of a confined space incident depending on the location of the victim. The agency has the equipment and 10 personnel trained at the technician level that regularly train for this type of response. However, if an incident occurs, the Licking County Technical Rescue and Delaware and Genoa Twp. Fire Departments can be called to assist.

Trench Rescue – these incidents are also referred to as trench "cave-in" incidents and involve an excavation trench or underground cave-in that traps a victim. The agency has limited equipment and training capabilities for this type of response. If an incident occurs, the Porter Kingston Joint Fire District, which has trench rescue capability can be called for assistance.

Swift-Water Rescue – these incidents involve the rescue of a victim(s) from fast moving water such as a river or other large stream. Of special concern are low-head dams, which can create dangerous currents and conditions, especially when river or stream water levels are elevated or during flood stage. The fire district has two low-head dams in its response area. The agency has 10 personnel trained at the technician level, one inflatable boat and associated rescue equipment, and train quarterly for this type of response.

Static-Water and Ice Rescue – these incidents involve the rescue of a victim(s) from a non-moving body of water such as ponds, quarries, or lakes. During winter, these types of incidents can involve surface ice. Each rescue involves a specific set of equipment and operating procedures. While the fire district does inventory the resources to conduct "boat-based" rescues on a limited basis, the agency relies on assistance from Genoa, Tri Twp., Berlin, and Orange Twp. Fire Departments for boat resources if an incident occurs within the agency's service area.

Rescue incidents involving any of the aforementioned water hazards require a specific set of equipment and operating procedures. The fire district has rescue equipment and personnel that

are trained for static-water and ice rescue incidents.

Structural Collapse Rescue – these incidents are often associated with large scale urban search and rescue operations following natural occurrences such as earthquakes or high-wind events. The fire district will respond to an incident where structural collapse or instability will have to be managed. Examples of incidents where structural collapse has to be managed include: vehicles or aircraft versus buildings; unsafe structures as a result of a gas explosion or structure fire, building construction or renovation failures, or natural forces related to weather (e.g., rain or snow accumulations on roofs, tornados, etc.). In managing these incidents, it is often necessary to push, pull, cut, breach, lift, or tunnel through the materials that make up the collapsed structure. Agency personnel are trained in basic shoring and stabilization techniques for single-point responses. Multiple-point responses are spread out over a larger area, involve many locations, and will require a larger resource pool, including outside agency support, large-scale incident management support, and technical expertise. If an incident occurs, the Porter Kingston Joint Fire District, which has structural collapse rescue capability can be called for assistance.

Hazardous Materials – All agency personnel have training in haz-mat response at both the technician and operations level. Operations level-trained personnel have the training and equipment to identify hazardous material presence through various recognition factors such as placards and labels, container shapes and sizes, and haz-mat sites in the response area. They also have the ability and equipment to undertake defensive type of actions and low-risk offensive operations such as placement of booms and absorbent pads, plugging, patching, diking, and other containment actions that help control or mitigate the incident. Technician level-trained personnel assume a more aggressive role than those at the operations level in that they will approach the point of release in order to plug, patch, or otherwise stop the release of a hazardous substance. The more advanced offensive operations can require the use of level “A” (completely encapsulated protective equipment) or acid splash suits require a technician level response.

Mitigating more complex haz-mat incidents that are considered moderate, high, and maximum risk may require mutual-aid assistance from other area fire departments and the Delaware Area Response Team (DART). DART is comprised of 13 fire departments and other member agencies across Delaware County. Each township and city are responsible for different equipment and operational assignments that is vital to DART's haz-mat operations. For example, the fire district’s primary responsibility is the east-side Level-A Entry Team. In addition, the department shares oversight responsibility of communications equipment and the command vehicle.

INSURANCE SERVICES OFFICE

The Insurance Services Office, Inc. (ISO) is the leading supplier of statistical, underwriting, and actuarial information for the property and casualty insurance industry. ISO conducts field evaluations in an effort to rate communities and their relative ability to provide fire protection and mitigate fire risk. This evaluation allows ISO to determine and publish the Public Protection Classification (PPC™). The published classification is based on a scale of one through 10, with one being the highest rating and 10 indicating that the community's fire suppression program does not meet ISO's minimum criteria.

The fire district currently has a PPC rating of 04/4Y, which was effective April 1, 2020. The most current rating is an improved evaluation from the previous 05/5Y, which shows the efforts of the fire district to better its service delivery and fire prevention activities. The lower score indicates a more favorable rating, which can translate into lower insurance premiums for the business owner and homeowner. This lower classification makes the community more attractive from an insurance risk perspective.

How the PPC for each community affects business and homeowners can be somewhat complicated because each insurance underwriter is free to utilize the information, as they deem appropriate. Most underwriters in Ohio utilize what is called in the industry, the "suburban rule." In this case, the split rating identified for the fire district is a 04/4Y. What this means is that most businesses and residents in the fire district who are located within 1,000 feet (ft.) from a fire hydrant and not over five road miles from a fire station receive a rating of four. Those businesses and residents and businesses who are located more than 1,000 ft. from a fire hydrant but not over five road miles from the fire station receive a rating of 4Y, which previously was an 8B under the former rating system. The reason that the rating is generally not more favorable is due to the lack of a dependable water supply, primarily in the eastern and northeastern sections of the township. When the ISO field evaluation is conducted on communities, the overall water system, including pumping capacity, storage capacity, distribution system and system maintenance, carries a weight of 40% of the total evaluation. Most underwriters consider properties over five-miles from a recognized fire station a PCC of 10. In this situation, the property may be subject to higher premium rates for coverage.

The "fire department" section of the summary report accounts for 50% of the total classification. The section focuses on the number engine companies or pumping apparatus, reserve pumpers, and pumper capacity; number of aerial ladder/service companies and reserve ladder/service apparatus; deployment analysis; company personnel; training; and operational considerations. Ensuring that a sufficient amount of personnel is on duty, sufficient apparatus is available to respond, and appropriate fire station locations are important for this part of the credit scoring.

The fire district received a score of 23.46 out of 50 points possible in this section as shown in Table 1.[25]

AREAS OF EVALUATED	EARNED CREDIT	CREDIT AVAILABLE
513. Credit for Engine Companies	3.75	6.0
523. Credit for Reserve Pumpers	0.47	0.5
532. Credit for Pumping Capacity	3.00	3
549. Credit for Ladder Service	0.87	4
553. Credit for Reserve Ladder and Service Trucks	0.00	0.5
561. Credit for Deployment Analysis	3.13	10
571. Credit for Company Personnel	6.38	15
581. Credit for Training	3.86	9
730. Credit for Operational Considerations	2.00	2
Item 590. Credit for Fire Department:	**23.46**	**50**

Table 1: ISO "Fire Department" summary report section scoring.

While the overall summary report does not recommend additional fire stations, it can be implied that based on the following two items in the aforementioned table, additional resources are suggested to improve the fire district's ISO PPC rating. Specifically, the fire department section examined the number of needed engine companies, considered the response distance to built-up areas, basic fire-flow, and the fire district's method of operation. First, item 513 "Credit for Engine Companies" documented that the fire district has two pumping apparatus currently "in-service". However, the report identified that three in-service pumping apparatus are required in the fire district to suppress fires in structures with a "needed fire flow" of 3,500 gallons per minute (GPM) or less, which was reflected in a 3.75 out of 6.0 credit points. Needed fire flow is the amount of water that should be available for providing fire protection at selected locations throughout the fire district.

Second, for full credit, the fire district's fire protection area with residential and commercial properties should have a first-due engine company within one and a half road miles and a ladder service company within two and a half road miles. Item 561 "Deployment Analysis" reflected a score of 3.13 out of 10.0 credit points, which indicates the fire district is deficient in meeting the road miles criteria.

[25] BST&G Joint Fire District Public Protection Classification Summary.

RISK ASSESSMENT

For a community to appropriately understand the need and provide for emergency services, a coordinated and comprehensive assessment must be performed. The risk assessment involved performing a coordinated survey of every "target hazard" property in the fire district's coverage area. Target hazards are locally identified occupancies or properties that pose specific human and technological-caused risks (i.e., fire, emergency medical, haz-mat, and technical rescue) to occupants, fire service responders, or the community.

The community risk assessment (CRA) tool was used to perform a coordinated survey of every target hazard as identified by the fire district. Schools, institutions, and multiple-story residential buildings were also included in the survey. Each property was assessed for the risk posed for each of the following elements:

- life hazard
- community impact
- hazard index
- water supply
- building usage
- building construction
- number of stories
- square footage

Each of the aforementioned areas described received a rating score from one to three with one equating to low risk or impact and three representing high risk or high impact. Each property address was then provided with a final rating from zero through nine for the lowest risk properties to 21 - 24 for the highest risk (based on the eight rated categories). The following levels of identified risk are classified as defined in Table 2:

RISK	CRA SCORE
Maximum	21 - 24
Significant	16 - 20
Moderate	10 - 15
Low	0 - 9

Table 2: CRA scoring index.

The risk assessment survey was conducted with the assistance of the fire district's personnel and covered 299 target hazards in the four communities. Of the total properties analyzed, three

properties rated a maximum risk and 66 properties rated a significant risk. Table 3 summarizes each community's property risk assessment.

RISK	BERKSHIRE	SUNBURY	TRENTON	GALENA	PROPERTY RISK TOTALS
Maximum	2	0	1	0	3
Significant	27	29	7	3	66
Moderate	31	153	18	24	226
Low	0	4	0	0	4

Table 3: Summary of the fire district's risk assessment by community.

Each property assessed as a significant or maximum risk was plotted on a map and is displayed in Figure 25. The maximum risk properties are shown with a red dot and significant risk properties are shown with a blue dot.

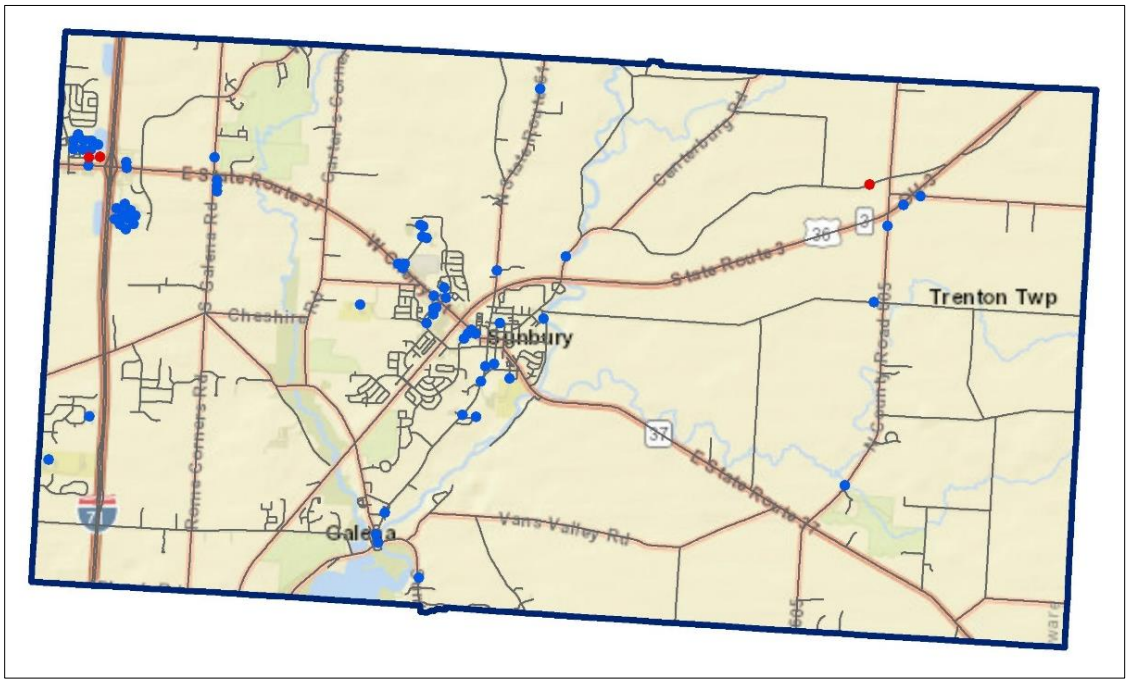


Figure 25: BST&G fire district's plotted target hazards locations.

Country View Care Center, located in Trenton Twp. at 14961 North Old 3C Highway is a maximum risk property. The facility specializes in skilled nursing, short-term rehab, long-term care, hospice care, and memory care for seniors living with Alzheimer's and Dementia.

Figure 26: Maximum risk property - Country View Nursing & Rehabilitation Center.

The Hampton Inn Hotel, located at 7329 OH SR-37 East and the Holiday Inn Express, located at 7301 OH SR-37, both in Berkshire Twp. are identified as maximum risk. While these properties feature automatic fire protection sprinkler systems, they can present increased complexity and challenges for the fire district's firefighters if a fire or other emergency occurs that threatens life safety. The primary challenge is verifying that all occupants have been evacuated and accounted for. This is accomplished by conducting a room by room or area by area search. Additional challenges include getting the needed fire hose, SCBA, and other necessary equipment to the floor or area where the fire is occurring. The firefighting strategies and tactics in these types of buildings require a significant amount of resources and are very labor intensive.

Figure 27: Maximum risk properties - Hampton Inn and Holiday Inn Express hotels.

While early detection and suppression of fire can positively impact fire incident mitigation efforts at these facilities, incidents affecting the facility or the welfare of the occupants may lead to the need for relocation of individuals or require long-term or permanent closure, and can have an impact on the availability of their services the community. As for emergency services resources, the number of personnel available in eight minutes driving time from nearby fire stations and the increased potential for difficulty in evacuation and rescue can pose significant challenges.

