Durham County, North Carolina

Fire District Consolidation Feasibility Study

November 2013

FINAL REPORT

prepared by:
Solutions for Local Government, Inc.

Durham County, North Carolina

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TABLE OF CONTENTS

SECTION 1. INTRODUCTION & OVERVIEW

During September 2012 Durham County issued a public Request for Proposals (RFP No. 13-006) to provide a "Fire District Consolidation Feasibility Study" with the stated purpose being *to determine if realistic, alternative methods exist to organize and provide fire services with increased effectiveness, coordination, cost efficiencies, economies of scale and a more consistent level of service countywide. The consultant will conduct a review of the current fire delivery system. The study shall include consideration of partial, functional or full consolidation, regional partnerships, and shall include delivery models of fire suppression.*

On February 7, 2013 it was announced that Solutions for Local Government, Inc. of Charlotte, NC was selected to produce the study.

What this study involved and what this report attempts to address is the assessment of the conditions that exist(ed) prior to and during the study, the identification of significant issues of concern and/or that mirrored the expressed County purpose for the study, recommendations that address the issues identified and, as appropriate, provide a framework for a plan to implement the changes suggested.

Study Purpose

The County's published purpose for the study is stated above. However, it went on to state further that; *at a minimum, this evaluation will make recommendations that:*

- *Enhance firefighter safety*
- *Enhance cost control and containment of mobile fire equipment*
- *Enhance cost control and containment of fixed fire building locations*
- *Increase Efficiency*
- *Increase Effectiveness*
- *Coordinate and optimize the use of resources to eliminate duplication of services (fixed and mobile assets).*
- *Standardize services and programs offered to the communities to provide a consistent level of service countywide.*
- *Provide consistent taxation of property owners countywide*
- *Optimize coordination with other public safety providers in Durham County*
- *Identify alternative methods to meet the County's needs*

The five Durham County Volunteer Fire Departments that are the focus of this study are currently responsible for providing fire protection to the majority of the unincorporated area outside the city limits of Durham. These departments include:

1. Bahama Volunteer Fire Department
2. Bethesda Volunteer Fire Department
3. Lebanon Volunteer Fire Department
4. Parkwood Volunteer Fire Department
5. Redwood Volunteer Fire Department

The County also contracts with two neighboring Orange County Fire Departments (Eno and New Hope Volunteer Fire Departments) to provide coverage to limited areas of west Durham County adjacent its

shared boundary with Orange County. These areas are currently difficult to access by the referenced Durham County Departments; a factor that will be considered further during the course of the study.

Report Organization

As with any planning process, in order to determine where you need to go and how you will get there you must begin with an assessment of where you *are*. This plan document is organized accordingly. The major report sections include:

1. Introduction & Overview
2. Existing Conditions
3. County Population & Growth
4. Service Ratings & Standards
5. Issues & Concerns
6. Recommendations
7. Probable Costs
8. Notes & Future Considerations

Methodology

The information gathered for this report has come from many sources. Primary among them included the numerous conversations and meetings with each Department's Fire Chief, meetings with several of the Department's Boards of Directors, site visits to each fire station within each of the five districts, discussions with residents of the fire districts, and riding each district with department personnel to observe the general geography, its urban, suburban and rural characteristics, the availability of water, existing structures and the associated commerce within each of the five Department's primary response areas.

Information was also provided by various County and City of Durham Departments whose representatives were willing to meet and/or assist with gathering much of the data needed to complete this report.

- Durham County Budget & Management Services
- Durham County Attorney's Office
- Durham County Emergency Medical Services
- Durham County Finance
- Durham County Human Resources
- Durham County Tax Administration
- Durham City/County Planning
- City of Durham Technology Solutions (GIS)
- City of Durham Emergency Communications (911) Center
- City of Durham Fire Department

The County Fire Marshal was the County's designated representative/liaison for the study. He and his staff provided valuable support and assistance throughout the process.

Information was also provided via conversations held with representatives from various regulatory and state agencies including the North Carolina Department of Insurance, the Office of State Fire Marshal and the University of North Carolina, School of Government, as well as Fire Service representatives from several jurisdictions outside the County.

The crediting of the source material cited in this report is either via footnote or noted directly in the text itself.

While the type of reports and information collected included annual County Budget and Finance Department reports, GIS maps, and County and Fire District boundary maps; the bulk of the call data regarding the Fire Departments' performance and call volume reports was obtained via access granted to the FIREHOUSE Software® records management system used by each of the Departments and the Fire Marshal's Office.

The consultant met together with the five Department Chiefs during the evening of May 22nd to provide an overview of the initial issues identified, and to discuss various means of addressing them in the formal recommendations that would follow.

Four (4) additional meetings were held which included as participants the five Fire Department Chiefs, the County Manager, the Deputy County Manager, the County Fire Marshal, Deputy Fire Marshal and the consultant. The July 17th and August 19th meetings discussed study findings regarding existing conditions and operational issues and generally introduced the format of the upcoming report. The meetings on October 16th and 29th were for the purpose of discussing the draft report itself, including the specific issues and the formal recommendations to address those issues and the extent to which consolidation in its various forms may in fact occur. The duration of these meeting ranged from 2-3 hours each.

Historical & Statutory References

As a means of introduction to the fire services discussed in this report, the information and references that follow are provided as background and for context. They are excerpted from several sources as noted; predominately from North Carolina General Statutes.

And, while fire services are the focus of this study, they could not be adequately studied nor addressed without overlapping at some point with those other entities/organizations associated with Durham County's emergency services delivery "system". Subsequently, additional information is included briefly in this section with regards to the County Fire Marshal, County EMS, and the Durham City Fire Department.

Statutory Basis for Providing County Fire Services

In accordance with G.S. 153A-233; Fire-Fighting and Prevention Services; *A county may establish, organize, equip, support and maintain a fire department; may prescribe duties of the fire department; may contract for fire-fighting or prevention services with one or more counties, cities, or other units of local government or with an agency of the State government, or with one or more incorporated volunteer fire departments; and may for these purposes appropriate funds not otherwise limited as to use by law. The county may also designate fire districts or parts of existing districts and prescribe the boundaries thereof for insurance grading purposes.*

Further, G.S. 69-25.5; Methods of Providing Fire Protection; if a Board of County Commissioners elects to provide fire protection services for a designated district within its boundaries, it may do so:

1) *By contracting with any incorporated city or town, with any incorporated nonprofit volunteer or community fire department, or with the Department of Environment and Natural Resources to furnish fire protection, or*

2) *By furnishing fire protection itself if the county maintains an organized fire department, or*
3) *By establishing a fire department within the district, or*
4) *By utilizing any two or more of the above listed methods of furnishing fire protection*.

Funding County Fire Services

Per Millonzi,[1] Article V, subsection 2(4) of the North Carolina Constitution allows the General Assembly to "enact general laws authorizing the governing body of any county, city, or town to define territorial areas and to levy taxes within those areas, in addition to those levied throughout the county, city, or town, in order to finance, provide, or maintain services, facilities, and functions in addition to or to a greater extent than those financed, provided or maintained for the entire county, city or town". And, that fire prevention services are in fact among the purposes for which the General Assembly has authorized counties to establish special tax districts.

Subsequently, the two most prominent forms of tax districts established to fund fire services in North Carolina counties are the *Rural Fire Protection District* and the *Fire Services District.*

Rural Fire Protection District

Article 3A of G.S. 69, beginning at G.S. 69-25.1 addresses the process for creating a rural fire protection district; i.e. the petitioning of resident voters, conducting an election, duties of the County Board of Commissioners, etc. as well as the formal request for a fire tax not exceeding 15 cents per $100 of property valuation.

G.S. 69-25.4 (originally) provided that the special (fire district) tax is to be used "only for furnishing fire protection within said district". However, a 1981 amendment to that section defined fire protection to also include emergency medical, rescue, and ambulance services, and it expressly authorized the expenditure of fire tax funds for those services. Further, no special election is required to authorize the expenditure of fire district taxes for these emergency services. The discretion to do so is up to the County Commissioners.[2]

G.S. 69-25.7 Administration of special fund; fire protection district commission; reads as follows:
"The special fund provided by the tax herein authorized shall be administered to provide fire protection as provided in G.S. 69-25.5 by the Board of County Commissioners . . . . . or by a *fire protection district commission* of three qualified voters of the area . . . said board to be appointed by the Board of County Commissioners"

Fire Service District

The General Statute subchapter that addresses county service districts is 153A-300 which is titled "The County Service District Act of 1973," and is enacted pursuant to Article V, Sec. 2(4) of the Constitution of North Carolina.

G.S. 153A-301 Purposes for which districts may be established.

(a) The board of commissioners of any county may define any number of service districts in order to finance, provide, or maintain for the districts one or more of the following services, facilities and functions in addition to or to a greater extent than those financed, provided or maintained for the entire county.

[1] Millonzi, Kara A.; *County Funding for Fire Services in North Carolina*, UNC School of Government Local Finance Bulletin, May 2011
[2] Loeb, Ben F., Jr.*; Fire Protection Law in North Carolina*, 5th edition; Institute of Government, UNC at Chapel Hill; 1993.

There are 11 specific services listed for which service districts may be created, number (2) is *fire protection*, and number (7) is *ambulance and rescue*.

G.S. 153A-302 Definition of service districts.

(a1) Findings-The board of commissioners may establish a service district if, upon the information and evidence it receives, the board finds that all of the following apply:

(1) There is a demonstrable need for providing in the district one or more of the services listed in G.S. 153A-301.
(2) It is impossible or impracticable to provide those services on a countywide basis.
(3) It is economically feasible to provide the proposed services in the district without unreasonable or burdensome annual tax levies.
(4) There is a demonstrable demand for the proposed services by persons residing in the district.

(c) Hearing and Notice. – The board of commissioners shall hold a public hearing before adopting any resolution defining a new service district under this section.

(d) Effective Date. – The resolution defining a service district shall take effect at the beginning of a fiscal year commencing after its passage, as determined by the board of commissioners.

Governing Authority

In both the Rural Fire Protection District and the Fire Service District, the relationship between the County and the Fire Departments is a contractual one. The Board of County Commissioners retains legal control over setting the district tax rate each year, as well as determining the fire services that are to be provided within the district and who will provide them. This means that, subject to any existing contractual agreements, a Board of County Commissioners may change service providers or the nature of the services that are being provided at any time.[3]

Ultimately, the fire district's governing board (the Board of County Commissioners) enters into a contractual agreement with the fire department to procure services for the district. The fire department is a contracting agent for the district and as such the department and the department's governing boards' control over the services provided are dictated (and limited) by the terms of the contract with the County.[4]

G.S. 153A-234. *Fire Marshal*

A county may appoint a fire marshal and employ persons as his assistants. A county may also impose any duty that might be imposed on a fire marshal on any other officer or employee of the county. The board of commissioners shall set the duties of the fire marshal, which may include but are not limited to:

1) Advising the board on improvements in the fire-fighting or fire prevention activities under the County's supervision or control.
2) Coordinating fire-fighting and training activities under the county's supervision or control.
3) Coordinating fire prevention activities under the county's supervision or control.
4) Assisting incorporated volunteer fire departments in developing and improving their fire-fighting or fire prevention capabilities.

[3] Millonzi, Kara A.; *County Funding for Fire Services in North Carolina*, UNC School of Government Local Finance Bulletin, May 2011
[4] Ibid

5) Making fire prevention inspections, including the periodic inspections and reports of school buildings required by Chapter 115 and the inspections of child care facilities required by Chapter 110.
6) A fire marshal shall not make electrical inspections unless he is qualified to do so under G.S. 153A-351.

In turn, the Durham County Code of Ordinances, Chapter 16 Fire Prevention and Protection, states in *Section 16-5 Fire Marshal to Enforce Code:*

> *"The fire prevention and protection code of the county, state and federal laws and ordinances, as they pertain to fire safety and fire prevention, shall be enforced by the county fire marshal and his authorized representatives or as otherwise provided in this chapter. The fire marshal is hereby authorized to promulgate rules, regulations and procedures necessary to enforce this chapter."*

Durham County Emergency Medical Services (EMS)

The North Carolina Office of Emergency Medical Services administers the State's EMS program, which is placed in the Division of Facility Services of the Department of Health and Human Services (G.S. 143-508). Two state agencies regulate the program. The North Carolina Medical Care Commission adopts the rules and standards that govern ambulance licensure and basic life support services, and the North Carolina Medical Board adopts rules and standards governing advanced life support services.[5]

Neither the State nor the regional EMS offices are engaged in the actual delivery of emergency medical services in North Carolina. That responsibility is taken on by agencies and organizations at the local level, the principal being County government. In fact, North Carolina General Statute 143-517 states: *"Each county shall ensure that emergency medical services are provided to its citizens"*.

Level of Care

"Level of Care" refers to the level of training and legal certification held by the caregiver or responder. Individuals are certified based on their highest completed level of training. 10 NCAC 3D and 21 NCAC 32H are quite specific with regards to the type of care, procedures, and medications that can be administered by individuals at each level of certification.

In North Carolina there are four (4) levels of certification assigned to EMS providers. The brief descriptions provided below are those defined by the North Carolina Office of Emergency Medical Services (NCOEMS). *The Medical Responder (MR) and Emergency Medical Technician-Basic (EMT-B) levels are referred to as "Basic Life Support", or BLS. The remaining levels of care; EMT-I, and EMT-P, are referred to as "Advanced Life Support", or ALS.*

Durham County's Department of Emergency Medical Services (EMS) is a certified Advanced Life Support (ALS) agency. It currently runs a minimum of 11 ambulances per day from nine (9) base locations throughout the County. In turn, the Durham County Fire Departments, as well as the City of Durham Fire Department, are dispatched as medical (EMS)/first responders to medical emergencies to supplement the resources of the County from up to 26 additional locations throughout the County. The map of Durham County Fire Stations on page 56 identifies the locations of all current County and City stations.

[5] A. Fleming Bell and Warren Jake Wicker; County Government in North Carolina; Inst. of Government, UNC at Chapel Hill; 1998.

The County fire departments run at the basic life support (BLS) level, with paid firefighters dually certified minimally, at the EMT-Basic Level. Brief explanations of the skills associated with the certification levels addressed include:

Medical Responder (MR): Assists pre-hospital technicians in providing basic life support (BLS) care; follows training guidelines of first responders per USDOT.

Emergency Medical Technician-Basic (EMT-B): Second level of BLS; individuals trained in advanced first aid, measuring vital signs, CPR, oxygen therapy, etc. intended to take advantage of automatic and semi-automatic external cardiac defibrillators for on-scene defibrillation of patients risking sudden death from ventricular defibrillation; additional training includes advanced airway and administration of epinephrine.

Emergency Medical Technician-Intermediate (EMT-I): Allowed to use advanced airway devices, provide intravenous fluid replacement, administer various medications used to correct diabetic, narcotic overdose, respiratory emergency, allergic reactions, and use of automatic and semi-automatic defibrillators.

Emergency Medical Technician-Paramedic (EMT-P): In addition to all previous skills, trained in techniques of cricothyrotomy, needle chest decompression, urinary catheter insertion and nasal intubations; in addition to administration of a broad range of medications.

City of Durham Fire Department

The North Carolina Office of Budget and Management estimated that the resident population of the City of Durham, as of July 2012, was 236,566. The city's land area currently comprises approximately 109 square miles. The City of Durham's Fire Department is responsible for providing fire prevention and emergency response services within the municipal boundaries of the City; also, via Memorandum of Understanding with the County, for two small parcels of unincorporated County property totaling approximately 5.6 square miles and referred to as Durham County East and Durham County West on the Fire District map on page56.

The Department's major divisions include Fire Operations, Fire Prevention, Planning and Administration, and Training and Special Operations. The majority of its approximately 300 employees' staff and respond to incidents dispatched from 16, soon to be 17, fire stations. Also, by virtue of its total land area, the Durham City Fire Department essentially surrounds the Bethesda and Parkwood Fire Districts and abuts major portions of the Redwood, and Lebanon Fire Districts as well as a small portion of Bahama Fire District's southern boundary.

Also, the City of Durham Fire Department shares mutual aide agreements with each of the County's five fire departments.

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SECTION 2. EXISTING CONDITIONS

This section addresses the current conditions found to exist regarding the fire services provided to and within the unincorporated areas of Durham County. And, while the Durham City Fire Department and several fire departments based in adjacent counties are referenced, the emphasis of the study and this report is the five (5) fire departments located within the County and with which the County has contracted for fire and first responder services for many years.[6]
These departments include:

- Bahama Fire Department
- Bethesda Fire Department
- Lebanon Fire Department
- Parkwood Fire Department
- Redwood Fire Department

County Fire Services

According to the US Census Bureau, Durham County comprises 286 square miles. The five Durham County Fire Departments identified are currently responsible for providing fire protection and first responder services to approximately 167 of those 286 square miles; 58% of the County's total land area.

The County also contracts with Eno and New Hope Fire Departments which are based in Orange County and service two small tracts within Durham County along its western boundary with Orange that are difficult to access from the existing station locations of the Durham County departments.

In addition, Memoranda of Understanding with Moriah Volunteer Fire Department (Person County) and Butner Volunteer Fire Department (Granville County) also provide coverage into Durham County; respectively along the northeast and western County line.

Finally, while the Durham City Fire Department is responsible for almost 100 square miles within the incorporated, and more heavily populated boundaries of the City it also, via Memoranda of Understanding,[7] provides coverage to two small tracts of unincorporated Durham County in the areas noted on the map that follows as Durham County-East Fire Insurance District and Durham County-West Fire Insurance District.