The fire district has nine school facilities located amongst its four communities. This includes four elementary schools, three intermediate or middle schools, a high school, and an early learning center. Although identified as significant risk properties, schools always pose a special challenge due to their size and number of occupants.

The fire district's Sunbury and Galena communities have business districts areas that contain several multi-story buildings (two- and three- floor levels), mixed-use occupancies, and small business and mercantile occupancies. Many of these properties individually can pose a moderate risk and some can rate a significant risk. However, with the age of the buildings and features of what is classified as "ordinary construction" methods, any fire gaining headway in one of these buildings can or may endanger numerous adjacent structures.

Ordinary construction is one of the five types of building construction methods. Ordinary construction features masonry or brick exterior walls with wood joists and interior structural components and can vary between two to six stories in height. These types of buildings are commonly existent in older downtown areas and often are referred to as "Main Street USA." These buildings rarely are protected with automatic fire-sprinkler systems, have multiple concealed spaces, and often are constructed abutting other similar buildings.

Source: NFPA 220 Standard on Types of Building Construction (2021)

There are a considerable number of apartment buildings in the fire district. Many of the buildings are part of multi-building apartment complexes in which their configuration pose accessibility challenges for responding fire apparatus. Depending on the age and size of the buildings, some may have automatic alarm systems and some may be equipped with automatic fire protection sprinkler or standpipe systems. There also are apartments and offices on the upper floors of some downtown businesses. The photos below are representative of the many apartment buildings in the district.

Figure 28: Sunbury "taxpayer" building with first-floor businesses and second-floor living spaces of ordinary construction.

Figure 29: Berkshire Twp. "multi-building" and "multi-floor" apartment buildings.

Figure 30: Berkshire Twp. "multi-building" townhouse apartment complex.

The fire district's manufacturers fuel the local and global economy by transforming raw materials into critical parts for products and designs that make, shape, and create the world we live in. Manufacturing sectors include precision machining, plastics, electronics, and industrial services. Several facilities from the fire district's target hazard list were rated as significant risk. The facilities may manufacture, use, transport, store and dispose of hazardous material products and dangerous wastes, which can pose a potential risk to the public health, safety and welfare, private properties, and the environment. Businesses include:

- Bry-Air, Inc. located at 10793 OH SR-37 West, Sunbury;
- Hitachi Astemo Ohio Manufacturing, Inc. located at 707 West Cherry St., Sunbury;
- Ohashi Technica Manufacturing located at 99 Burrer Dr., Sunbury;
- Holmes Lumber located at 3477 County Rd. 605 RD, Trenton Twp.; and
- AD Farrow located at 7754 OH SR-37 East, Berkshire Twp.

Figure 31: Hitachi Astemo plant facility in Sunbury.

Non-fire Risk Assessment Process

This section normally contains an analysis of the various non-fire related risks considered within the district. This would include non-fire or natural-caused risks such as flood, tornado, earthquake, drought, etc. Due to the limited scope of the project, this area was not included in the risk analysis.

FIRE STATION FACILITY

The fire district operates from one fire station facility located at 350 West Cherry St. in Sunbury (Figure 32). The station was constructed in 1985 to replace a station in the older section of Sunbury. It was most recently remodeled in 2017.

Figure 32: BST&G fire district's fire station facility and administrative offices.

Besides the station, the lot on which it is situated also comprises a large three-bay storage building and areas for parking and outdoor training. The lot is positioned on a main thoroughfare and its proximity to a traffic light-controlled intersection presents traffic congestion with a negative impact on entrance to and exit from the station. Construction in the area of a new school is anticipated to add to this congestion. The two front ramp areas allow apparatus to sit on the ramp without obstructing traffic. There is a clear line of sight in both directions, giving apparatus operators ample time to observe approaching vehicles while enabling the motoring public to observe emergency vehicles exiting the station. The fire district is installing traffic preemption devices to improve this condition. The lot is approximately 275 ft. by 350 ft. and fronts on West Cherry St. or U.S. 36 / OH SR-37.

This location appears to generally offer adequate access to most main thoroughfares; however, may not be convenient for a significant number of fire district's residents due to its single central location, which is distant from many parts of the communities served. In many communities across the U.S., municipalities and fire departments use fire stations to strengthen their connection to a community or neighborhood by incorporating into fire station facilities a community room or rentable space where citizens can host community events like neighborhood meetings, celebration events, and community risk reduction and public education (e.g., fire prevention, life safety, healthcare, etc.) opportunities. Additionally, fire stations are often used as Safe Place shelters or Safe Haven Baby Box locations. Safe Place designated locations provide access to immediate help and supportive resources for youth in crisis situations. A Baby Box is a safety device provided for under the state's Safe Haven Law that legally permits a mother in crisis to safely, securely, and anonymously surrender their infant if they are unable to care for

their newborn.

The facility's structure was primarily constructed using steel framing with the side walls and roof covered by steel clad panels. The facility has a total of 10,068 sq. ft. with approximately 5,874 sq. ft. of the structure utilized as apparatus bays and storage space. An additional 4,194 sq. ft. is utilized for offices, communications, restrooms, a dayroom, dormitory area, utility room, and kitchen spaces. Overall, the facility is in good condition and appears well-maintained in daily cleanliness, with appropriate supplies and equipment furnished to support this prominence.

The facility is secured at all times and personnel are issued electronic access cards by the fire chief; combination door locks have been installed and can also be used for entry into the building. The administrative section and the firefighter living facilities are separated by a card-reading access control system. The apparatus bays, designated living, and office spaces as well as storage rooms off the east apparatus bay have smoke alarms installed under a local alarm notification system. The facility is supplied with natural gas for heating and cooking purposes.

To serve and accommodate firefighter residential needs, the individual dormitory rooms and area is equipped with lockers to address the peculiarities of full-time and part-time housing. The restroom facilities can accommodate gender separation and privacy. The kitchen and dayroom can accommodate the seven personnel that staff the station on a 24 hours basis. The kitchen has been designed to provide for ventilation and fire control by means of a hood system where cooking appliances produce grease and smoke, and cleaning and associated infection control. Laundry facilities are separated for contaminated personal protective equipment (PPE) and maintenance operations in the apparatus bay and "domestic" laundry needs in the living area. There is an industrial-grade extractor type washer to clean PPE.

Apparatus Bays

The apparatus bay section of the building is configured in a four-bay arrangement. Three bays are 70 ft. deep and bi-directional or drive-through and the fourth is "shared" with a large fitness area. The bay areas also are utilized to store fire hose and other firefighting equipment, cleaning supplies, exercise equipment, training aids, and flammable liquid storage cabinets. The apparatus housed are equipped with a MagneGrip® diesel exhaust capture system that controls exhaust at the point source. The system requires human intervention for attachment upon the vehicles' return to station. Trench-type floor drains are present.

All four bays have electrically operated 12 ft. wide x 12 ft. high overhead doors. They are equipped with electronic door sensors for emergency stopping or reversing direction, and emergency release levers that will permit manual door operation in the event of a power failure. During the site visit, two features of fire department function were obvious by their presence on the apparatus bay floor. A large fitness area equipped with aerobic and weight training systems was present. In addition, several training props were observed including a smoke simulation machine, forcible entry simulators, and rescue mannequin. There is a mezzanine level storage area accessible off the bay floor.

Figure 33: Fire station apparatus bay interior.

A separate interior pressurized and temperature-controlled air space is used to store firefighter PPE. This space is also used for breathing air production, storage, and transfer to SCBA cylinders. The compressed air is drawn from the interior conditioned space so an integrated air-quality monitoring system with sensors for carbon monoxide, carbon dioxide, oxygen, humidity, and temperature protect the compressed breathing air from contamination. A multi-cylinder cascade system stores the air. Ideally, protecting the air to be compressed and stored for SCBA use should be drawn from the building's exterior and the monitor/detection and alarm system remain in place.

The facility has a permanently installed 20 kilowatts natural gas-fueled emergency electric service generator. It is equipped with an automatic transfer switch that enables the generator to start and transfer building circuits to the generator anytime normal power is lost. The generator can power the entire building. Replacement of this generator system is planned for the future.

FIRE APPARATUS AND VEHICLES

The fire district operates the following apparatus and vehicles: two pumping engines, one aerial ladder platform, one heavy rescue apparatus (designed to transport and provide the specialized equipment necessary for technical rescue), one water tanker, also commonly termed a "water tender", one grass truck, two command, and three staff vehicles. Overall, the impression of the fire district's fleet and equipment is that it is well maintained and of the appropriate size and design for the intended purpose. The maintenance records and equipment inventory were reviewed by the assessment team during the site visit. The following is a summary description of each apparatus and condition.

Engine 351

Figure 34: Engine 351 - 2018 Rosenbauer pumping apparatus.

Engine 351 (E351) is a 2018 Rosenbauer pumper with a 1,250 GPM pump and 750 gallons water tank. It has several attack hand lines as well as 1,000 ft. of five-inch (in.) large diameter supply hose line. E351 also carries some rescue tools to operate at an auto accident until the heavy rescue arrives. The unit carries an array of EMS equipment such as a cardiac monitor and oxygen so personnel can provide emergency medical treatment until an ALS medic unit arrives. The unit also has a compressed air foam system and light tower.

Engine 352

Figure 35: Engine 352 - 2009 Rosenbauer pumping apparatus.

Engine 352 (E352) is a 2009 Rosenbauer pumper with a 1,500 GPM pump and 750 gallons water tank. It has a light tower and a compressed air foam system. E352 carries all of the department's haz-mat response equipment.

Ladder 351

Figure 36: Ladder 351 - 2012 Rosenbauer aerial ladder apparatus.

Ladder 351 (L351) is a 2012 Rosenbauer 75 ft. aerial ladder platform apparatus with a 2,000 GPM mid-mount fire pump and 300 gallons water tank. It carries a full complement of ground ladders, overhaul equipment, ventilation equipment, tools for specialized forcible entry, search and rescue tools, and tools to control utilities. The tower basket is equipped with a pre-piped water way capable of delivering 1,000 GPM. The basket also is equipped with brackets to allow an emergency stretcher to be attached. It is also equipped with a light tower and a full complement of grain bin rescue equipment.

Rescue 351

Rescue 351 (R351) is a 2008 Spartan chassis with a Salsbury custom rescue body. Its inventory includes: heavy rescue equipment including battery-powered hydraulic rescue tools, heavy lift airbag system, an assortment of wood cribbing, stabilization struts and a full assortment of battery-powered hand tools. It also equipped with an onboard air supply system to refill SCBA cylinders. A replacement Rosenbauer rescue apparatus that features enhanced capabilities of a small capacity pump and water tank with one pre-connected hose line is currently in production with an expected delivery in Spring 2023.

Figure 37: Rescue 351 - 2008 Spartan Saulsbury rescue apparatus.

Water Tanker 351

Tanker 351 (T351) is a 4 Guys custom-built stainless-steel water tanker on a 2000 International chassis. It has a 1,500 gallons water tank along with a 500 GPM pump. The apparatus features two 1¾-in. pre-connected attack hose lines, each 200 ft. in length, and is equipped with a 2,000 gallons collapsible portable water tank, also known as a drop tank, designed for use in rural areas and on highways where water is difficult to supply.

Figure 38: Tanker 351 - 2000 International 4 Guys water tanker apparatus.

Grass 351

Grass 351 (G351) is a 1991 Ford F-350 with a wildland or grass firefighting skid unit. It carries 200 gallons of water along with a full complement of wildland firefighting tools and equipment.

Figure 39: Grass 351 - 1991 Ford F-350 wildland firefighting apparatus.

Utility Terrain Vehicle 351

Utility Terrain Vehicle (UTV) 351 is a Kubota UTV purchased in 2014. UTV351's main purpose is grass fires and accessing areas that a full-size wildland or grass vehicle cannot. Its secondary purpose is assisting EMS and extricating victims from areas such as fields or wooded areas to an ambulance. It has a water tank with a capacity of 100 gallons, a pump, and a 100 ft. hose reel.

Figure 40: UTV 351 Kubota utility terrain vehicle.

Chief 350

Chief 350 is a 2019 Chevrolet Tahoe sport utility vehicle used as a command vehicle and assigned to the fire chief. It is equipped with command boards, firefighter accountability equipment, and radios that allows communication on multiple radio channels. It carries a wide array of reference materials and pre-fire plans of commercial occupancies. The vehicle is designed to serve as a command post at major incidents.

Figure 41: Chief 350 - 2019 Chevrolet Tahoe command vehicle.

RESPONSE CONSIDERATIONS

In fire suppression and EMS response there are several recognized safety and response standards or guidelines that are considered when analyzing fire protection services. National Fire Protection Association (NFPA) 1500, *Standard on Fire Department Occupational Safety and Health* is the safety standard for the fire service and deals with all aspects of fire department operational safety. Major components of the standard include personnel, apparatus, equipment, and incident management. The topics have general performance objectives, but the specific topic is generally more formally addressed in its own specific standard. Appendix B in NFPA 1500 contains a checklist that can be useful for departments to evaluate their overall safety and health program. While NFPA 1500 is non-binding, the Ohio Administrative Code (OAC) specifically references provisions from NFPA 1500 and other standards related to firefighting and firefighting equipment in Chapter 4123, which does have binding authority over the fire district.

OSHA has established a national standard for fire ground staffing as it relates to interior firefighting operations. Although the directive is very detailed, it essentially states that before two properly trained and equipped firefighters can enter a structure fire there must be at least two or more properly trained and equipped firefighters ready to replace, rescue or assist the initial entry firefighters. This standard is often referred to as the "2-in, 2-out" rule. This rule also is listed in §4123:1-2 OAC, which applies to firefighting operations in Ohio.

NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Departments* states that fire suppression companies should be staffed with four personnel, with one of them being a supervisor. This staffing standard is based on fire ground evolution studies and task analyses for a response to a 2,000 sq. ft. two-story single-family dwelling fire, commonly found in communities across America. NFPA 1710 is non-binding, but the staffing recommendation is considered an ideal or optimal staffing goal for communities. However, few communities across Ohio are able to achieve this staffing goal due to financial limitations.

NFPA 1561, *Standard on Emergency Service Incident Management System* also has some relevance. It states that an effective span of control shall be determined by the ability of each supervisory position to monitor the activities of assigned subordinates. Span of control is a term to describe the number of workers that a supervisor can effectively manage. The range of span of control is considered to be three to seven, with an optimum of five. However, span of control is determined by the degree of complexity or danger of the task or activity. For example, a serious auto accident involving a difficult extrication procedure may require a span of control of three, while an officer may be able to effectively manage 10 water tankers operating in a water shuttle at a rural fire.

Another critical factor in meeting service expectations is assuring that response crews are capable of performing the required tasks on arrival. The dispatching of a specific response with a minimum crew assignment is a concept that is widely supported by fire service literature and industry best practices. The NFPA's *Fire Protection Handbook* provides recommendations for the minimum response to various structures. Table 4 describes those recommendations.

High-hazard occupancies Schools, hospitals, nursing homes, explosives plants, refineries, high-rise buildings, and other high life hazard or large fire potential occupancies.	At least four pumpers, two aerial ladder trucks (or combination apparatus with equivalent capabilities), two chief officers, and other specialized apparatus as may be needed to cope with the combustible involved, not fewer than 24 fire fighters and two chief officers. One or more safety officers and a rapid intervention team(s) are also necessary.
Medium-hazard occupancies Apartments, offices, mercantile and industrial occupancies not normally requiring extensive rescue or fire-fighting forces.	At least three pumpers, one aerial ladder truck (or combination apparatus with equivalent capabilities), one chief officer, and other specialized apparatus as may be needed or available; not fewer than 15 fire fighters and one chief officer, plus a safety officer and a rapid intervention team.
Low-hazard occupancies One-, two-, or three-family dwellings and scattered small businesses and industrial occupancies.	At least two pumpers, one aerial ladder truck (or combination apparatus with equivalent capabilities), one chief officer, and other specialized apparatus as may be needed or available; not fewer than 14 fire fighters and one chief officer, plus a safety officer and a rapid intervention team.
Rural operations Scattered dwellings, small businesses, and farm buildings.	At least one pumper with a large water tank (500 gallons or more), one mobile water supply apparatus (1,000 gallons or larger), and such other specialized apparatus as may be necessary to perform effective initial fire-fighting operations; at least 12 fire fighters and one chief officer, plus a safety officer and a rapid intervention team.
Additional alarms	At least the equivalent of that required for rural operations for second alarms. This may involve the immediate use of mutual-aid companies until local forces can be supplemented with additional off-duty personnel.

Table 4: NFPA recommended minimum response resources based on occupancy hazard type.

The fire district has developed response guidelines that identifies resources (i.e., number and types of apparatus) and response sequence, which are listed below. These response guidelines are entered in the computer-aided dispatch (CAD) system at the Delaware County Emergency Communications (DCEC) 911 Center and used by the dispatchers on duty to determine appropriate emergency equipment response.

Response assignments:

- Fire 1: one engine.

  - Fire (i.e., odor investigation, dumpster, mulch, open burn, service incidents, wires down, carbon monoxide detector activation, and fuel or oil spill).
- Fire 2: one engine and one aerial ladder.
  - Fire [i.e., electrical problem (no fire), lightning strike (no smoke or fire), bomb threat, suspicious package, oven fire, gas leak – inside or outside, vehicle fire – passenger and large vehicle, and fire alarm – commercial or residential].
- Fire 4: three engines, one aerial ladder, one medic (paramedic transport unit), one rescue, and two chief officers.
  - Fire (i.e., chimney flue, barn, residential structure, and explosion).
- Fire 5: three engines, two aerial ladders, one medic, one rescue, and two chief officers.
  - Fire (i.e., commercial).
- EMS 1: one medic.
  - Basic medical and injury (e.g., mental, abdominal, or back pain, lift assist, medical alarm, sick person, injured from a fall, and lacerations or bleeding, etc.).
- EMS 2: one medic and one rescue.
  - Dead on arrival, cardiac or respiratory arrest, allergic reaction, cardiac emergencies, trouble breathing, long falls and traumatic injuries, and obstetrics.
- EMS 3: one medic, one rescue, and chief officer.
  - Shooting, stabling, police officer down, and penetrating trauma.
- Rescue 1: one engine, two medics, and one rescue.
  - Motor vehicle accident (MVA).
- Rescue 2: one engine, two medics, two rescues, and two chief officers.
  - Technical rescue (i.e., MVA with entrapment or fire, aircraft crash, and machinery extrication).
- Rescue 3: one engine, one medic, and one rescue.
  - Technical rescue (i.e., elevator or escalator rescue).
- Rescue 4: two engines, one aerial ladder, two medics, two rescues, and two chief officers.
  - Technical rescue (i.e., confined space, structure collapse, and trench collapse).
- Rescue 5: two engines, one aerial ladder, two medics, two rescues, and two chief officers.
  - Bike trail incident.
- Rescue 6: two engines, one aerial ladder, two medics, two rescues, and two chief officers.
  - Water rescue incident.

As stated on page four, there are seven personnel assigned to each of the three 24 hours shifts. Thus, depending on how many personnel are off-duty (vacation, sick leave, etc.) the staffing

level will have varying number of personnel. The following table represents the deployment of personnel and type of apparatus assigned to an incident. It should be noted that personnel assigned to the aerial ladder will "cross-staff" the rescue, grass-unit and tanker depending on the type of incident and resources required.

The number of personnel responding on a specific apparatus may vary at times depending on the number of personnel on duty, as displayed in Table 5 below.[26]

	STAFFING LEVELS							
	7 firefighters (ffs.)		**6 ffs.**		**5 ffs.**		**4 ffs.**	
FIRE INCIDENTS	E351	L351	E351	L351	E351	L351	E351	L351
Personnel	4 ffs.	3 ffs.	3 ffs.	3 ffs.	3 ffs.	2 ffs.	4 ffs.	0 ffs.
EMS	R351		R351		R351		E351	
Personnel	3 ffs.		3 ffs.		2 ffs.		4 ffs.	
MVA	R351	E351	R351	E351	R351	E351	R351	
Personnel	3 ffs.	4 ffs.	3 ffs.	3 ffs.	3 ffs.	2 ffs.	4 ffs.	
TECHNICAL RESCUE	R351	L351	R351	L351	R351	L351	R351	
Personnel	4 ffs.	3 ffs.	3 ffs.	3 ffs.	3 ffs.	2 ffs.	4 ffs.	
SERVICE INCIENTS	E351		E351		E351		E351	
Personnel	4 ffs.		3 ffs.		3 ffs.		4 ffs.	
WILDLAND FIRES	E351	G351	E351	G351	E351	G351	E351	G351
Personnel	5 ffs.	2 ffs.	4 ffs.	2 ffs.	3 ffs.	2 ffs.	3 ffs.	1 ffs.
WATER TANKER ONLY	T351		T351		T351		T351	
Personnel	2 ffs.		2 ffs.		2 ffs.		1 ff.	

Table 5: Apparatus response matrix and personnel deployment strategy.

The fire district's response to a specific incident could also be affected as personnel are committed to an emergency incident. For example, with five personnel on duty, two personnel could be on an EMS incident. If a building fire incident were received, there would only be three personnel available to respond.

The fire district is part of the Delaware County mutual-aid agreement and can call additional resources as needed for large fires or in some cases, simultaneous incidents. The fire district has also established AMR procedures for structure fire responses in the fire district. A medic unit from the DCEMS is dispatched for structure fire responses. In addition, for a confirmed structure

[26] BST&G Fire District Fire Procedure Manual.

fire, two additional engine companies respond. Getting additional equipment and personnel on the incident scene more quickly helps the fire district achieve operational benchmarks in a timelier and effective manner, and results in a more positive outcome for the residents, businesses, and visitors.

THE SCIENCE OF FIRE AND THE NEED FOR RAPID RESPONSE TO AFFECT POSITIVE CHANGE

Because there is such a wide variation in the fire dynamics of each particular fire, it is imperative to find a common reference point, something that is common to all fires regardless of the risk-level of the structure, the material involved, or length of time the fire has burned. Such a reference point exists. Regardless of the speed of growth or length of burn time, all fires go through the same stages of growth. One stage in particular emerges as a very significant one because it marks a critical change in conditions; it is called *flashover*.

The flashover stage of a fire event marks a major turning point in fire conditions that increases the challenge to a fire department's resources. How and why this occurs is explained in the following descriptions of each stage of fire growth in a structural fire.

Incipient Stage

The smoldering stage is the first stage of any fire. When heat is applied to a combustible material, the heat *oxidizes* the material's surface into combustible gases. The oxidation process is exothermic, meaning that the oxidation process itself produces heat. The heat from the oxidation raises the temperature of other materials, which increases the rate of oxidation and begins a chemical chain reaction of heat-release and burning.

A fire progresses from the smoldering phase immediately or slowly depending upon the fuel, nearby combustibles, and the surrounding air. For example, a bundle or stack of newspapers will smolder only a few seconds before progressing to the next stage, but a couch with a burning cigarette may continue smoldering for an hour or more.

Growth Stage

When the temperature gets high enough visible flames can be seen. This is called the growth stage or open burning. The visible burning at this stage is still limited to the immediate area of origin. The combustion process continues to release more heat, which heats nearby objects to their ignition temperature and they begin burning.

Flashover or Fully Developed Stage

Not all of the combustible gases are consumed in the growth stage. They rise and form a superheated gas layer on the ceiling that can quickly reach 1,500° Fahrenheit (F). As the volume of this gas layer increases, it begins to bank down to the floor, heating all combustibles regardless of their proximity to the burning object. The gas layer is mostly carbon monoxide so the absence of oxygen prevents the heated objects from bursting into flame.

Oxygen gets introduced into the space in two ways. There is often enough available oxygen near floor level to start the open burning process when the gas layer reaches that level. Or, the high heat breaks a window and the incoming oxygen allows the burning to begin. It should be noted that the room becomes untenable long before flashover. Even though open flaming may not be present until everything reaches 500°F and oxygen is introduced, the room becomes untenable for human survival at 212°F.

When flashover occurs, everything in the room ignites into open flame at once. This instantaneous eruption into flame generates a tremendous amount of heat, smoke, and pressure with enough force to push beyond the room of origin through doors and windows. The combustion process then speeds up because it has an even greater amount of heat to move to unburned objects.

Flashover is a critical stage of fire growth for two reasons. First, no living thing in the room of origin will survive, so the chance of saving lives drops dramatically. Second, flashover creates a quantum jump in the rate of combustion and a significantly greater amount of water is needed to reduce the burning material below its ignition temperature. A fire that has reached flashover means that it is too late to save anyone in the room of origin, and a significant increase in staffing is required to handle the larger hose streams necessary to extinguish the fire. A post-flashover fire burns hotter and moves faster, compounding the search and rescue problems in the remainder of the structure at the same time that more firefighters are needed for fire attack. See the information in Table 6.

PRE-FLASHOVER	POST FLASHOVER
Fire limited to room or area of origin. Requires small attack lines.	Fire spreads beyond room or origin. Requires more or larger attack lines.
Search and rescue efforts easier.	Compounds search and rescue efforts.
Requires fewer resources and can be handled by initial effective response force.	Requires additional resources (companies).

Table 6: Pre-flashover and post flashover firefighting comparison.

It has long been known that the real killer in a structural fire is smoke, not the flame or heat. Smoke contains many toxic gases released as by-products of the combustion process. Carbon monoxide is one of these gases and the most prevalent. Test fires in residential structures have demonstrated the production of carbon monoxide in measurable amounts after 3½ minutes from the ignition of the fire.

The primary objective of fire operations is to provide enough firefighters and equipment in a strategic location so that an effective response force can respond to and reach fire scenes to mitigate the problem before flashover occurs. The "time-temperature curve" standard is based on data from NFPA and ISO that establishes that a typical point source of ignition in a residential house will flashover at some time between five and 30 minutes after ignition, turning a typical room and contents fire into a structural fire of some magnitude. The time-temperature curve illustrated in Figure 42 comes from research efforts of the NFPA on smoke alarms and other detection equipment (2004). The illustration demonstrates the relationship between time and how a fire grows.