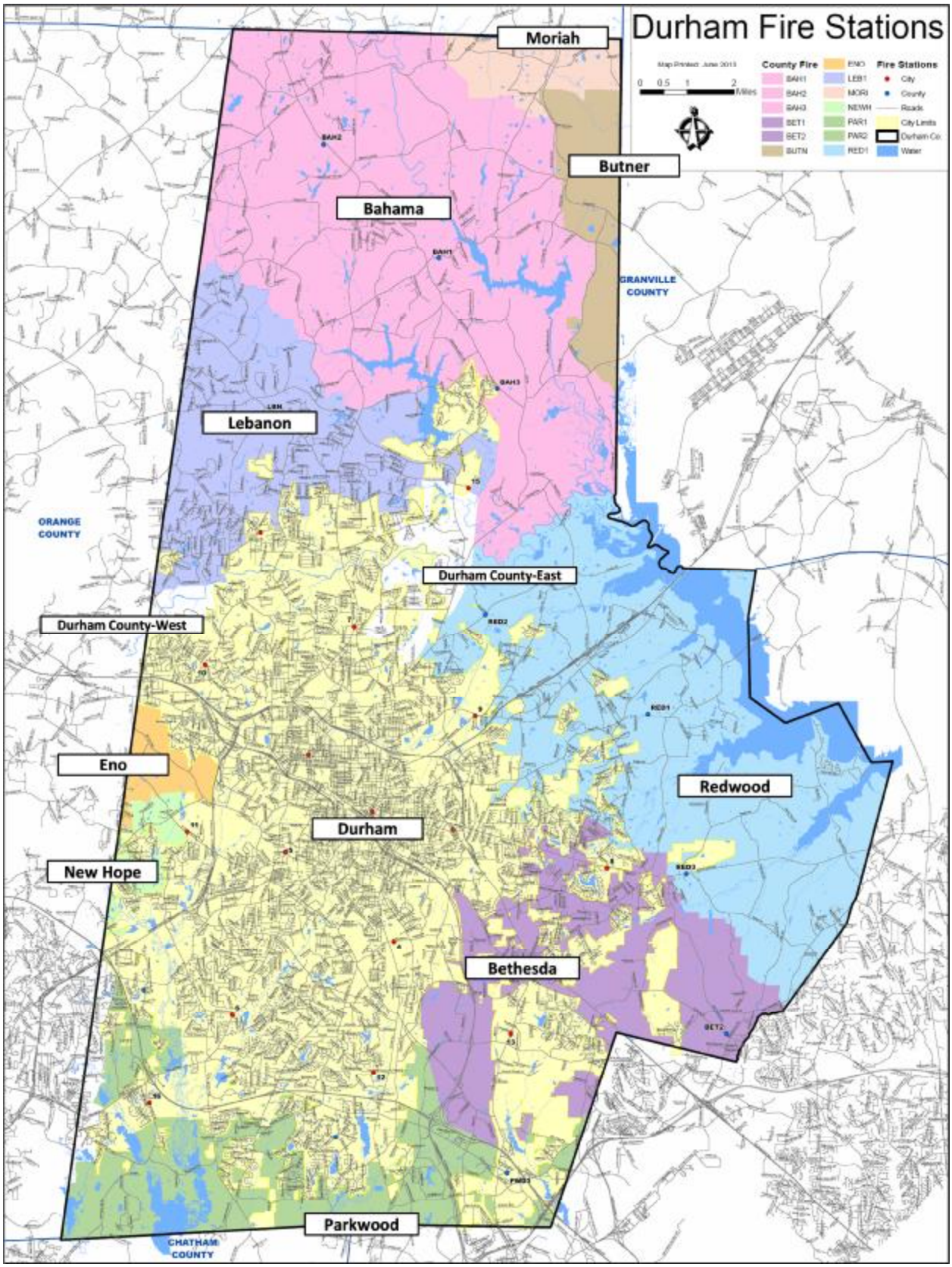
Figure 1
Fire District Land Area

Department/Area	Sq. Miles
Bahama	58.48
Bethesda	19.41
Lebanon	21.50
Parkwood	18.33
Redwood	49.14
Butner	6.62
Eno	2.51
Moriah	4.49
New Hope	1.86
Durham Co. East	1.92
Durham Co. West	3.68
Total	187.94

The color coded map that follows identifies the location and area of each of these districts. Of course the large cream colored area is the Durham City Fire District and correspondingly the City boundaries. Note that the City is far from a single and contiguous parcel. The numerous "out parcels" represent favored developments or businesses that the City has chosen to annex over the years. The extent to which these spot parcels extend into and/or intermix with the County's existing fire districts raises a number of questions; the implications of which will be discussed in the report sections that follow.

[6] Effective 1 July 2013 governance of the Bethesda Fire Department was transferred to the County.
[7] Consent Agenda Item 6.f, meeting of the Durham County Board of County Commissioners, 27 February 2006

Figure 2
Durham County Fire Districts



Legal Organization & Minimum Requirements
To become a certified Fire Department in North Carolina the following *minimum requirements* must be met and subsequently approved by the Office of the State Fire Marshal (OSFM) pursuant 11 NCAC 05A of the North Carolina Administrative Code.

Establishment

- *The fire department shall be incorporated under Chapter 55A of the General Statutes (The North Carolina Nonprofit Organization Act) or be operated by a city, county, or sanitary district as a division of that governmental unit.*
- *If the fire department is incorporated, it shall operate under a contract with a city, county, or sanitary district or any combination thereof.*
- *Boundaries defining the area of responsibility shall be established by a County Board of Commissioners for areas outside municipalities pursuant to G.S. 153A-233.*
- *The fire department shall provide the OSFM with a hand drawn map and written description or a GIS computer generated map of its initial or revised fire district.*

Personnel

- *The department shall have a minimum of twenty (20) personnel with at least two (2) designated as traffic control and at least eighteen (18) designated as firefighters.*
- *At least one engine with four (4) personnel must respond to each reported structure fire.*

Apparatus
To qualify for initial certification and receive a minimum district rating of "9s", the fire department shall have the following apparatus:

- *An approved pumper (an automotive fire apparatus equipped with a fire pump and water tank).*
- *The vehicle must be certified by Underwriter's Laboratory, Inc. and constructed in accordance with the National Fire Protection Association Standard 1901-Standard for Fire Apparatus.*
- *The pump shall have a rated capacity of not less than 750 gallons per minute.*
- *The pumper shall be equipped with at least a 500 gallon tank.*
- *The fire department shall have a motorized tank truck of at least 1,000 gallons capacity or enough to equal at least 1,500 gallons total for pumper and tanker combined.*
- *All tankers shall be baffled in accordance with National Fire Protection Association Standard 1901- Standard for Fire Apparatus.*

Each of the Fire Departments operating in the unincorporated areas of Durham County are chartered as private, nonprofit [501.c.3] corporations organized and authorized by the State of North Carolina, via existing statutes, to furnish fire protection and medical assist/EMS First Responder services to the citizens within their approved fire districts as well as outside their districts upon request via Automatic Aid Agreements in place with each Department and with the City of Durham.

Each Department has entered into a "Contract for Fire & Rescue Services" with Durham County which is renewed annually. Section 4 of that contract," Services to be Provided", states as follows:

> *Fire Department shall furnish fire protection and EMS first responder services within the District twenty-four hours seven days per week and shall provide the necessary equipment, personnel and those things necessary for furnishing such protection in the District (hereinafter "Services"). The services shall be in accordance with the minimum standards set forth in this Contract. Fire Department shall furnish said fire protection and EMS first responder services without charge to*

all persons and property located in the District in an efficient, professional and workmanlike manner. This provision shall not prohibit the Fire Department from entering into contracts with the Federal, State or other local governments, or utility companies for the provision of emergency services outside of the District for a fee.

The Fire Department shall submit to the Durham County Fire Marshal, a description of the Fire Department's capability to provide twenty-four hour coverage, seven days per week for the District.

For the County's part, it agrees in Section 1; "Special Tax"; that:

…it will cause to be assessed or levied a special tax pursuant to G.S. §153A-300 or G.S. §69-25 as applicable in the District, for fire protection purposes in an amount determined in the sole discretion of the Durham County Board of Commissioners. The County will collect said tax as part of the ad valorem taxes of the County, provided said tax shall only be levied in an area in which there has been previously established a special fire tax district or service district for fire protection purposes.

A special or separate fund shall be maintained by the County for funds collected as a result of said special tax.

Further, Section 20; "Minimum Performance Standards"; identifies ten (10) standards that are agreed to by the County and the Fire Department as part of the contract. They are:

A.DISPATCHING PROTOCOLS: Fire Department shall comply with the Durham County Dispatching protocols as developed and amended from time to time by the Durham County Fire Marshal.

B.RESPONSE TIME: Fire Department shall have an average response time (time of dispatch until time of arrival) consistent with its rating by the State Fire Marshal's Office. The Fire Department shall submit an accurate estimate of the minimum and maximum times for a response to calls within the District.

C.MANPOWER (ON SCENE): Fire Department shall have adopted standard operating guidelines that address the appropriate number of firefighters needed on all type fire calls. A current, valid copy of the Fire Department's guideline shall be kept on file with the Durham County Fire Marshal's Office. Each Fire Department shall have the goal of placing sufficient personnel on the scene to operate at least one pumper, one tanker (when necessary) and flow two 1.5" or 1.75" hose lines when making an initial attack on all structure fire calls.

D.TRAINING: Fire Department shall have the minimum standard training requirements set forth by the State for providing Fire and Rescue services provided by the Fire Department.

E.PRE-FIRE INCIDENT SURVEYS: Fire Department shall have the goal of developing pre-fire incident surveys and updating them annually for all commercial buildings within the fire district. Facilities will be given priority with buildings displaying NFPA 704 placards, hazardous, institutional and assembly occupancies. Upon request, the Durham County Fire Marshal's staff

shall assist Fire Departments in developing pre-fire incident surveys for buildings within the Durham County Fire Marshal's fire code enforcement service area.

F.FIRE INVESTIGATIONS: The Fire Department officer in charge at all fire scenes shall attempt to determine the origin and cause of every fire. When the officer in charge cannot determine the origin and cause of the fire or if the cause is suspected to be incendiary in nature, the officer in charge shall request a representative from the Durham County Fire Marshal's Office to assist. The Fire Department shall, to the extent practicable, provide whatever assistance is needed by the Durham County Fire Marshal's Office at the fire scene.

G.FIRE HYDRANTS: Fire Department shall conduct fire hydrant testing and maintenance as required by the State Fire Marshal's Office. Records of fire hydrant tests and maintenance conducted by fire departments shall be kept and be available for review by the County Fire Marshal's Office.

H.EMERGENCY DISASTER RESPONSE: Fire Department shall follow the Durham City/ County Emergency Operations Plan when responding to a disaster.

I.STATE OF EMERGENCY: Fire Department shall, to the extent practicable, assist with the following services when requested by the County during a State of Emergency but not limited to before, during and following times of emergencies/disasters:

(1) Debris Removal;
(2) Debris Clearance;
(3) Traffic Control;
(4) Search and Rescue;
(5) Evacuation;
(6) Medical Services as identified by the County, and;
(7) Other lifesaving and property protection measures as necessary.

All operations shall be in accordance with the Durham County Emergency Operations Plan and County Emergency Management Ordinance (if manpower within the Fire District allows this).

J.DURHAM COUNTY CHIEF'S ASSOCIATION: Fire Departments shall have a representative present at all Durham County Chief's Association meetings to provide an exchange of information between the County and each Fire Department unless there are extenuating circumstances that would prevent someone attending.

Of course the contract also addresses the use of funds, equipment requirements, health and safety, record keeping, financial reporting, annual audit requirements, budget procedures, insurance, insurance ratings, incident reports and more. The current document is nine (9) pages and is signed by the County Manager, the County Finance Director, and the Chief and president of the contracting Fire Departments Board of Directors.

Membership & Training

When originally established and recognized by the Board of County Commissioners[8], the five (5) Fire Departments were all "volunteer" departments. All were established as and, with the exception of Bethesda, remain today under contract with the County to provide fire protection services within their respective districts as private, non-profit, 501.c.3 status corporations. Today, each have paid employees as well as volunteers and are referred to as "combination" departments. While the differences may be subtle to the general public, as the percentage of career (paid) to volunteer members increases, it will generally not only determine the designation of the Department but also the level of service provided .

According to the National Fire Protection Association:[9]

- A *Volunteer Fire Department* is one "having volunteer emergency service personnel comprising 85 percent or greater of its department membership".
- A *Combination Fire Department* is one "having emergency service personnel comprising less than an 85 percent majority of either volunteer or career (paid) membership."
- A *Public Fire Department* is "an organization (public, governmental, military, or private) providing rescue, fire suppression, emergency medical services, and related activities to the public".

This table identifies the relevant information for each department in this regard. Note that the number of paid personnel listed for each includes *both* full time and part time employees.

Figure3
Volunteers & Paid Employees

Department	Established	Roster	No. Volunteers	Paid: Part-Tme	Paid: Full-Time	Total Paid	% Paid
Bahama	1960	67	41	26	0	26	39%
Bethesda*	1964	65	24	22	19	41	63%
Lebanon	1971	47	17	19	10	30	64%
Parkwood	1968	67	25	13	29	42	63%
Redwood	1978	53	7	46	0	46	87%

*The number of volunteers and paid personnel reflect those listed on the membership roster prior to 1 July 2013 when governance of the department was transferred to the County.

Also, while the number of paid employees listed for Redwood is greater than 85 percent; i.e. that of a "Public Fire Department", for purposes of this study it will be referred to as a combination department.

Overall, based on the rosters provided, fire department membership, not including cadets, auxiliary, or board members; total 299. Of that number currently 114 (38%) are volunteer members and 185 (62%) are full or part-time paid members of the five County departments. It is significant to note that many of the referenced part-time County Fire Department employees are already certified Firefighters and full-time employees of career fire departments; predominately the City of Durham.

[8] Durham County Attorney's Office; internal memorandum; 1 July 2012.

[9] NFPA 1710, Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Volunteer Fire Departments, 2010 Edition.

State of North Carolina Minimum Training Hours Required for Certification

It is interesting to note that the Fire Departments' contracts with the County are titled "Contract for *Fire & Rescue* Services" yet that contract also states that the Fire Department shall furnish fire protection *and EMS first responder services*; i.e. fire, rescue *and* EMS first responder services. This is intentional and significant. The fire service today has evolved well beyond simply putting out fires when called to do so.

Be they volunteer, combination, or career depart- ments, "fire" departments today, more often than not offer fire specific, rescue specific, and medical specific response services.

For combination and paid/career departments today the position classifications and minimum number of hours required to achieve certification in each of these disciplines are identified in the adjacent table.

Figure 4
Position Certification Requirements

Service/Discipline	Hours
Firefighter I	228
Emergency Vehicle Driver	20
Pump Operations	146
Aerial Operations	60
Technical Rescue	186
EMT	169

FIRE-Firefighter I certification requires the successful completion of 18 component classes, the longest of which is Hazardous Materials (HAZMAT) at 38 hours. The hours listed to achieve certification in Aerial Operations, Pump Operations, and Emergency Vehicle Driver are *in addition to* those completed for Firefighter I certification. Firefighter II classes, taken separately, require an additional 143 hours.

RESCUE-Basic certification requires the successful completion of seven (7) core component classes totaling 88 hours, a major Vehicle Rescue component totaling 60 hours, and the referenced HAZMAT class totaling 38 hours. Individuals wishing to specialize in one or more of the various specific technical rescue areas; such as water rescue, confined space rescue, collapsed building rescue, trench rescue, etc. are required to complete additional core subject classes which range from 48 to 88 hours each depending upon discipline.

EMS-the basic certification as an Emergency Medical Technician (EMT-Basic) requires the successful completion of nine (9) modules of instruction totaling 169 hours. Certification at the EMT-Intermediate level requires 256 hours of instruction in addition to the EMT-Basic classes; and EMT-Paramedic requires 1,096 hours in addition to the EMT-Basic *and* Intermediate classes.

The qualifications, training, and certification requirements for Firefighters and Technical Rescue personnel are determined and overseen by the Fire and Rescue Commission Division of the NC Office of State Fire Marshal.

The qualifications, training and certification requirements for EMTs is the responsibility of the North Carolina Division of Health Service Regulation, Office of Emergency Medical Services.

Fire District Insurance Service Ratings

The Insurance Services Office (ISO) has for years been responsible for the evaluation and rating of public fire departments throughout the country. The Public Protection Classification program (PPC) as it is known utilizes the Fire Suppression Rating Schedule (FSRS) as the assessment tool from which is derived the PPC rating assigned to the fire district being evaluated. The ratings range from 1-10, with a rating of

'1' representing superior/exceptional fire protection and a rating of 10 an indication that the fire district does not meet ISO's minimum criteria. The importance of this fire rating is that it is used by the insurance industry to establish home and business owners' insurance rates.

In North Carolina the Department of Insurance, Office of the State Fire Marshal (OSFM) has, since July 2001, assumed responsibility for the initial certification, on-going evaluation, and the assignment of ratings to both public and volunteer fire departments within the state who serve jurisdictions of 100,000 residents or less. The "North Carolina Fire Service Rating System" now determines the Fire Insurance District Rating Classifications. The process and criteria upon which ratings are based have essentially remained the same. In fact, local fire department members and administrators as well as OSFM personnel continue to refer to "ISO Ratings" regularly.

Figure 5
Existing Fire Department Area, Population & Service Ratings

Fire District	Predominant Area Characteristics	Resident Population	Area Square Miles	ISO Rating
Bahama	Rural	4725	58.48	9
Bethesda	Suburban	7550	19.41	4/9
Lebanon	Rural/Suburban	9275	21.50	6
Parkwood	Suburban	3675	18.33	5
Redwood	Rural/Suburban	7650	49.14	5/9

Note that while the U.S. Census Bureau defines suburban and urban areas as having 500-1,000, and greater than 1,000 people per square mile respectively, the reality is that;

- Lebanon, with significant rural characteristics has definite suburban characteristics as well, particularly along the southern edges of its district boundary that it shares with the City of Durham.

- Redwood, also with significant land area that is clearly rural, shares its western district boundary with the City of Durham, and surrounds dozens of "islands" and "peninsulas" of land spot annexed by the City of Durham over the years and subsequently introducing suburban characteristics to the District. In turn, the '6' in Redwoods' split 5/9 ISO rating can be attributed to the availability of City provided fire hydrants within and surrounding these many shared boundaries.

- On paper, the resident population of both Bethesda and Parkwood are less than 500/square mile each. However, both are characterized as "suburban" and the overlapping area they share with six (6), soon to be seven (7), City fire station coverage areas is significant. In fact, all three of Parkwood's fire stations are located within the City limits of Durham. This proximity to the city offers both Bethesda and Parkwood excellent access to available fire hydrants which has contributed to their low ISO ratings. The principal reason for their characterization as "suburban" districts however is the fact that the south end of the County, which both departments cover, realizes an increase in daytime business/commerce population of approximately 40,000 "day-residents". As well, the combined annual calls to which Bethesda and Parkwood have been dispatched over the past three (3) years; 2010-2012; has represented 55%, 58%, and 54% of the total combined call volume of all five County Departments.

Split Classifications

As noted in the above table, both Bethesda and Redwood have what are called "split" ratings. When ISO/the OSFM develop a Public Protection Classification for a fire district, all of the district's properties will typically receive the same rating. In other districts, however, ISO/the OSFM may develop a split classification (for example, 4/9). Generally, the first class (Class 4) will apply to properties within five road miles of a fire station and within 1,000 feet of a fire hydrant. The second class (Class 9) will apply to properties within five road miles of a fire station but beyond 1,000 feet of a hydrant.

And, while ISO generally assigns a Class 10 rating to properties beyond five road miles, the OSFM has established criteria under which a fire department can extend its fire protection *insurance district* to six (6) miles *providing* the extension is agreed to and approved by the Board of County Commissioners.

Subsection E of the State's "Requirements to Meet 9s Rating" states: *"Each Fire department shall have as a minimum, the equipment that is specified by the North Carolina Department of Insurance Rating Bureau (OSFM) as necessary for Grade 9s communities with a five (5) mile response."* This corresponds to the State's minimum requirements *that "a fire district's boundaries extend no further than 5 road miles from the fire station in any one direction to attain a 9s rating".*

Call Response

The discussion and accompanying illustrations that follow provide details with regards to the alarm response activities of the County's fire departments. The significant factors addressed include the annual number of calls, distribution of calls by Department, type of call, distribution of calls by hour of day, and response time.