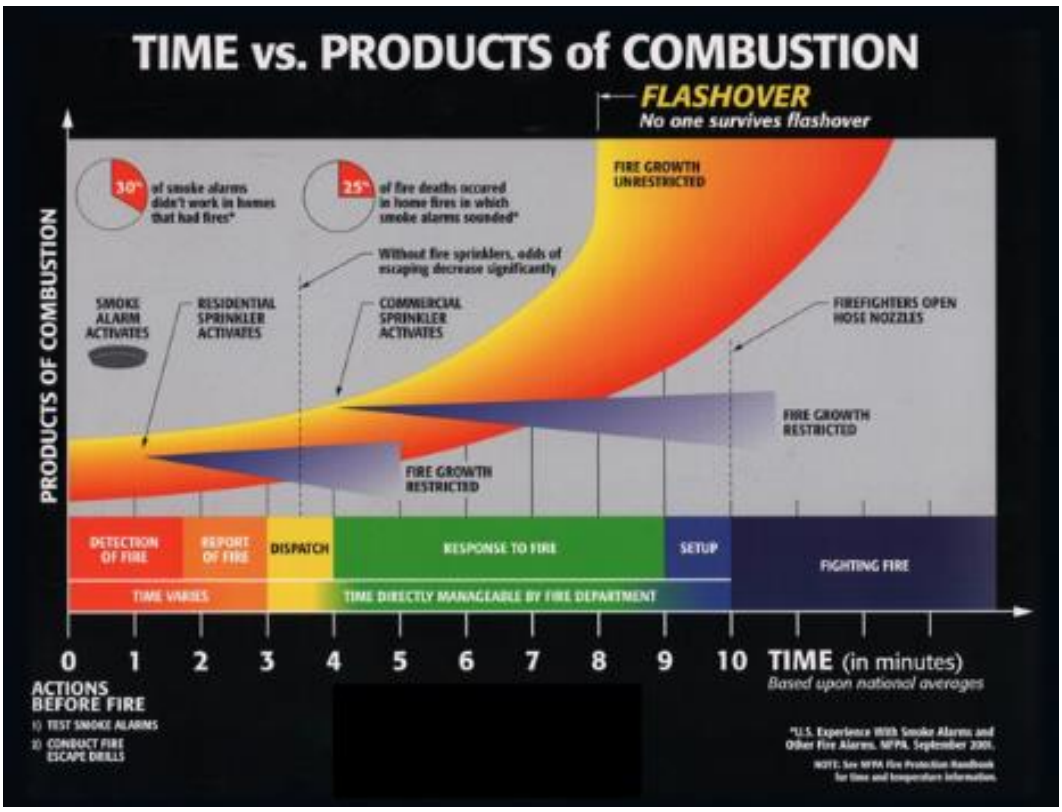


Figure 42: Time vs Products of Combustion.

Time requirements for EMS calls are comparable to fire incidents. The purpose of a quick response, especially in the most critical situation (cardiac arrest), is that the brain, deprived of oxygen and circulation begins to die within four to six minutes. Brain damage is normally

irreversible after 10 minutes. Interventions include early cardiopulmonary resuscitation (CPR) and electrical defibrillation. Previous studies show the time to deliver a shock (called defibrillation) to the patient in cardiac arrest to be three to six minutes. Current guidelines from the American Heart Association plus additional guidelines from the American College of Emergency Physicians and the National Highway Traffic Safety Administration suggests a response time interval of not more than five minutes from alarm notification to scene arrival for responders capable of performing CPR and utilizing an automatic external defibrillator (AED).

An AED is a portable device that the first responder or trained civilian can use on a patient who is pulseless and not breathing. When the device is connected to the patient, it analyzes the patient's heart rhythm and automatically delivers electric shocks to the patient if needed. Furthermore, guidelines provide for no more than a 10 minutes response interval for providers capable of performing ALS level interventions, if that level of service is available. The importance of time of intervention in a cardiac arrest event is illustrated in Figure 43, which comes from the Arizona Heart Rhythm Center.

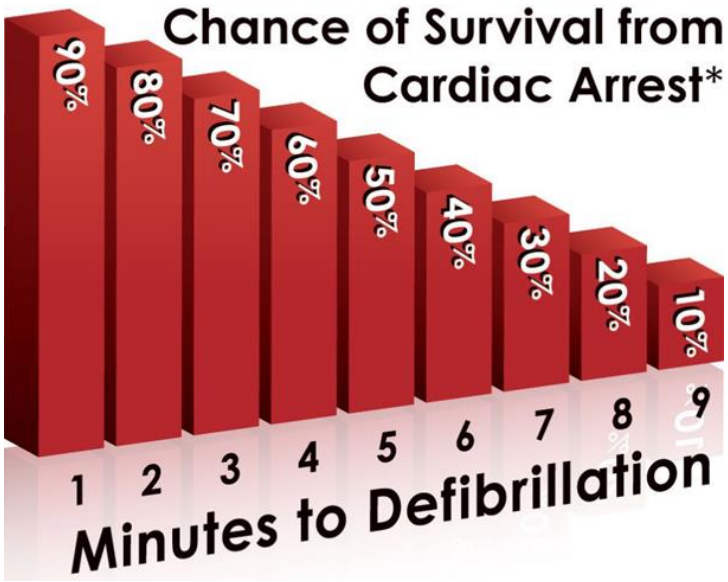


Figure 43: Survival from sudden cardiac arrest.

STRUCTURAL FIREFIGHTING OPERATIONS

Understanding the structural fire dynamic is the key in any discussion of fire ground evolutions or actions. Variables of fire growth dynamics and property and life risk combine to determine the fire ground task that must be accomplished to mitigate loss. These tasks are interrelated, but can be separated into two basic types: fire flow and life safety. Fire flow tasks are those related to getting water on the fire. Life safety tasks are those related to finding trapped victims and safely removing them from the building.

Fire flow tasks can be accomplished with handheld hoses or master streams (i.e., nozzles usually attached to the engine or ladder). Master streams take relatively fewer firefighters to operate because they are most often fixed to the apparatus or an appliance anchored to the ground.
The decision to use hand lines or master streams depends upon the stage of the fire and the threat to life safety. If the fire is in a pre-flashover stage, firefighters can make an offensive fire attack into the building by using smaller, more mobile handheld hose lines to attack the fire and shield trapped victims until they can be removed from the building. If the fire is in its post-flashover stage and has extended beyond the capacity or mobility of handheld hoses, or if structural damage is a threat to firefighters' safety, the structure is declared lost and master streams are deployed to extinguish the fire and keep it from advancing to surrounding exposures (i.e., other buildings or objects in close proximity). Initial arriving firefighters may use a transitional "defensive to offensive" strategy to limit or remove an immediate danger to life or health (IDLH) threat while awaiting the arrival of additional resources. IDLH is a National Institute for Occupational Safety and Health (NIOSH) term used to describe an environment or atmosphere that because of contaminants, heat, or oxygen deficiency can cause death or serious injury to a worker if they are exposed to those conditions for even a short period without the proper level of protective equipment.

Life safety tasks are based upon the number of occupants, their location, their status (e.g. awake vs. sleeping), and their ability to take self-preserving action. For example, ambulatory adults need less assistance than non-ambulatory adults require; the elderly and small children always require more assistance. The key to a fire department's success at a fire is adequate staffing and coordinated teamwork, regardless of whether the fire ground tasks are all fire flow related or a combination of fire flow and life safety.

Before on-scene procedures can be established, the initial IC must select an appropriate initial strategy; offensive or defensive. An offensive strategy is an aggressive interior fire attack and is used whenever possible. The top priority is rescue of trapped victims. The department's goals are to eliminate any or all fire-related deaths or injuries and contain fires to their room of origin. The first objective is to put a hose line flowing water between the victim(s) and the fire and to rescue those victims by removing them from proximity to the hazard. The second objective is to contain the fire to the room or area of origin.

A defensive strategy is one that does not allow interior fire attack except as needed to rescue trapped firefighters. When opting for a defensive attack all victims are considered to have already expired because there are no tenable spaces. No attempts are made to retrieve bodies because fire and structural conditions do not warrant the risk to firefighters.

CRITICAL TASK CAPABILITIES

In order to effect positive change, agency personnel must be properly assigned, resources must be properly placed and equipped, and each individual must be assigned a critical task to complete. Consequently, those individuals must arrive within a time frame which allows them a chance to use their skills to stop the loss or convert a potentially fatal medical condition. The following section will establish critical task assignments for fire and EMS responses and duties.

Structural Firefighting Critical Tasking

Single-family and two-family dwelling fires have been identified by the NFPA as the most frequent type of fire incident facing fire departments. These types of buildings are where the majority of fire fatalities occur. In 2020, 26% of the 3,500 lives lost in fires occurred in a residential setting including one- and two-family dwellings and apartment units.[27] It is worth noting that a response to a structure fire in a residential setting is used by the NFPA as the basis for developing task and performance objectives in relative codes and standards.

Since the single-family and two-family dwelling fire is the most prevalent and most at risk for serious injury or death to the occupant, critical tasks are outlined for this type of response. These tasks must be completed in a timely manner by firefighters in order to control the fire prior to flashover or to extinguish the fire in an effective manner. The fire district is responsible for assuring that responding companies are capable of performing all of the described tasks in a prompt and proficient manner.

Attack line: a minimum of two firefighters are required to advance a 1¾-in. hose line that produces a fire stream of 150-200 GPM or a 2½-in. hose line that produces up to 250 GPM. Each engine carries a set of attack lines that are either pre-connected to the apparatus, folded in the hose bed, or in a special pack for carrying into high-rise buildings. The selection of which attack line to use depends on the type of structure, the distance to the seat of the fire, and the size of the fire. The pre-connected lines are the fastest to use but are generally limited to fires within 200-250 ft. of the pumping apparatus. When attack lines are needed beyond 250 ft., the line must be physically extended to a longer length. A 2½-in. attack line may be used when the fire is already beyond the flashover stage and threatens an unburned portion of a structure.

Search and Rescue: a minimum of two firefighters are assigned to search for living victims and remove them from danger while the attack crew moves between the victims and the fire to stop the fire from advancing. A two-person crew is normally sufficient for most moderate risk structures, but more crews are required in institutional occupancies or multi-story buildings like

[27] NFPA - Fire Loss in the United States During 2020.

the Country View Care Center, Hampton Inn or Holiday Inn Express Hotels, or structures with people who have limited or are not capable of self-preservation (i.e. nursing homes).

Ventilation Crew: a minimum of two firefighters may be required to open a horizontal or vertical ventilation channel when the attack crew is ready to enter the building. Vertical ventilation or ventilation of a multi-story building can require more than two firefighters. Ventilation removes super-heated gases and obscuring smoke, preventing flashover, and allowing attack crews to see and work closer to the seat of the fire. It also gives the fire an exit route so that the attack crew can "guide" the fire out the opening they choose and keep it away from endangered people or unburned property.

Ventilation must be closely timed with the fire attack. If it is performed too soon, the fire will get additional oxygen and grow. If performed too late, the attack crew cannot control the fire in the direction they want. Instead, the gases and smoke will be forced back toward the firefighters and their entry point, which endangers them, any victims they are protecting, and unburned property. The latest technical information is from Underwriter's Laboratories and other technical sources. That information recommends and outlines the actions necessary to control "flow-paths" within a structure during firefighting operations, especially as it relates to ventilation.

Back-up line: a minimum of two firefighters are required to advance a 1¾-in. hose line that is taken in behind the attack crew to cover the attack crew in case the fire overwhelms them or a problem develops with the attack line. This back-up team could also be assigned to temporarily assist the search and rescue team if needed. If 2½-in. hose lines are used, it doubles the staffing requirement.

Rapid Intervention Team (RIT): a minimum of two firefighters equipped with SCBA and select tools must be available near the entry point to enter the structure, perform search and rescue, or back-up a suppression crew if something goes wrong. The RIT is an outcome of the "two-in and two-out" rule. This particular requirement is an OSHA rule that requires two firefighters to be suited up and ready to rescue firefighters who are assigned to interior firefighting operations and are in an IDLH environment should one of those firefighters become disabled (see page 42).

Exposure line: a minimum of one 1¾-in. hose line may be taken above the fire in multi-story buildings to prevent fire extension, or used externally to protect nearby structures or objects from igniting from the radiant heat. In situations where the heat release is great such as a flammable or combustible liquid fire, a 2½-in. hose line or portable deluge monitor (deluge gun) could be used. If 2½-in. hose lines are used, it doubles the staffing requirement.

Pump operator: one firefighter must be assigned to operate the fire apparatus to establish and maintain the correct pump discharge pressures to the attack, back-up, and exposure lines, monitor the pressure changes caused by changing flows on each line, and ensure that water hammer does not endanger any of the hose line crews. This firefighter also completes the hose connections to the correct discharges and completes the water supply connection to the correct intake. The pump operator can sometimes make the hydrant connection alone if the engine is near a hydrant, but the hydrant spacing for moderate risk fires normally precludes this.

Water supply: either the first-due or second-due engine must establish a reliable water supply by connecting a larger diameter (four-in. or five-in. fire hose) "supply line" from a fire hydrant to the pumping engine. Once the connection is made, the fire hydrant is then turned on allowing water to flow from the water distribution system into the intake side of the pump on the engine. Timing is a critical factor in establishing a continuous water supply for the fire. The fire district's front-line engines carry 750 gallons of water, which provides about five minutes of water for the attack crew if one 1¾-in. hose line (150 GPM) is flowing.

Responding to an area without hydrants, a water shuttle with tankers is used to establish a reliable water supply. This involves two or more tankers unloading water into portable reservoirs called "drop tanks." This initially would take several firefighters to set up the drop tanks and assist the pump operator in placing the necessary hoses and connections.

Patient/Victim Care and Firefighter Rehabilitation: two firefighter/EMTs or paramedics must be assigned to treat any victims of the fire who may be exposed to smoke or fire or who may become injured escaping the fire environment. This assignment is also responsible for treatment of firefighters who suffer injuries during fire attack. Once this task is completed the assignment shifts to monitoring the conditions of firefighters during rehabilitation periods which includes monitoring of vital signs, body cooling, and fluid replacement. These assigned tasks are the primary responsibility of DCEMS.

Safety Officer: one firefighter or officer is assigned to continuously monitor the scene for situations that could injure or kill firefighters. The safety officer monitors and evaluates changing fire conditions. The structural integrity of the building including roof, floor, and wall assemblies, are some of the areas evaluated. The safety officer works in concert with the IC to maintain a safety plan during the incident.

Incident Command: one officer is assigned to remain outside the structure to manage the overall incident by coordinating the attack, maintaining a constant evaluation of the scene, and making changes as necessary, planning for additional resources, and monitoring conditions that can jeopardize crew safety.

In managing many of the typical residential fires, departments are able to assign multiple tasks to some of the responding personnel. For example, after establishing a water supply, which is typically connecting a large diameter hose line from a hydrant to the on-scene pumper, personnel completing that task (two or three personnel on the second engine) can be given another task, such as utility control, search & rescue, or assistance with tasks such as ventilation. However, additional personnel also are needed to rotate and rest crews during active fire ground operations, especially in extreme weather conditions. The number of personnel identified in the critical tasking in Table 7 is a practical and common-sense approach to structural firefighting.

TASKS	PERSONNEL
Attack Hose line	2
Back-up Hose line	2
Water Supply and Support	2
Search and Rescue	2
Ventilation and Utility Control	2
RIT Team	2
Pump Operator	1
Safety Officer-aid to IC	1
Incident Commander	1
Victim Care and Rehabilitation*	2
TOTAL:	**17**

** - Tasks are the assigned responsibility of DCEMS.*

Table 7: Structure firefighting critical tasks assignments.

When the fire district responds to a residential structure fire, they will have between four and seven personnel on the initial dispatch, depending on the number of personnel on duty. If a structure fire incident occurs when a fire company is committed on another incident, the fire district responds with fewer personnel. When the incident is confirmed as a “working fire” additional resources from mutual-aid fire departments are requested. Responding short-handed makes it difficult to accomplish multiple tasks simultaneously, which is a key to an effective fire suppression effort. It also makes successful rescue operations for any victims trapped very dangerous with minimal chance of success. It also increases the injury risk to personnel.

Response to incidents in large commercial or industrial complexes requires significantly more personnel as noted in Table 4 on page 43. Mutual-aid resources as well as recalled off-duty personnel are required to have sufficient numbers of personnel to meet the demands of the incident. However, mutual-aid companies or recalled personnel will arrive later into the incident.

Emergency Medical Critical Tasking

Critical tasking analysis of EMS response is dependent on the type of incident encountered. The fire district's standard response for the majority of medical-oriented incidents is one engine company, with up to a total of four personnel. The primary role provided by the fire district is one of assist or support, in which personnel may provide scene control, patient assessment, stabilization, and treatment while working collaboratively with DCEMS staff.

The fire district's standard response for an MVA with injury and entrapment is an engine company with up to four personnel, a rescue company with up to three personnel, and a chief officer, a total of five to eight personnel. The purpose of the rescue company with the rescue equipment is to provide trained personnel and specialized rescue tools such as the "Jaws of Life" or high-pressure air bags, cribbing, etc., which are used to stabilize, extricate, and remove entrapped victims. The engine company personnel also must address any fire or hazardous situation found at the scene or additional resources respond to the incident. As described in the aforementioned paragraph, JDF personnel work collaboratively with DCEMS staff. The minimum critical tasking for motor vehicle accidents with injured victims is described in Table 8.

TASKS	PERSONNEL
Incident Commander / Safety	1
Extrication	2
Hazard Suppression	2
Victim Care and Transport *	2
TOTAL:	**7**

** - Tasks are the assigned responsibility of DCEMS.*

Table 8: MVA critical tasks assignments.

Understanding critical tasking is important because it describes in a basic way why certain numbers of personnel are required for certain types of responses.

RESPONSE PERFORMANCE

Response goals are a local decision and based on a variety of factors. Some of those factors include demographics and size of the response area, risk, demand volume, and public expectation. If a local community does not establish response goals, then any evaluation of the local department's performance would use national developed criteria. A number of efforts have been made to develop a nationally accepted consensus standard for response time, unit staffing

and deployment of resources. While there is no single consensus standard, several provide guidance.

ISO provides some guidelines, but those are singularly focused on travel distance. Two national publications address response performance. NFPA 1710 (described briefly on page 42) addresses functions and objectives of career fire department emergency service delivery, response capabilities, and resources.

Fire departments are classified as career departments, combination departments (a combination of career and "on-station" part-time paid or volunteer personnel), or volunteer departments. Based on the classification, a department is expected to meet the professional objectives outlined within NFPA standards. Career departments and combination departments staffed with part-time personnel operate under NFPA 1710. As addressed previously in this report, the fire district is classified as a combination agency, and based upon these classifications, the fire district is operating under NFPA 1710 standards.

Established in NFPA 1710 criteria, fire departments should meet the following response time objective: for 90% of all fire incidents, the first-due unit shall arrive within seven minutes, six seconds total response time. This response objective includes 106 seconds (one-minute, 46 seconds) for call processing, 80 seconds (one-minute, 20 seconds) for turnout, and 240 seconds (four minutes) for travel time. This response objective begins when the 9-1-1 call is received at the communications center.

The second published criteria are found in the *Standards of Cover*, published by the Commission on Fire Accreditation International (CFAI), which is part of the Center for Public Safety Excellence. CFAI criterion refers to the NFPA 1710 standard for communities that have personnel on-station, regardless if the personnel are career or part-time, or the community is suburban or urban in nature.

The published response criteria are based on national fire behavior research and data collected on past EMS response in relationship to patient outcomes. This information and research were further discussed on pages 46 - 48 in the Science of Fire and the Need for Rapid Response to Affect Positive Change section of this report.

It is important to note however, that communities should establish their own response objectives that meet the expectations of its residents. The fire district's response performance is detailed in the following section of the fire station location analysis report.

Dispatch and Radio Communications

The fire district's emergency communications are provided and supported by the DCEC 911 Center agency. The DCEC 911 Center is the only Public Safety Answering Point (PSAP) in Delaware County and is responsible for answering all 9-1-1 calls within Delaware County, excluding the areas annexed into the cities of Columbus, Dublin, and Westerville. This includes wireless, wireline, voice over internet protocol, and text to 9-1-1. The DCEC 911 Center provides dispatch for 13 fire departments, DCEMS, Office of Homeland Security and Emergency Management (EMA), Ohio Wesleyan Public Safety, Delaware City Police and Powell Police. DCEC 911 Center meets and adheres to the operating requirements in Ohio Revised Code (ORC) 128 and the OAC 5507-Emergency Response. The DCEC operates an 800-megahertz trunked radio system using a GIS platform along with CAD application for its call center.

Total Response Time Measurement

The concept of a response time continuum (sometimes referred to as cascade of events) has evolved from the standards established by NFPA and CFAI. Each component of the total fire response-time continuum was reviewed. This cascade of events is displayed in Figure 44.

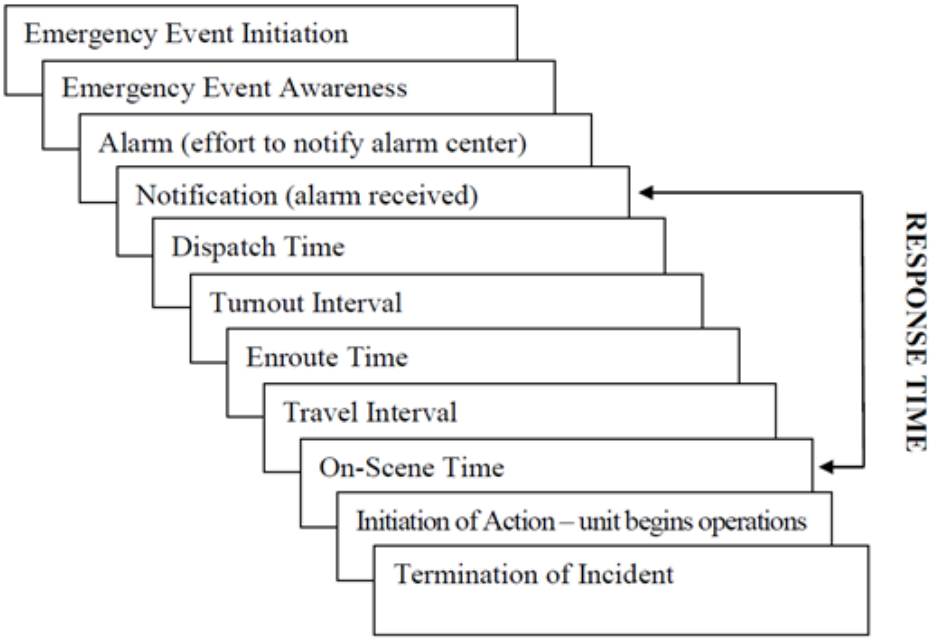


Figure 44: Cascade of events.

Call Processing Time

Call processing time is a component of the communication system. NFPA 1221 *Standard on Emergency Services Communications Systems* establishes various benchmarks for call handling depending on the system, type of call and level of caller assistance provided. The total call handling time is measured from the time the 9-1-1 call is received to the time the fire district is "toned out" for the call. For example, DCEC 911 Center "telecommunicators" are trained in Emergency Medical Dispatch (EMD), which is an enhanced service to the public. EMD is where a properly trained telecommunicator can provide medical assistance instructions to a 9-1-1 caller who is requesting emergency help. Examples would be bleeding control, emergency breathing, and CPR instructions. With this enhanced level of service, EMS incident processing and dispatching shall be completed within 120 seconds (2:00 minutes) 99% of the time. For fire incidents, emergency call processing and dispatching shall be completed within 106 seconds (1:46) for at least 95% of the alarms. These call processing criteria is adopted by CFAI and included in the criteria listed in NFPA 1710. The total alarm handling time is measured from the time the 9-1-1 call is received to the time the emergency response agency is "toned out" for the incident.

Turnout Time

Turnout time is measured from the time personnel are "toned out" or notified for an emergency response to the time the first unit is enroute or responding to the incident. Turnout time is a measurement used for personnel who are "in-station". The turnout time benchmark is 60 seconds (1:00) for EMS calls and 80 seconds (1:20) for fire responses.

Travel time

Travel time is the time it takes for dispatched response units to arrive on scene at the emergency. Travel time is generally considered to encompass the distance and time traveled from the fire station housing the apparatus until it arrives on scene at the location of the emergency. However, several factors can affect travel time. Winter weather conditions as well as localized flooding can affect travel time during certain times of the year. Traffic patterns on heavily traveled roadways, especially during peak travel hours can affect the emergency response. Another problem that can increase travel time and ultimately responder response time is receiving multiple calls for services. When simultaneous emergencies occur and adequate resources are not available to respond, a condition occurs that is referred to as a "stacking effect." A component to the stacking effect is that at times units may need to respond from mutual aid departments in an effort to provide the quickest and most reliable response to the incident. Clearly, this would lengthen the travel time of the response unit because of the unavailability of the fire district's units. The travel time benchmark is 240 seconds (4:00).

Total Response Time

Total response time (sometimes referred to as total reflex time) is that time which totally encompasses the response event, from the time the call for service is initially received through the time dispatched units arrive on location. If the call handling time previously identified is taken into consideration, the total response time for fire emergencies should be seven minutes, six seconds (7:06) for 90% of the incidents.

EMS Response Time

Time requirements for EMS calls are comparable to fire incidents and are based on research conducted on pre-hospital delivery of medical care and patient outcome and survivability. The purpose of a quick response, especially in the most critical situation (cardiac arrest) is that the brain, deprived of oxygen and circulation, begins to die within four to six minutes. Interventions include early CPR and electrical defibrillation.

For medical emergencies, a prompt response is needed to relieve suffering and save lives, but few calls for service are true life or death emergencies. Again, a reasonable service goal is to be on scene soon enough to: 1) assess patients and prioritize to prevent death and disability; 2) intervene successfully in life-threatening emergencies; and 3) stabilize patients to prevent additional suffering. The travel time benchmark is four minutes and the total response time is seven minutes, zero seconds (7:00) for 90% for EMS incidents.

Data Analysis

Data generated during the reporting period of January 1, 2018 through December 31, 2020 was analyzed to determine actual response performance. The data set included fire responses and EMS responses coded as an emergency response. Responses that were coded as non-emergency responses (no lights and sirens) were not included in the analysis. False alarm responses where the responding units were cancelled before arrival and mutual-aid response were also excluded from the data set.

It is common for many organizations to use average response times in determining response performance. However, the use of averages and median measurements does not provide a true indication of performance. One or two “outliers” may adversely affect the response analysis, leading management, and residents to an inaccurate and at times, unfair service expectation. Therefore, the NFPA and CFAI have recognized the use of percentiles as the most accurate method to analyze and evaluate response performance.

It is understood that no agency can meet a stated performance 100% of the time. Many factors can influence an agency's response including multiple calls, apparatus deployment, training assignments, traffic patterns, weather, human performance, and travel distance. The data in Tables 9 and 10 shows the fire district's response performance for all fire and EMS responses in the fire district in 2020. The percentage column identifies the frequency the fire district met the target-time benchmark. The 90th and 95th percentile columns identify the department's actual segment or response time for 90% and 95% of the responses.

ELEMENT	TARGET (minutes)	PERCENTAGE	90th PERCENTILE	95th PERCENTILE
Call Processing Time	1:46	94%		1:56
Turnout Time	1:20	43%	2:20	
Travel Time	4:00	51%	7:34	
Total Response Time	7:06	55%	11:25	

Table 9: Fire incident response performance.

For EMS responses, the target-time benchmark is 99% for call handling and 90% for turnout time, travel time, and overall response time. Meeting the target-time benchmark for at least 70% of the responses is often considered the baseline or threshold measurement.