Number of Calls

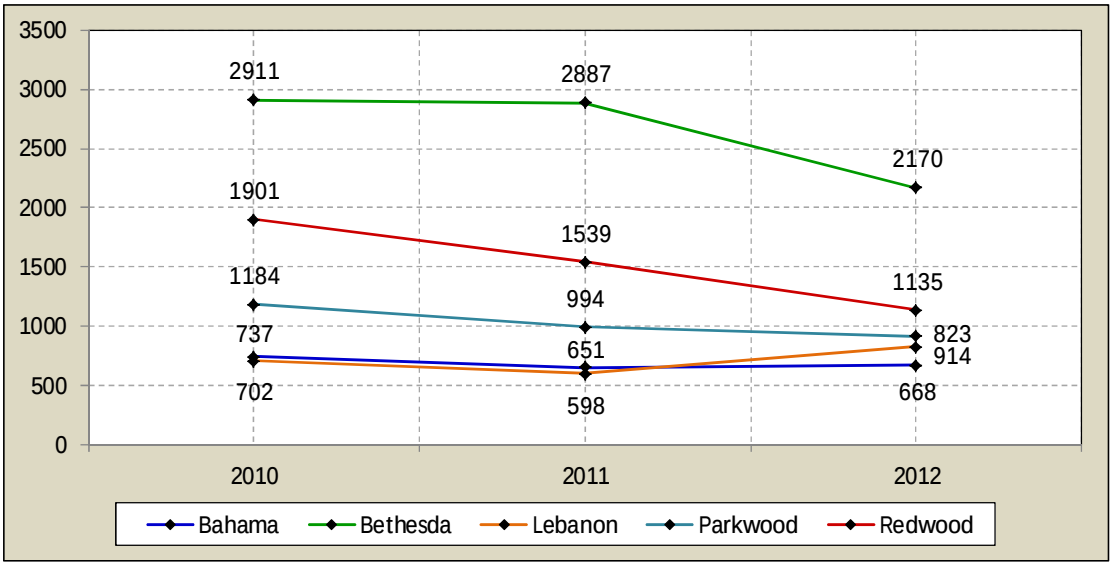
This table identifies the total number of calls dispatched to the County Fire Departments for the years 2010-2012.

Figure 6
Annual Calls Dispatched by Department

Department	2010	2011	2012	3-Yr. Avg
Bahama	737	651	668	685
Bethesda	2911	2887	2170	2,656
Lebanon	702	598	823	708
Parkwood	1184	994	914	1,031
Redwood	1901	1539	1135	1,525
Total	7435	6669	5710	6,605

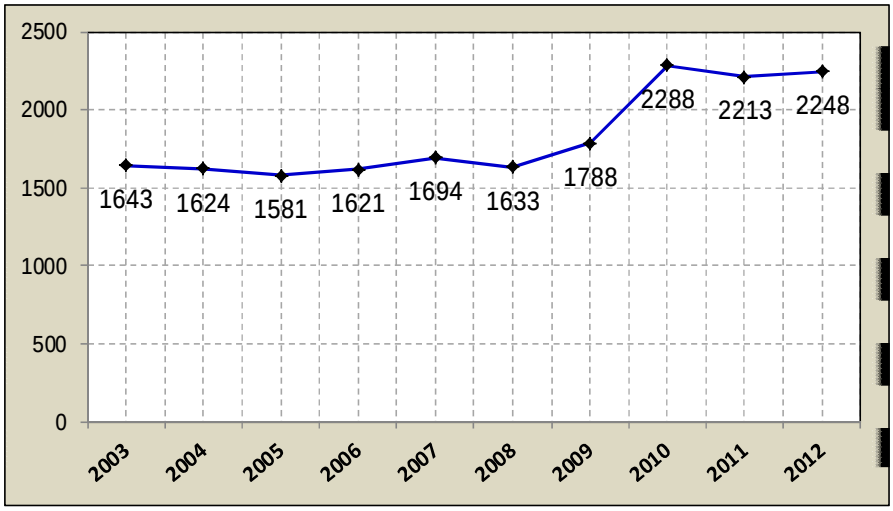
As noted in Figure 7 and Figure 8 that follow, the total annual calls decreased approximately 11.4 percent from 2010 to 2011, and 16.7 percent from 2011 to 2012; i.e. "downward". Every department had fewer total calls in 2011 than in 2010. And, while Bethesda, Parkwood and Redwood each recorded an additional decrease in total calls from 2011 to 2012, Bahama and Lebanon both had an increase.

Figure 7
Department Annual Call Volume Trends



The combined Bethesda/Redwood drop in call volume from 2011 to 2012 was 1,121; more than the total drop of all five departments combined, taking into account the increases in Bahama and Lebanon. *However,* both Bethesda and Redwood stopped running ambulances June 30, 2012 which, for each department, very likely accounts for most if not all of the decrease. In Bethesda's case as well was that the City of Raleigh, with whom Bethesda had contracted to run calls into an area of the City that was reachable by Bethesda, chose not to renew their contract-the effective date: June 30, 2012.

Figure 8
County Fire Department Combined "Fire-Only" Calls



The FIREHOUSE data base maintained by the Fire Marshal's Office records County fire department call data which is reported to the National Fire Incident Reporting System (NFIRS) annually. The "fire-only" calls recorded for the years 2003-2012, which included, EMS first responder, medical assist calls but *not* ambulance calls, provided the information illustrated in figure 8 here.

Needless to say, based on future year projected county populations and the corresponding development that will occur with it (see Section 3, County Population & Growth) there seems little likelihood that fire department call volumes will be "down" for long.

Type of Call

Generally speaking, the "type of call" to which the County's Fire Departments are dispatched refers either to the situation as reported by the caller to the 911 Call-Taker or as categorized by the Call-Taker once they have heard the caller's explanation of the incident. The way in which the incident is officially coded in the Incident Report entered into FIREHOUSE is determined by the Firefighter(s)/EMT(s) that responded to the incident itself; for example: "311-medical assist/assist EMS", "143-grass fire", "324-motor vehicle accident", "745-alarm system activation", etc.

The page that follows includes two columns of tables. By virtue of their contract requirements to furnish fire protection and EMS first responder services, the tables on the left side of the page break down the type of call by either "Fire" or "Medical Assist" (EMS); including the percent of the total calls per year that were Medical Assist. Note that Bahama, Bethesda, and Redwood ran "medical assist" calls with BLS ambulances during 2010, 2011, 2012; which included emergency transports of patients. As discussed, Bethesda and Redwood stopped the practice June 30, 2012; although both still respond as EMS first responders. Bahama stopped running ambulances December 31, 2012 and also still responds as EMS first responders.

What is immediately apparent is that for each Department and for each of the three calendar years recorded (2010-2012); there has been but a single year in one department (Bethesda at 48%) wherein the Medical Assist calls were less than 50 percent; the range being a high of 84 percent in Redwood to a low of 48 percent in Bethesda.

The tables on the right side of the page further break down the Fire and Medical Assist categories by identifying the five (5) most frequently dispatched calls within each. Interestingly, Traffic Accident or Fire Alarm is either the most or second most frequent type of call for each of the five Departments. And, of the five most frequent call types in the Medical Assist category all five Departments share four of the five call types in common; Chest Pain, Sick Person, Unconscious, and Difficulty Breathing.

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BAHAMA

Year	Fire	Med. Assist	Total	% Med. Asst.
2010	159	578	737	78%
2011	167	484	651	74%
2012	123	545	668	82%

BAHAMA [2012]

Fire	Percent	Med. Assist	Percent
Traffic Accident	31%	Chest pain	16%
Fire Alarm	25%	Sick person	15%
Investigation	23%	Unconscious	9%
Structure Fire	5%	Diff. Breathing	8%
Woods Fire	4%	Fall	8%
	88%		56%

BETHESDA

Year	Fire	Med. Assist	Total	% Med. Asst.
2010	1154	1757	2911	60%
2011	1086	1801	2887	62%
2012	1130	1040	2170	48%

BETHESDA [2012]

Fire	Percent	Med. Assist	Percent
Traffic Accident	35%	Fall	19%
Fire Alarm	21%	Sick Person	16%
Investigation	8%	Diff. Breathing	10%
Vehicle Fire	5%	Unconscious	10%
Structure Fire	4%	Chest Pain	9%
	73%		64%

LEBANON

Year	Fire	Med. Assist	Total	% Med. Asst.
2010	187	515	702	73%
2011	222	376	598	63%
2012	228	595	823	72%

LEBANON [2012]

Fire	Percent	Med. Assist	Percent
Fire Alarm	20%	Fall	24%
Traffic Accident	19%	Sick Person	16%
Investigation	16%	Unconscious	10%
Vehicle Fire	10%	Diff. Breathing	10%
Brush Fire	3%	Chest Pain	9%
	68%		69%

PARKWOOD

Year	Fire	Med. Assist	Total	% Med. Asst.
2010	493	691	1184	58%
2011	494	500	994	51%
2012	416	498	914	54%

PARKWOOD [2012]

Fire	Percent	Med. Assist	Percent
Traffic Accident	32%	Sick Person	18%
Fire Alarm	25%	Unconscious	10%
Confined Space	15%	Fall	9%
Investigation	8%	Chest Pain	9%
Structure Fire	5%	Diff. Breathing	7%
	85%		53%

REDWOOD

Year	Fire	Med. Assist	Total	% Med. Asst.
2010	295	1606	1901	84%
2011	244	1295	1539	84%
2012	351	784	1135	69%

REDWOOD [2012]

Fire	Percent	Med. Assist	Percent
Traffic Accident	23%	Sick Person	16%
Fire Alarm	16%	Diff. Breathing	13%
Investigation	9%	Fall	12%
Structure Fire	7%	Chest Pain	9%
Vehicle Fire	4%	Seizure	7%
	59%		57%