ELEMENT	TARGET (minutes)	PERCENTAGE	90th PERCENTILE	99th PERCENTILE
Call Processing Time	2:00	92%		1:21
Turnout Time	1:00	18%	2:11	
Travel Time	4:00	51%	7:34	
Total Response Time	7:00	60%	10:01	

Table 10: EMS incident response performance.

The travel times for fire responses were below the 70% threshold and significantly below the 90% target. While the travel time was expected and total response time was somewhat expected, a closer examination showed the alarm-received time was the same as the dispatch time for a significant number of the incident responses analyzed. This brings into question the accuracy of some of the response data provided. The DCEC 911 Center's CAD system produces time stamps to document incident response times relative to the actions of telecommunicators and emergency responders. An incident that is initiated by a field unit can be a possible explanation for the aforementioned alarm-received, alarm-dispatch scenario (e.g., an incident is called directly to the fire station, and the responding unit notifies the 911 center while enroute to the scene or a unit

comes upon an incident and reports it to the 911 center). The department is meeting the turnout time of 1:20 only 43% of the time for fire incidents and 18% for EMS incidents.

The travel and total response times for EMS responses show a similar result. The target travel time of 4:00 for EMS responses was met 51% of the time, which indicates a performance gap. However, the total response target of 7:00 was met 60% of the time, which is significantly shy of the 90% target. The alarm-received time was the same as the dispatch time for 92% of the EMS responses analyzed.

As the fire district is comprised of four different communities, the data in Tables 11 and 12 display the response performance for travel times and total response times for fire and EMS incidents in each of the fire district's communities.

ELEMENT	COMMUNITY	TARGET	PERCENTAGE
Travel Time	Berkshire	4:00	23%
Response Time		7:06	35%
Travel Time	Sunbury	4:00	89%
Response Time		7:06	90%
Travel Time	Trenton	4:00	1%
Response Time		7:06	17%
Travel Time	Galena	4:00	55%
Response Time		7:06	61%

Table 11: Fire incident travel and total response time performance by community.

ELEMENT	COMMUNITY	TARGET	PERCENTAGE
Travel Time	Berkshire	4:00	19%
Response Time		7:00	35%
Travel Time	Sunbury	4:00	87%
Response Time		7:00	92%
Travel Time	Trenton	4:00	10%
Response Time		7:00	14%
Travel Time	Galena	4:00	38%
Response Time		7:00	67%

Table 12: EMS incident travel and total response time performance by community.

As can be seen, a significant performance gap exists for travel times in Trenton Twp. and Berkshire Twp. These areas of the fire district area farthest from the current fire station. While Trenton is primarily an agricultural community, it has 26 building occupancies classified as mercantile, storage, assembly, business, and institution. Berkshire includes considerable residential (i.e., single, multi-family apartments and townhomes), mercantile, assembly, business, and education occupancies. The primary thoroughfares through this area are I-71 and U.S. 36 / OH SR-37, which are high-volume and high-speed roadways.

Part of the analysis was to identify "high-volume" incident areas. The data indicated there were eight areas or response zones that exceeded a total of 100 incident responses over the three-year period (2018-2020). This data can be utilized to identify areas of concern or help determine the need for any strategies to assist citizens who may need additional assistance meeting daily needs or engage in risk reduction opportunities. Table 13 lists the fire district areas or neighborhoods identified as areas of increased incident activity.[28] Four of the eight areas with increased incident activity are located in Berkshire Twp.

[28] BST&G Fire District Data.

	ZONE	AREA or NEIGHBORHOOD	2018	2019	2020	TOTAL
BERKSHIRE	002	Northlake Summit Apartments		11	28	39
	005	Northstar	4	21	11	36
	008	Cheshire Woods	12	18	11	41
	011	Hotel District	11	17	17	45
	015	Berkshire Rd. west of Carters Corner Rd.	61	75	77	213
	016	Berkshire Rd. east of Carters Corner Rd.	28	44	50	122
	018	I-71- south of OH SR-37	52	45	27	124
	021	OH SR-37 and I-71 intersection / area	91	82	52	225
		PERCENTAGE OF ANNUAL TOTAL INCIDENTS:	25.4%	25.6%	23.8%	24.9%
SUNBURY	029	West of OH SR-3	92	85	92	269
	031	Sunbury Meadows West	11	14	15	40
	032	Sunbury Meadows East	8	14	25	47
	033	Big Walnut Schools	17	25	20	62
	034	Sunbury Mills- Heartland	8	14	21	43
	035	Land of Furry Creatures	14	16	19	49
	036	Creekside Village Apartments (Reed)	11	23	7	41
	038	Prairie Run Development	12	15	26	53
	039	McGill Street Apartments	8	16	15	39
	040	The Gardens	19	36	30	85
	042	Old Sunbury	150	161	141	452
	043	LC Apartments	10	8	12	30
	044	Sunbury Park Apartments	6	9	15	30
		PERCENTAGE OF ANNUAL TOTAL INCIDENTS:	35.9%	35.7%	38.2%	36.6%
TRENTON	045	North of OH SR-3	33	34	25	92
	046	OH SR-3 and OH SR-37 Triangle	42	66	59	167
	047	South of OH SR-37	23	28	22	73
	050	Condit	31	29	25	85
	051	Country View	27	47	47	121
		PERCENTAGE OF ANNUAL TOTAL INCIDENTS:	15.3%	16.7%	15.5%	15.9%
GALENA	023	Old Galena	29	24	24	82
	025	Arrowhead Estates	8	8	9	25
	027	Galena Misc.	21	12	12	45
		PERCENTAGE OF ANNUAL TOTAL INCIDENTS:	5.7%	3.6%	3.9%	4.5%

Table 13: Increased incident activity by area or neighborhood (2018-2020).

FIRE STATION LOCATION ANALYSIS

Determining the location to build a fire station(s) involves evaluating several factors including, but not limited to: travel times, roadway accessibility, first-due area impact, neighborhood type, service demand, land availability, and various risk management factors. Anticipated growth was also taken into consideration when analyzing the best location(s) for the fire district. The factor examined as the basis for this study were *travel times from the existing fire station in Sunbury* and plotted to display the current fire district's response areas for six, eight, and 10 minutes travel time.

Utilizing GIS technology and the ArcGIS9 Fire Analysis Tool Software™ ("the software"), the assessment team was able to determine the areas of the fire district currently covered by responders at six, eight, and 10 minutes travel time intervals. The analysis tool applies the standard speed limit along the involved route to plot the covered area.

Travel times are used to provide quantifiable and reliable data for analysis and discussion. Travel time is a constant that can be measured accurately and is dependent on the location and deployment of resources. The use of travel time provides the foundation from which to determine how fire station location can influence the fire district's total response performance. The maps contained within this report will display fire district travel times from the current fire station and potential fire station locations in six, eight, and 10 minutes intervals. It should be noted that the fire district does not currently utilize a uniform system of internal objectives related to response performance. The time intervals used were based on current NFPA response performance criteria, fire growth dynamics, and EMS patient outcomes.

The fire district can be primarily characterized as suburban in nature, as well as rural with remote areas. Suburban communities are usually described as areas with mixed occupancy, having average to high density populations somewhere between 500 to 1,000 persons per square mile. There can be a moderate number of buildings per square mile with gridded streets, and the existence of cul-de-sac and dead-end residential development and some gated communities. There also can be a varying mixture of open space, green areas, mid-rise and low-rise buildings, and a minimal number of multi-story buildings. There may also be industrial or manufacturing and commercial development within the community, including strip malls, brand boxes, such as fast-food restaurants and big boxes, such as Wal-Mart, Target, and Lowes.

NFPA 1710 suggests four minutes travel time at the 90th percentile for first due arrival of emergency medical BLS and fire incidents. However, achieving the response times outlined in NFPA 1710 has proven physically unobtainable for the fire district in areas outside of Sunbury as the response performance data indicates in Tables 11 and 12 on page 61 of the Response Performance section of this report.

The assessment team was able to determine the current travel time and coverage areas from the present station and subsequently, most advantageous location for additional fire stations based on travel times. Planning maps were developed to show visually the emergency travel times within the district.

In considering a potential new fire station, several factors must be evaluated such as the cost to acquire the property; lot size in relation to site needs; parking; site construction and development costs; location, accessibility, and traffic; utilities; neighborhood impact; zoning restrictions; and more. It is important to emphasize that in the scenarios presented, land may not be available at the exact location identified. The best option for the fire district would be the closest site to the identified location that has sufficient land, topography, drainage, etc., and is within fair market value. Factors that should be considered in site selection include the availability of public infrastructure (water and sanitary systems), telecommunications (internet, cable, etc.), and environmental impact (i.e., noise from stations located in proximity to residential development).

The map in Figure 45 shows the six, eight, and 10 minutes travel time throughout the fire district from the current fire station in Sunbury. The travel time areas from the Sunbury station were plotted and are displayed as the base evaluation factor travel time in subsequent maps. The fringes of the western, northwest, and southwest areas of the fire district have 10 minutes travel times or exceed 10 minutes travel times. These areas also are where multiple significant risk properties are located. The far eastern, northeastern, southeastern, northern; and areas in the south of the fire district are also beyond 10 minutes travel time. Approximately one-half of Trenton Twp. has 10 minutes or greater travel time. All of the areas in closer proximity to the station are within six minutes and beyond eight minutes. The developing western areas west and east of I-71 has six, eight, and 10 minutes travel time.

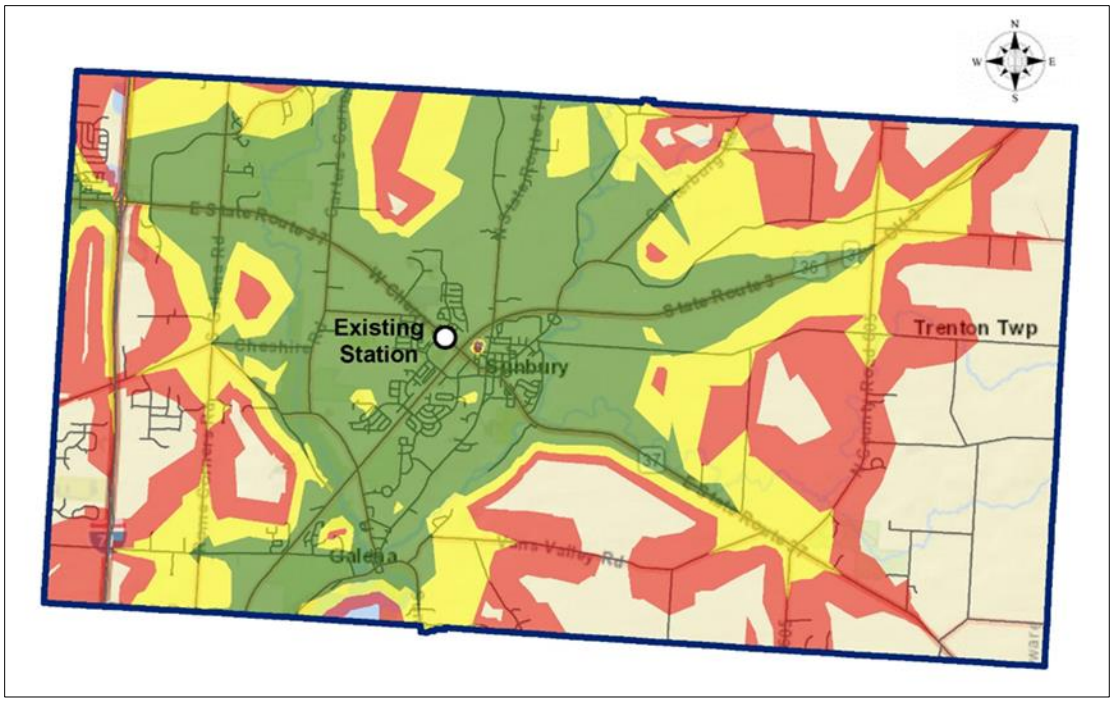


Figure 45: Fire district travel time map from Sunbury fire station.

Under the current one-station configuration, there are considerable areas of future and current development, commercial and residential centers and elements of critical infrastructure that are beyond six minutes travel time. This was reflected in the total response time data where the total response target of seven minutes was met 55% of the time for fire responses and 60% of the time for EMS responses, which is far short of the 90% target. The fire district's current response performance coupled with the significant amount of response area beyond six minutes travel time clearly demonstrates the need for an additional station(s). Strategically locating resources positions the fire district to improve response times, thus improving service to the citizens when an emergency occurs.

Several locations were analyzed to determine the best location to construct additional fire stations to improve the fire district's response performance. Subsequently, three such areas were examined in the western area (Berkshire Twp.) and one in the eastern area (Trenton Twp.) of the fire district, to generate maps with the six, eight, and 10 minutes travel time parameters.

The resulting locations and maps were generated for discussion and consideration in this report:

- Current station travel time and coverage.
  - 350 West Cherry St.
- Current station and "optimal" location for a second station; identified as Option A.
  - Optimal second station location: Rome Corners Rd. south of Cheshire Rd.
- An alternative location was identified for comparison with the aforementioned optimal location.
  - Alternative second station location: Wilson Rd. north of U.S. 36 / OH SR-37; identified as Option B.
- For future planning, a three-station configuration with existing station, optimal second station, and a third station.
  - Optimal third station location: area near North County Rd. 605 and Murphy Rd.; identified as Option C.
- Three new stations, in recommended and optimized locations; identified as Option D.
  - Wilson Rd. north of U.S. 36 / OH SR-37,
  - Area near North County Rd. 605 and Murphy Rd., and
  - Area of OH SR-3 and South Galena Rd.