Figure 9
County Fire Department Calls by Type

Distribution of Calls by Hour of Day

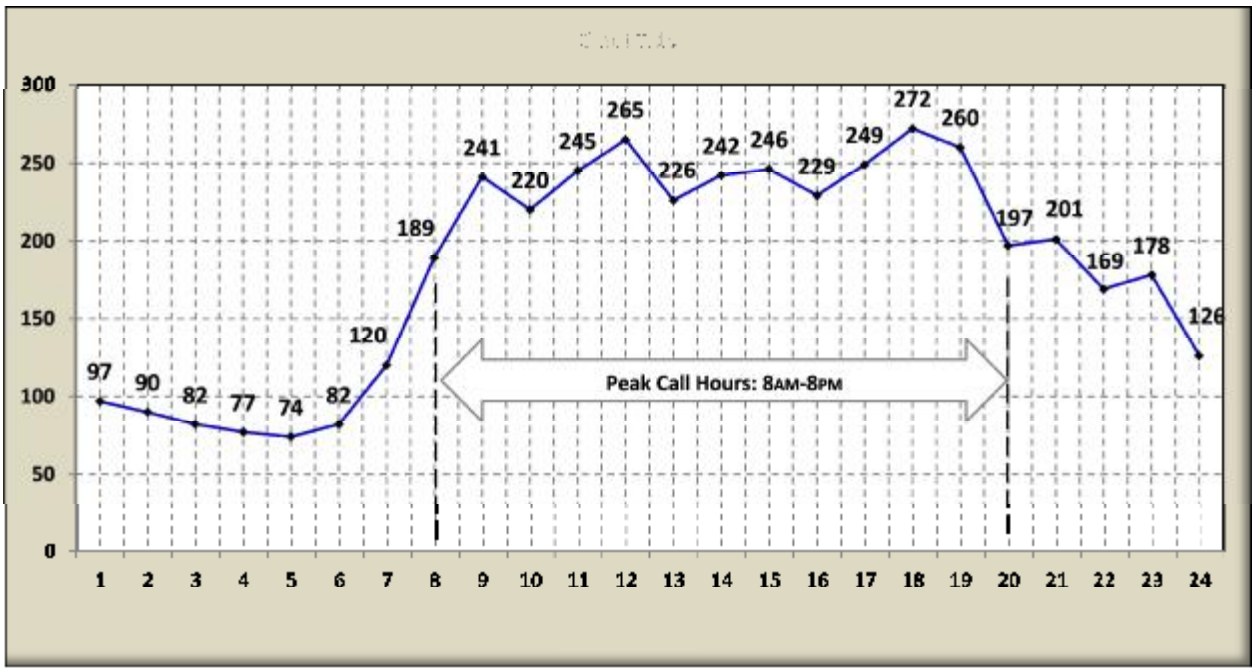
As discussed, the County's five Fire Departments are *combination* departments; i.e. their membership rosters are made up of a combination of paid and volunteer members. Historically, these volunteer members are (typically) employed at their respective places of employment during traditional daytime business hours of +/- 8:00am-5:00pm. These members' availability then, to respond with their respective Fire Departments, will (typically) be limited to evenings and weekends.

The graph that follows identifies, by hour of day, when the combined fire service calls of all five departments were received during calendar year 2012 For example, between the numbers '7' and '8' on the graph (7:00am-8:00am) 189 calls for service were received.

Based on the illustration, the busiest hour of the day during 2012 was between '17' and '18' (5:00pm-6:00pm) during which there were 272 calls. The least busy hour of the day was between '4' and '5' (4:00am-5:00am) wherein there were 74 calls received.

More specifically, in considering when personnel are in highest demand, the busiest 12 hour period of the day illustrated for 2012 was between 8:00am and 8:00pm wherein the number of calls received never dropped below 220 until the hour between 7:00pm and 8:00pm ('19' and '20') when the number of calls received was 197.

Figure 10
Calls/Hour/Year

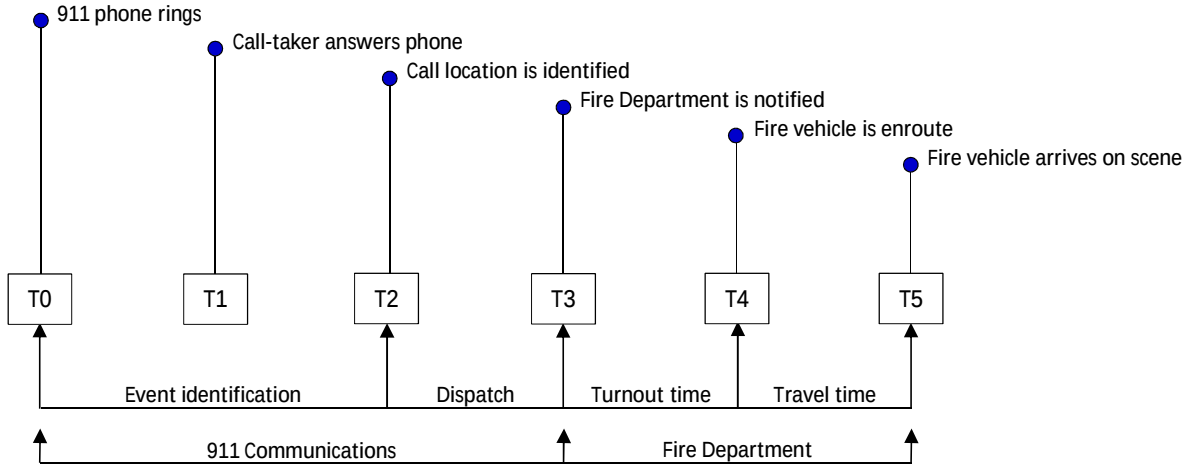


Response Time

"Response time" for Fire, Rescue, and Emergency Medical Service agencies alike is the sum of what is referred to as "turn-out time" plus "travel time". The diagram that follows illustrates the interval times (T0-T5) that occur from the time someone calls 911 until the emergency responder, in this instance Fire Department personnel, arrives on the scene of the reported incident.

While numerous factors, not the least of which will include development density, travel distance, and the natural geography of an area, ultimately contribute to a unit's or department's response time, in the Fire Service the availability of personnel is paramount.

Figure 11
The 911/Emergency Call Process



More specifically, turn-out time is the time it takes to react to the "alarm", "tone", or announcement of the emergency transmitted from the Communications Center (T3), to the time the emergency vehicle is occupied and "in motion"; i.e. "enroute" to the reported incident location (T4). The "travel time", is the interval from when the vehicle is enroute (T4) until the vehicle's wheels are stopped at the scene (T5).

Response time information was obtained from the FIREHOUSE Software® data maintained by each department. It was collected, analyzed and collated as it appears for each of the years 2010-2012. The following table represents the average annual *Total Response Time* and *Net Travel Time* results for each department for the years studied. The FIREHOUSE data available with regards to *Turnout Time* was incomplete. Subsequently the combination of a cursory study of the information that was available for each department, combined with NFPA recommended standards and known neighboring County and Durham City Fire Department performance standards in this regard an allowance of 90 seconds was identified as the average turnout time, particularly since all of the Durham County Departments have paid employees on duty 24 hours per day.

Note that Bahama had the slowest 3-year average Total Response Time at 10:07 minutes; however, it must be noted too that Bahama is the most rural and the largest County Fire District in land area at almost 60 square miles. Bethesda had the fastest 3-year average Total Response Time at 5:07 minutes; and, while the busiest County Department, its total land area is but the second smallest of the County Departments (after Parkwood) at just under 20 square miles.

Figure 12
Fire Department Total Average Response Times

BAHAMA

Year	Total Response Time	Turnout Time Allowance	Net Travel Time
2010	0:11:26	0:01:30	0:09:56
2011	0:09:44	0:01:30	0:08:14
2012	0:09:11	0:01:30	0:07:41

BETHESDA

Year	Total Response Time	Turnout Time Allowance	Net Travel Time
2010	0:06:06	0:01:30	0:04:36
2011	0:05:25	0:01:30	0:03:55
2012	0:05:30	0:01:30	0:04:00

LEBANON

Year	Total Response Time	Turnout Time Allowance	Net Travel Time
2010	0:07:03	0:01:30	0:05:33
2011	0:08:22	0:01:30	0:06:52
2012	0:07:01	0:01:30	0:05:31

PARKWOOD

Year	Total Response Time	Turnout Time Allowance	Net Travel Time
2010	0:07:11	0:01:30	0:05:41
2011	0:07:49	0:01:30	0:06:19
2012	0:08:07	0:01:30	0:06:37

REDWOOD

Year	Total Response Time	Turnout Time Allowance	Net Travel Time
2010	0:07:37	0:01:30	0:06:07
2011	0:08:13	0:01:30	0:06:43
2012	0:08:29	0:01:30	0:06:59

Mutual Aid

North Carolina General Statute 58-83-1 authorizes fire departments, both municipal and volunteer, to send personnel and equipment beyond the territorial limits normally served.[10]

The individual firefighters and the department, when responding to a call outside the area normally served, have the same authority and immunities as they enjoy inside their own territory or district. It is this statute that has long been interpreted as authorizing "mutual aid", essentially anywhere in the State. Indeed in rural areas, or areas where water is not readily available, mutual aid agreements between departments become very important.

In Durham County mutual aide agreements exist among and between the operating County Fire Departments, as well as with the City of Durham Fire Department. Of course the Durham City and County fire Departments can also have mutual aide agreements with municipalities or fire districts in adjacent Counties, Raleigh in Wake County and Chapel Hill in Orange County are examples.

When mutual aid is provided by a department *outside their normal district*, the recorded response time for that call will be *longer than* the average recorded response time within their own district. Subsequently, while response to mutual aid calls reflects man and vehicle hours, mileage, and of course costs, these calls should not be included when evaluating a departments in-district response time performance. A review of the many incident reports generated within FIREHOUSE found the reports *did not* identify whether the calls dispatched were mutual aide to another Department's district.

A copy of the standard "Fire Department Automatic Aid Agreement" is included in the Appendix.

Fire Apparatus

Clearly, the most significant pieces of equipment purchased in terms of size, complexity and cost, and owned and maintained by the County's Fire Departments are the firefighting and fire/emergency response vehicles; i.e. "fire apparatus".

Figure 13
Allocation of Fire/Rescue Apparatus

Department	Engine	Engine/Ladder	Tanker	Rescue/Brush	Utility	Air	Reserve	
Bahama	4	0	3	2	1	0	0	Engine
Bethesda	1	2	0	1	3	0	Tanker	Engine
Lebanon	3	0	1	1	2	0	0	0
Parkwood	3	2	2	3	5	1	0	0
Redwood	3	0	3	1	2	0	0	0
Total	14	4	9	8	14	1	1	2

*Note that while Bahama does not list a "rescue" designated vehicle, it does carry extrication equipment on each of its first-out engines.