Option A

The map in Figure 46 shows a proposed second fire station on Rome Corner Rd. (south of Cheshire Rd.) that actually fronts South Galena Rd. This location was recognized by the software as "optimal" or optimizing travel times from that location to the fire district area, while maintaining the current station. Based on travel time only, this location is a recommended site for the next (second) fire district station. This location improves travel times to the southwestern, southern, and western areas of the fire district. No significant improvement would be realized in the northwestern area of the district and the response area east of Sunbury remains unchanged. However, several characteristics of the area and other factors do not support this location as viable for consideration. Please see pages 69 and 70 for a more detailed description of the site.

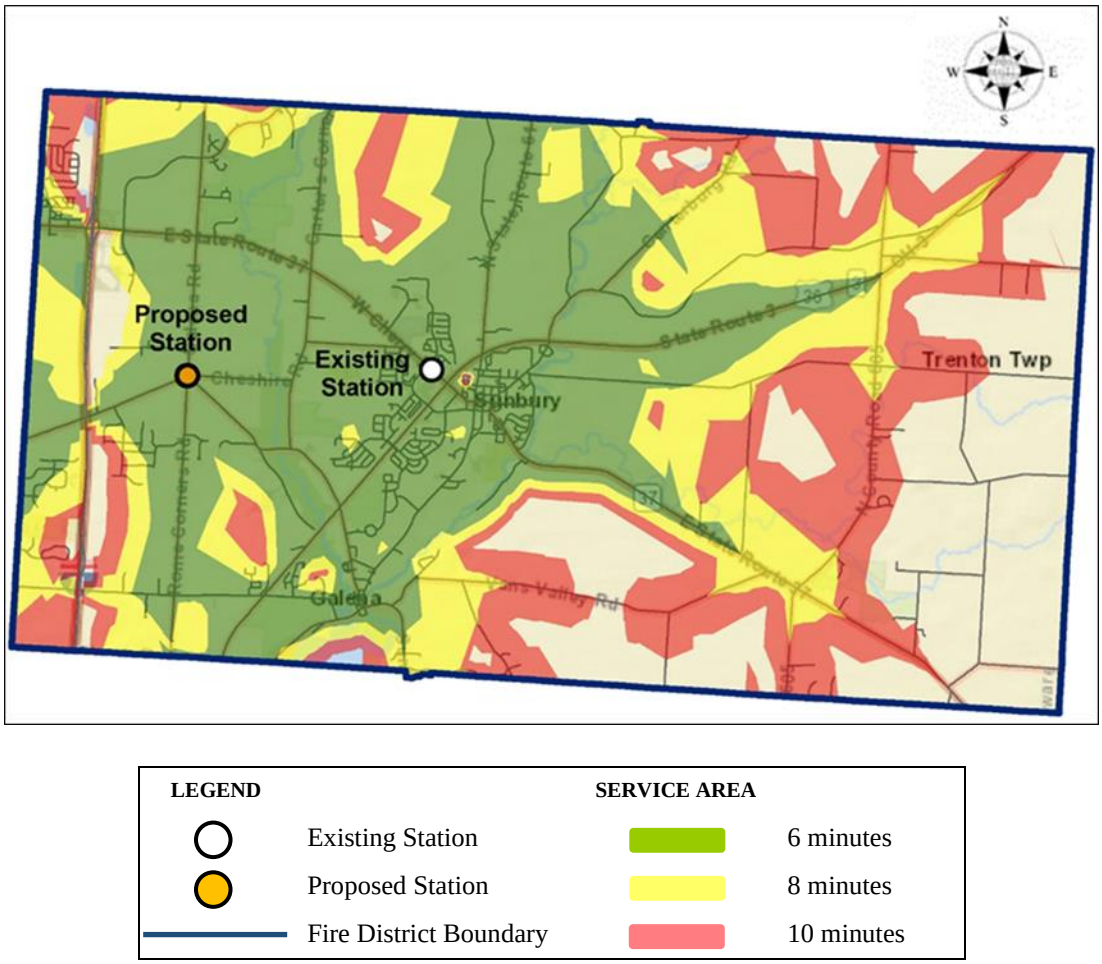
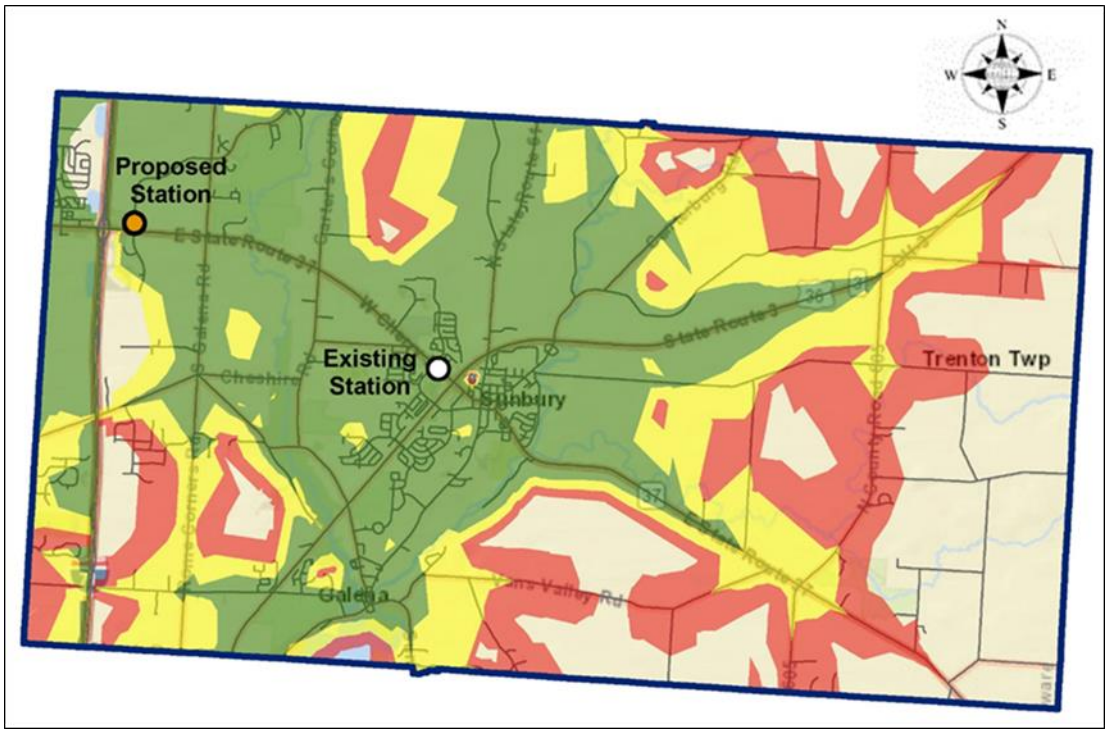


Figure 46: Option A - travel time map from the existing Sunbury station and station located in the area of Rome Corner Rd. and Cheshire Rd.

Option B

The map in Figure 47 shows an alternative proposed second fire station on Wilson Rd. (north of U.S. 36 / OH SR-37). This site was analyzed as a potential fire station location based on an offer to donate the needed property by a property owner tangent to the identified site. The three-acre parcel is located near to currently in-progress and proposed developments in the northwest corner of the fire district. This location significantly improves the travel times to the northwestern and western areas of the fire district. This location also improves travel times to two maximum risk and multiple significant risk properties located near the I-71 and U.S. 36 / OH SR-37 interchange and on South Wilson Rd. This location also will improve travel time to areas currently undergoing residential and commercial development. The southwestern area will also have some improvement, but the response area east of Sunbury remains unchanged. However, the site has potential complications due to its proximity to high activity truck fueling centers (i.e., Flying J Travel Center and Pilot Travel Center) and seasonal traffic accessing and egressing

Tanger Outlet that predictably can introduce heavily congestion and traffic concerns. Perhaps, the installation and use of a traffic intervention system may be beneficial in managing this high-traffic area.



LEGEND		SERVICE AREA	
○	Existing Station		6 minutes
●	Proposed Station		8 minutes
—	Fire District Boundary		10 minutes

Figure 47: Option B - travel time map from existing Sunbury and proposed Wilson Rd. fire stations.

The potential site on Rome Corners Rd. (Option A) has area characteristics that are less than ideal for a fire station location. In general, properties are undeveloped and presumed available for a fire station purpose and occupancy; the area is considered primarily rural in nature. There can be several complications associated with locating public or fire station facilities in rural areas. First, the roadways can be described as "county rural roads". Typically, these types of roadways have unique characteristics and conditions. They are not city or suburban streets and they may not be maintained in the same manner. While the roadways in the area are not necessarily narrow, they have very restricted shoulders or berms, or none at all, making it difficult for vehicles to safely pull over or get completely off the road when fire equipment is coming up behind them. Additionally, these types of roads lack curbs and storm water management structure to move water off the roadway surface as efficiently as possible, as they

feature drainage culverts and ditches as a natural means for stormwater control. Though these natural means are designed to accommodate the anticipated drainage volume, deep ditches are frequently surrounded by non-traversable slopes due to space limitations, and can lead to severe impacts and rollover motor vehicle crashes. The roadways can be extremely hazardous at night as there are no street lights. Overall, the area and properties have limited or no elements related to public infrastructure systems to efficiently support a critical facility, such as sufficient municipal water service (i.e., two fire hydrants exist on Rome Corner Rd.), sewer and sanitation, communication (i.e., fiber optics), and natural gas. At the time of this report, there were no plans in the distant future to enhance or upgrade any elements of the public infrastructure systems in the area. Any infrastructural enhancements or improvements would come at a considerable cost to the public or a private developer. Lastly, the Sunbury Parkway Project includes dead-ending Three B's and K Rd. There also is high-probability in the future that the project will dead-end Romes Corner Rd. north of Meadow Chase Dr.

From a resident's perspective, the potential for opposition to a new fire station can exist in a quiet rural setting, whereas, if a site is selected in a business or commerce park area there can be minimal impact or disruption as a result of noise and traffic. In Mecklenburg County, near Charlotte, North Carolina, the Steele Creek Volunteer Fire Department recently faced disapproval of a new fire station location, as some area homeowners mounted a "Not in My Backyard" campaign, trying to keep out an incoming fire department neighbor. The department wanted to build a fire station near the top of a two-lane, dead-end road just over the city limits in the county.

Option C

For future planning, a three-station configuration was analyzed to minimize travel times within the fire district. The software identified an optimal or optimizing location in addition to maintaining the current station in an eastern location near North County Rd. 605 and Murphy Rd. This location was identified as a site for a third fire district station as displayed in Figure 48. This configuration greatly improves travel times in the southern, southwestern, northeastern, eastern, and southeastern areas of the fire district, placing approximately 90% of the response area within eight minutes travel time.