Currently the 5 County Fire Departments are responsible for 53 fire, rescue, and utility vehicles, which include three (3) designated reserve vehicles that range from a 2013 F-550 Brush Truck to a 44 year old reserve status engine (pumper/tanker) and a 33 year old active duty engine (pumper/tanker). Of the current inventory of vehicles, sixteen (16) vehicles are more than 20 years old, eight (8) are between 25-30 years old, and three (3) are more than 30 years old.

[10] G.S. 58-83-1 Authority to send firemen and apparatus beyond territorial limits; privileges and immunities.

Apparatus Terminology

To the average person on the street a "fire truck" or "fire engine" is the large (often red) truck with a siren, on its way (assumedly) to the scene of a fire, rescue, or medical emergency. Within the fire service, the terminology becomes more specific. In an effort to clarify the column headings in the previous table and to latter discuss the vehicles themselves, the following definitions are provided.[11]

Fire Apparatus-A vehicle designed to be used under emergency conditions to transport personnel and equipment, and to support the suppression of fires and mitigation of other hazardous situations.

Engine-A fire department vehicle ("fire engine") that includes a pump with a rated pumping capacity of not less than 750 gallons per minute (gpm).

Pumper-Fire apparatus with a permanently mounted fire pump of at least 750 gpm capacity at 150 psi net pump pressure, a minimum 500 gallon water tank, and hose body whose primary purpose is to combat structural and associated fires.[12]

Tanker (Mobile Water Supply Apparatus)-A vehicle designed primarily for transporting (pickup, transporting, and delivering) water to fire emergency scenes to be applied by other vehicles or pumping equipment.

Ladder Truck (Aerial Fire Apparatus)-A vehicle equipped with an aerial ladder, elevating platform, or water tower that is designed and equipped to support firefighting and rescue operations by positioning personnel, handling materials, providing continuous egress, or discharging water at positions elevated from the ground.

Rescue Vehicle- A special vehicle, also known as a heavy rescue or squad, equipped with tools and equipment to perform one or more types of special rescue operations such as building collapse, confined space, high angle, vehicle extrication, and water rescue.

Utility Vehicle (Special Services Fire Apparatus)-A multipurpose vehicle that primarily provides support services at emergency scenes; many times an SUV, Pickup or similar.

Air Truck-A vehicle that can travel to the scene of an active fire, or to neighboring fire station locations to deliver and/or refill with compressed breathable air the self-contained breathing apparatus (SCBA) air tanks worn by firefighters during fire suppression efforts

Brush Truck-is a combination of an all-terrain, mini-pumper and a wilderness rescue vehicle, often used to fight wildfires. An example would be a heavy duty pickup truck outfitted with a 200 gallon water tank and a pump to distribute that water under pressure.

In-Service Fire Apparatus- Any fire apparatus, including reserve apparatus, which is available for use under emergency conditions to transport personnel and equipment and to support suppression of fires and mitigation of other hazardous conditions.

Reserve Fire Apparatus- A fire apparatus retained as a backup apparatus and used to replace a primary apparatus when the primary apparatus is out of service.

[11] NFPA @ www.NFPA.org/Glossary
[12] Requirements to Meet the 9-S Rating for Initial Certification/Re-Inspection of Fire Departments in North Carolina; NC OSFM

Major Apparatus Inventory

Note that the number, in the Unit Number column, indicates which Fire Department the apparatus belongs to; i.e. the 300 series-Bahama, 400 series-Bethesda, 500 series-Lebanon, 600 series-Parkwood, and the 700 series-Redwood

Figure 14
Inventory of Major Apparatus

Vehicle Category	Unit Number	Year	Make	Pump GPM	Tank GAL
Engines	Engine 311	2006	Ferrara	1500	720
	Engine 312	1991	E-One	1250	1500
	Engine 321	1990	E-One	1250	1000
	Engine 331	2006	Ferrara	1500	720
	Engine 421	2004	Sutphen	1500	1000
	Engine 511	2002	E-One	1500	1000
	Engine 512	1990	E-One	1500	300
	Engine 514	2002	E-One	1500	1000
	Engine 611	2000	E-One	1750	1000
	Engine 621	1983	E-One	750	750
	Engine 631	2000	E-One	1750	1000
	Engine 711	2004	Sutphen	1500	1000
	Engine 721	1990	E-One	1000	1000
	Engine 731	1986	GMC	1000	1000
Ladders	Engine 411	2008	Sutphen Quint	1500	500
	Engine 413	2003	Sutphen-110' Platform	1500	300
	Engine 613	1993	E-One75' Ladder	1500	500
	Engine 633	1985	E-One 95' Platform	1500	300
Tankers	Tanker 316	2010	Peterbuilt/Alexis	1000	3000
	Tanker 325	2010	Peterbuilt/ Alexis	1000	3000
	Tanker 335	1989	E-One	250	1500
	Tanker 515	2010	International	1250	3000
	Tanker 615	2005	US Tanker	1000	3000
	Tanker 616	2006	US Tanker	1000	3000
	Engine 715	2009	Ferrara	1500	1000
	Engine 725	1980	Ford	1000	1250
	Engine 735	1985	Ford	1000	1250
Rescue	Brush 327	2004	Ford/ Anchor-Richey	250	300
	Brush 337	2012	Dodge/Anchor-Richey	500	300
	Rescue 414	1990	Sutphen Heavy Rescue	250	300
	Brush 417	1988	GMC/E-One	250	300
	Brush 517	2013	Ford F-550	200	250
	Rescue 614	2006	EVI Rescue	N/A	N/A
	Brush 617	2004	Ford F-150-Brush Truck	300	300
	Brush 717	2003	Ford	200	500
Support	A-618	2001	Pierce-Air Truck	N/A	N/A
Reserve	Engine 324	1969	Ford/John Beam	750	750
	Engine 412	1992	Sutphen	1500	1000
	Tanker 415	1983	Sutphen	1500	1000

Funding & Costs

The statutory basis for establishing and funding County Fire Departments was discussed in Section1. Figure 15 identifies the total value of the property within the boundaries of each Fire District, the fiscal year 2012-2013 tax rate assessed per $100 of the property value, and the total amount of the fire tax assessed within each district.

Figure 15
Fire District Property Value, Tax Rate & Fire Tax Assessment

Department	Property Value	Tax Rate	Total Assessment
Bahama	$ 1,373,301,799	0.0600	$ 823,981
Bethesda	$ 1,721,352,182	0.1000	$ 1,721,352
Lebanon	$ 972,764,581	0.1000	$ 972,765
Parkwood	$ 1,292,715,452	0.1150	$ 1,486,623
Redwood	$ 623,342,443	0.1125	$ 701,260

Annually, each Fire Department prepares and submits to the County Fire Marshal a proposed annual budget for the upcoming fiscal year. Following review, and subsequent any discussions or revisions with the Fire Marshal, the County Budget Office and/or the County Manager, the budgets of the Fire Departments, as initially approved, are included in the Manager's annual Budget Proposal that is submitted to the Board of County Commissioners for their final approval.

Currently the Fire Departments' budget submittal includes:

- A Budget Summary-which which outlines sources of revenue and general categories of expenses for the requested year as well as the previous two (2) fiscal years.
- A Line Item Budget-which breaks down Personnel Expenses (salaries & wages and fringe benefits); Operating Expenditures such as utilities, office supplies, and vehicle maintenance; Capital Outlay for major furniture, equipment, and vehicles; and, Notes payable/Debt Service.
- A Capital Budget-which describes and offers further justification for the larger; i.e. more expensive; capital items requested in the Line Item Budget.

Figure 16 identifies each Department's annual budget as allocated for the past three fiscal years.

Figure 16
Annual County Allocation/Department

Department	FY 2010-11	FY 2011-12	FY 2012-13
Bahama	$ 683,755	$ 731,106	$ 820,778
Bethesda	$ 1,592,463	$ 1,686,858	$ 1,704,059
Lebanon	$ 995,547	$ 1,097,638	$ 1,145,628
Parkwood	$ 1,644,444	$ 1,564,240	$ 1,614,691
Redwood	$ 746,895	$ 746,000	$ 770,000
Total	$ 5,663,104	$ 5,825,842	$ 6,055,156

Annual Financial Statements

In addition, upon completion of the fiscal year (June 30th), each Department is required by contract their contract with the County, to submit all necessary requested financial records to an accounting firm selected by the County for the completion of an annual "Independent Auditor's Report" which prepares a statement of financial position of the Fire Department and related statements of financial activities and changes in net assets and cash flow for the year just ended.

Contracted Services

As discussed in the introduction to this section, Durham County contracts with Eno and New Hope Fire Departments, which are based in Orange County, to provide fire protection to two small tracts (Eno @ 2.51 square miles and New Hope @ 1.86 square miles) within Durham County along its western boundary with Orange that are difficult to access from the existing station locations of the Durham County departments.

In addition, Memoranda of Understanding with Moriah Volunteer Fire Department (Person County) and Butner Volunteer Fire Department (Granville County) each also provide coverage into Durham County; respectively along the northeast and western County line.

With regards to the cost of these contracted services, the area covered within Durham County by Butner has been assessed a fire district tax in the past, however, it is no longer. The area within Durham County covered by Moriah Volunteer Fire Department (4.49 square miles) is not assessed a fire district tax principally because Moriah does not assess a fire district tax for the area it covers in Person County .

The tax rates assessed and the annual budgets approved for Eno and New Hope Fire Departments are provided in these tables. It should be noted that the tax rate identified for each department, which is assessed on Orange County property owners in the areas each department covers, are established and approved by the Orange County Board of Commissioners and passed on to Durham County for approval and inclusion in its annual budget.