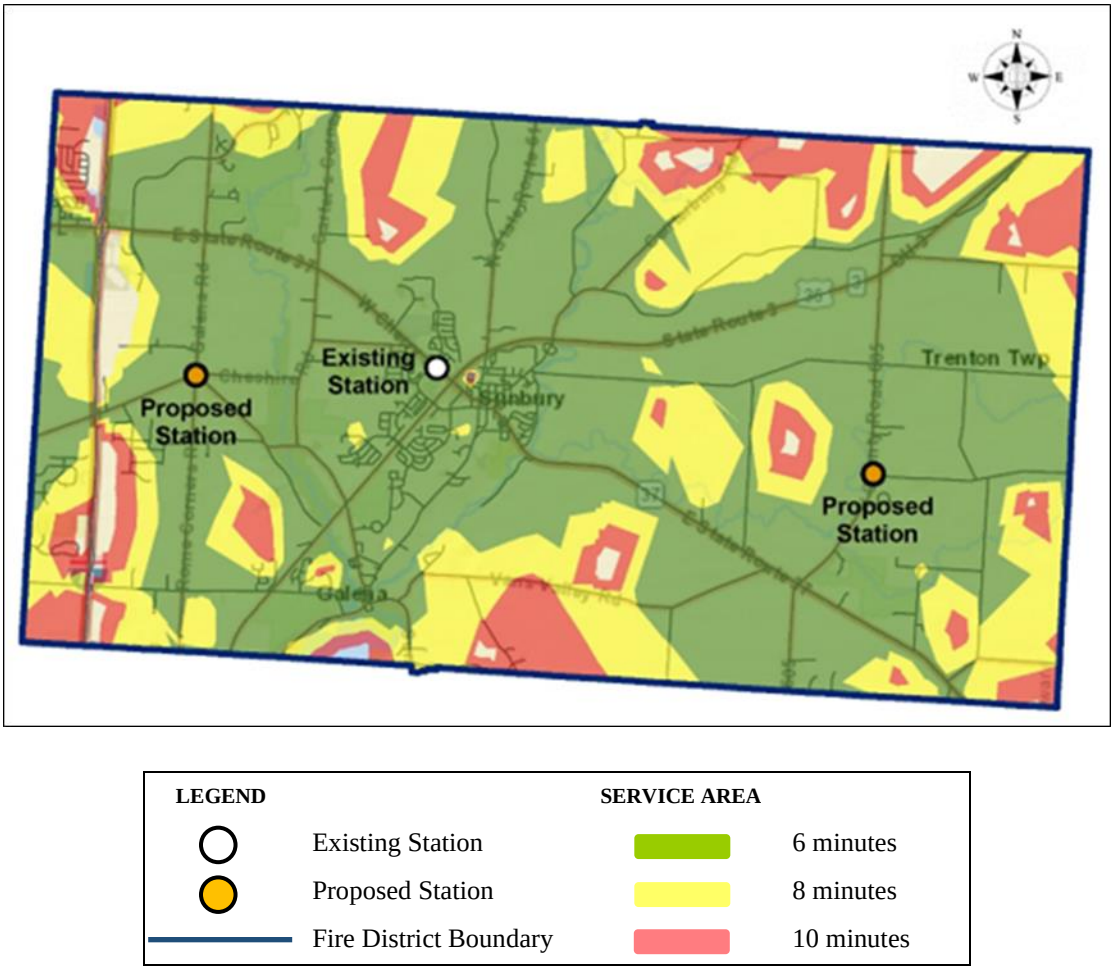
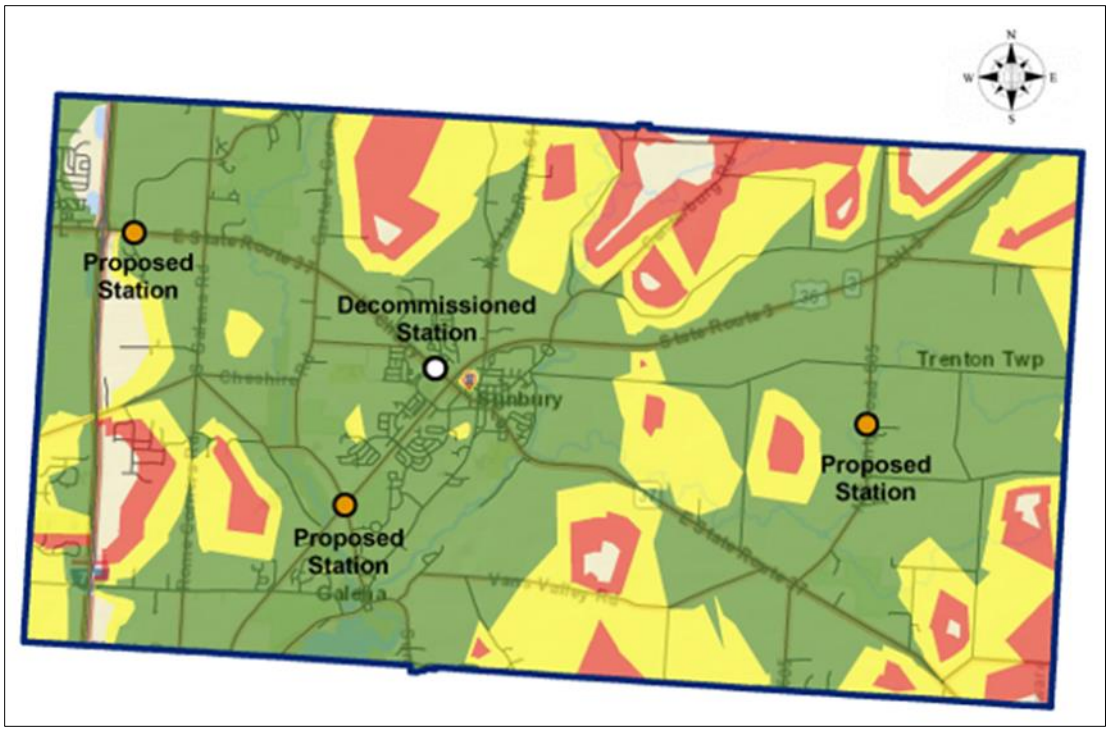


Figure 48: Option C - travel time map from the existing Sunbury station and station located in the optimal area of near North County Rd. 605 and Murphy Rd.

Option D

Also, as a consideration for future planning, a three-station configuration was analyzed to minimize first-due travel times within all areas of the fire district from three newly located and constructed stations displayed in Figure 49 (Option D). Note: the plotted location of the existing station and its decommissioning on the next map is for reference only. There is no recommendation for a fourth fire station. This configuration greatly improves travel times in the southern, southwestern, northeastern, eastern, and southeastern areas of the fire district. It also improves travel times to the northwestern area of the fire district.



LEGEND		SERVICE AREA	
○	Existing Station		6 minutes
●	Proposed Station		8 minutes
—	Fire District Boundary		10 minutes

Figure 49: Option D - three recommended and optimal fire district fire station locations for future planning.

From these recommended and optimal locations, the best option for the fire district would be the closest site to the identified location that has sufficient land area, topography, drainage, existing infrastructure, etc., and is within fair market values. With the exception of the all-new stations configuration, the analysis was completed on the assumption that the department would continue to operate from the existing station.

SUMMARY AND RECOMMENDATIONS

Projections suggest that BST&G Joint Fire District's fifth decade will not end the changing dynamic that has marked the fire district's early history. Municipal, township, district officials, and fire department administration are committed to doing their best to protect all those who live, work, and visit in the fire district. The information contained in this report provides a multi-faceted look at who lives in the fire district, where the demand for emergency service occurs, the standards germane to providing emergency services, and the impact of growth (projected and actual) on the service delivery system in the fire district.

Many fire department agencies establish a goal of arrival at the scene within a specified period of time (i.e., minutes) of notification at a specified percentage of the time. However, the district has not established this type of performance goal. The fire district should consider a specific review of any incident that takes longer than 10 minutes from notification to ensure there is no failure of personnel or the district's response system. The ISO establishes a national standard based on travel distances. The three metrics are five miles from a fire station, one and a half miles from an engine company and two and a half miles from a ladder company. The NFPA Standard 1710 establishes a four minutes travel time for the first arriving unit and an eight minutes travel time for all other arriving units 90% percent of the time. Finally, people are more at risk where they sleep than where they shop or dine so the fire district should place priority on protecting bedrooms. Population is increasing, incident volume is increasing and trending upwards, and building permits are increasing at a rapid rate.

These recommendations show the prudent next steps for the fire district for future emergency services delivery.

Berkshire Township

The community of Berkshire Twp. has grown 142% over the past 50 years. The residents and visitors of this area generated over 900 calls for service during the years of 2018 - 2020. However, the fire district's responders are not meeting the standards established by ISO and NFPA 1710. Fire Station 350 is located more than six minutes projected drive time from much of the Berkshire Twp. area. Much of the township lies outside the prediction modeling's six minutes response, so for many of the residents there is virtually no chance they will receive timely service the fire district strives for. Most of Berkshire Twp. is within the ISO five miles standard from the existing fire station but most of the area is greater than one and a half miles from an engine company. Under the current model this area is virtually excluded from meeting NFPA 1710's four minutes first arriving complement; however, the additional station and staffing can improve response performance significantly to most parts of the fire district that experience the second greatest incident volume.

While the research and software identified an optimal location, the characteristics, lack of public infrastructure, and future transportation project undertakings in the Sunbury Parkway corridor do~~es~~ not support any recommendation to locate a second fire station in this area. However, the recommendation is that the fire district move forward with building and staffing a new fire station at the Wilson Rd. location to address the current and future demand for service in this area in a way consistent with residents and local government officials' expectations and national response standards. This site provides service and significantly improves travel times to areas that appear to be of primary development, and the site can allow the department to serve future growth areas to the west and southwest, should development occur. While, the property has been offered as donation and the existence of public infrastructure, significant cost savings can be realized.

Trenton Township

Currently, the eastern area appears to be one of limited or hindered growth, and the identified site can allow the department to serve future growth in areas to the northeast, east and southeast, should annexation and development occur. The recommendation is for fire district staff to continue to monitor this area and its growth. Should the population and incident volume increase and if growth projections prove accurate, the fire district should consider both building and staffing a new fire station to meet the demand for service in this area in a way consistent with residents, local government expectations, and national response standards.

The fire district has the potential to positively impact future ISO ratings by addressing deficiencies identified in its PPC evaluation. Specifically, the summary report suggests at least an additional engine company to address needed fire flow and enhancing the deployment of resources to meet its road miles criteria can be regarded as a need for additional fire stations strategically located throughout the fire district.

Performance Goal Development

The fire district is strongly encouraged to work collaboratively with the jurisdictional administrations in developing and adopting performance goals. An example of a fire district performance goal is the first-due fire department unit will arrive within seven minutes, 30 seconds total response time for 80% of all incidents. This performance goal then provides the foundation, along with other factors, from which to determine the appropriate level of resources to meet the goal(s). This also provides a method from which to analyze response and other related data, and report to the citizens and jurisdictional governing bodies on the agency's performance in a clear and understandable manner. This approach can also be applied to the various response zones throughout the fire district.

Records Management System Upgrades

Second Unit Arrival Analysis

The second unit arrival analysis is looking at the distance for each "second due" company. Not all emergencies are created equal and often at the most critical incidents the arrival of the second due unit can make a significant difference in life safety and fire control. The National Institute of Standards and Technology, also known as NIST, studies utilized to develop NFPA 1710 proved that at fire incident scenes the appropriate staffing makes a significant impact. Greater understanding of the frequency of multi-company incidents and an analysis of second unit arrivals can provide data to decision makers about incidents that place the greatest strain on the fire district's response system. Additionally, ensuring that the fire district can provide great service and adequate personnel to the situations requiring the greatest measure of each is a significant part of the fire district's responsibility.

Conclusion

Deciding whether to take advantage of station locations for best travel time by adding one, two, or three stations is a political choice. These issues are best addressed upfront and transparently with community leaders and neighbors. The three-fire station configuration significantly improves travel times to almost all areas of the fire district and positions the fire district to meet service delivery challenges as all four communities continue to prosper. The presence of the current and future risk, in areas of the fire district where credible emergency response coverage is lacking, constituted the findings, which led to the recommendations within this report.

The fire district is to be commended for their efforts in providing quality service to all four communities. Their pride in the fire district and communities served, and dedication to quality service delivery was evident to the assessment team throughout this project. The OFCA hopes this analysis will help the BST&G Joint Fire District continue that effort.

APPENDIX A

In the State of Ohio, the Ohio Division of EMS is responsible for all the laws governing EMS. These laws are listed in §4765 of the Ohio Revised Code (ORC) [http://codes.ohio.gov/orc/4765]. Each level of certification is based on the National EMS Scope of Practice, which has been incorporated into the ORC. This outlines exactly what procedures can be performed by each certification level. A basic EMT requires a minimum of 150 hours of initial training and at least 40 hours of continuing education every three years. An advanced EMT requires an additional 200 hours of training above that of an EMT-Basic and at least 60 hours of continuing education every three years. Advanced EMTs are able to perform many ALS procedures and administer certain medications to patients. To advance to the paramedic level, a person must possess EMT certification and is required to attend nearly 900 additional hours of clinical and didactic training, which allows them to perform even more life-saving procedures and administer additional medications. Examples of these procedures would be performing cardio-version, heart pacing, heart defibrillation (shocks to the heart) and advanced invasive procedures such as chest decompression and needle cricothyroidotomy. The paramedic must obtain 86 hours of continuing education every three years, which includes maintaining advanced cardiac life support certification offered through the American Heart Association.

In firefighting, training and certification has three distinct levels. Volunteer firefighting is the basic level and is limited by law to 36 hours of initial training. It is the minimum level required to perform the duties of a volunteer firefighter. This level of training is also the minimum required by law to serve as a part-time firefighter unless additional training is required by the local fire agency.

The next level of firefighter training is Firefighter I (FF I). This level requires an additional 104 hours of training beyond the volunteer course level. This level of training also requires the demonstration of competency in several specific areas such as proper use of SCBA. The highest level of training is Firefighter II (FF II). This includes 240 - 260 hours of training in a variety of subject matter and the ability to demonstrate competency in several required areas. Full-time firefighters in Ohio are required by law to achieve certification at this level to work in their position. All certification levels require personnel to obtain 54 hours of continuing education every three years for certification renewal.

APPENDIX B

BST&G Joint Fire District US Census 2020 Decennial Data

	AREA (sq. mi.)	POPULATION	POPULATION DENSITY (sq. mi.)	HOUSING UNITS	MEDIAN INCOME	HOUSEHOLDS
BERKSHIRE	21	5,477	261	1,951	$114,375	1,146
SUNBURY	4.8	6,614	1,378	2,476	$80,663	1,960
TRENTON	26.6	2,276	86	851	$110,385	898
GALENA	1.7	924	544	315	$102,083	228
TOTAL:	54.1	15,291	283	5,593	$106,234	4,232

Table 14: BST&G – district profile.

	WHITE		AFRICAN AMERICAN		HISPANIC or LATINO		ASIAN		OTHER RACES[29]		TWO OR MORE RACES	
	Population	Percentage	Population	Percentage	Population	Percentage	Population	Percentage	Population	Percentage	Population	Percentage
BERKSHIRE	4,781	87.3%	137	2.5%	159	2.9%	150	2.7%	63	1.2%	346	6.3%
SUNBURY	5,772	87.3%	138	2.1%	223	3.4%	159	2.4%	82	1.2%	463	7.0%
TRENTON	2,173	95.5%	8	0.4%	19	0.8%	7	0.3%	10	0.4%	78	3.4%
GALENA	824	89.2%	21	2.3%	26	2.8%	33	3.6%	8	0.9%	38	4.1%
TOTAL:	13,550	88.6%	304	2.0%	427	2.8%	349	2.3%	163	1.1%	925	6.0%

Table 15: BST&G – Race and Ethnicity.

	< 5-YEARS			> 65-YEARS	
	Population	Percentage		Population	Percentage
BERKSHIRE	318	5.8%		679	12.4%
SUNBURY	476	7.2%		807	12.2%
TRENTON	52	2.3%		332	14.6%
GALENA	79	8.5%		138	14.9%
TOTAL:	925	6.0%		1,956	12.8%

Table 16: BST&G – at-risk population by age range.

[29] American Indian and Alaska Native, Native Hawaiian and other Pacific Islander, and some other race alone.

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