Figure 17
Contracted Fire Service Costs

Eno Fire District	2010	2011	2012
Tax Rate Assessed	0.0599	0.0599	0.0599
Approved Budget	$ 22,956	$ 22,956	$ 23,582

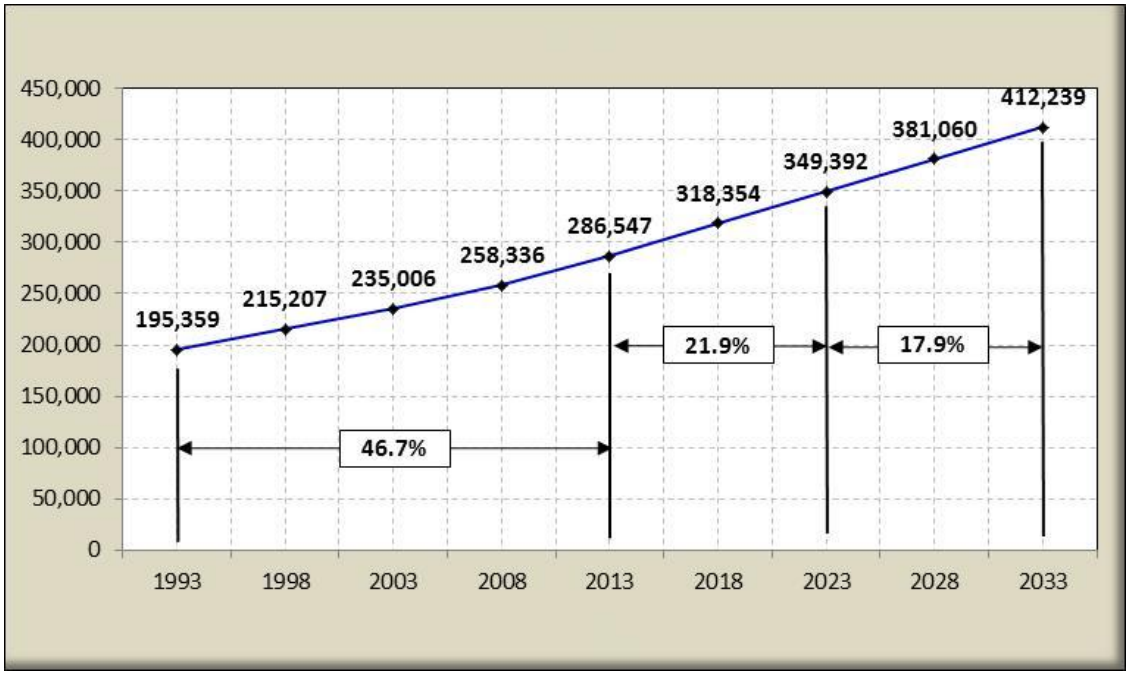
New Hope Fire District	2010	2011	2012
Tax Rate Assessed	0.0695	0.0895	0.0895
Approved Budget	$ 72,518	$ 72,518	$ 73,724

Total Amount :	$ 95,474	$ 95,474	$ 97,306

SECTION 3. COUNTY POPULATION & GROWTH

This section briefly examines Durham County's recent past and projected future populations. The relevance of the County's population to the future demand for Fire and EMS first responder services will be considered in an effort to project future demands and in turn the needs of both operations. The principal source of the information presented in this section is the North Carolina Office of Budget and Management (NCOBM).

Figure 18
Durham County Experienced & Projected Populations



These figures indicate that over the last 20 years the County's population has increased 46.7%. The projected July 2013 resident population was 286,547. Over the next decade the County's population is projected to increase by 62,845 residents; 21.9%. The following decade, 2023-2033, although increasing at a lower rate; i.e. 17.9%; will still experience an increase in population of yet another 62,847 residents. As a means of comparison, the counties sharing boundaries with Durham County are expected to experience the following in terms of growth over the next 20 years:

Figure 19
Adjacent County Projected Populations/2012-2032

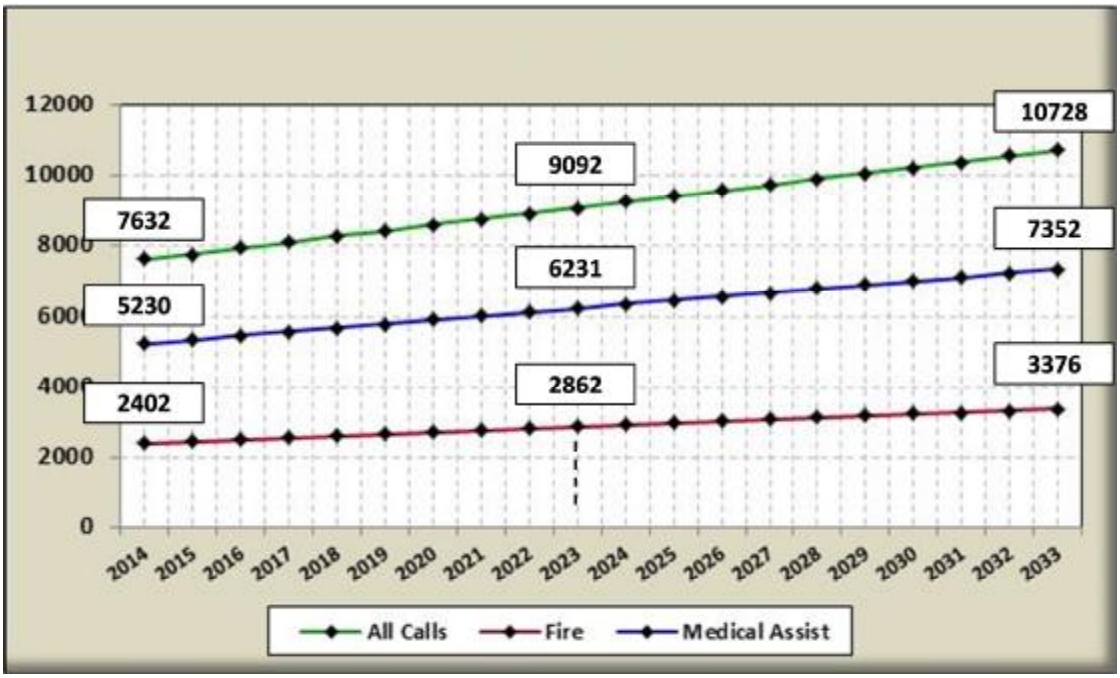
County	Jul-13	Jul-23	% Change	Jul-33	% Change	Total % Change
Chatham	67,840	80,964	19.3%	94,085	16.2%	35.5%
Durham	286,547	349,392	21.9%	412,239	17.9%	39.8%
Granville	58,500	62,550	6.9%	66,602	6.5%	13.4%
Orange	140,651	161,672	14.9%	182,751	13.1%	28.0%
Person	39,300	39,901	1.5%	40,502	1.5%	3.0%
Wake	965,833	1,174,425	21.6%	1,383,017	17.8%	39.4%

Both Wake and Durham County are expected to realize population increases of almost 40 percent over the next 20 years. Although Wake is much larger in terms of population, Durham's rate of increase over the next two decades is slightly greater than Wake County's. Also, the projected rate of growth in both Orange County to the east and Chatham County to the south are expected be significant as well, at 28 percent and 35.5 percent respectively.

As a means of looking ahead, each Fire Department's call data was studied for the calendar years 2010-2012. The identified total call volumes, as well as the medical assist and fire sub-categories were evaluated against the County's population for each of those same years. The purpose for this exercise was to assess the rate of those calls per every 1,000 county residents. Then, utilizing the average rate per thousand for each category and applying it to the projected future annual county populations can begin to provide some insight into what might be anticipated for total and sub-category annual call volumes in the future. The average rate/1,000 for "all calls" was 26.02; for "medical" calls, 17.83; and for "fire" calls, 8.19.

Note also that the findings/numbers generated are intended to serve as "indicators" of what future call demand might become. Also, while each of the five departments have specific districts which they serve, each are dispatched to aid neighboring districts on many occasions; subsequently the ratio of calls to total county population was used since their services were frequently extended over much more area than that of their own districts and very often to areas within the city limits of Durham.

Figure 20
Projected Fire Department Calls/1,000 Population



When tracked over the years to come, the numbers certainly will not fall into straight lines as illustrated and at times will more likely than not may vary considerably. In all likelihood, however, the most significant indicator of call volume for the fire departments in the years ahead will be the County's general population and where that future population choses to live.

Population Demographics

The following tables provide information regarding Durham County's estimated populations for 2013 and its projected populations for 2033; 20 years hence. In each table the youngest identified population subgroup-age 13 years and younger; the oldest identified population subgroup-age 65 years and older; and the largest subgroup-ages 25-54, are identified. Note the number of residents in each subgroup for the year designated and the percent of the total county population that each subgroup represents.

While the number of residents in each subgroup is projected to increase between 2013 and 2033, the 13 & under and the 25-54 subgroups decreased in their percentage of the population by 1.6 and 3.7 percent respectively. Yet, the 65 & over subgroup increased in the number of residents, but also grew as a subgroup of the total county population by 4.2 percent. Note also the total 2013-2033 increase in the number of residents in each subgroup. While the 13 & under subgroup and the 25-54 subgroup increased by 31.5 and 31.8 percent respectively; the 65 & over subgroup increased by 114 percent.

Figure 21
County Population Subgroup Estimates

Year	Population	Age Group		
		13 & under	25-54	65 & over
2013	286,547	53,468	124,898	30,693
% of County's Population		18.7%	43.6%	10.7%

Year	Population	Age Group		
		13 & under	25-54	65 & over
2033	412,239	70,318	164,468	65,717
% of County's Population		17.1%	39.9%	15.9%

2013-2033 Increase:	31.5%	31.8%	114.0%

The significance of this information is this: each of the five fire departments is dispatched and responds as EMS first responders to medical emergencies. Under the "Medical Assist" column listing *each* of the Department's (5) most frequently dispatched (medical) calls were included (not necessarily in this order) "chest pain", "difficulty breathing", and "fall". The sufferers' of these conditions are very often members of the 65 & over age group.

Development

The numbers indicate that between now and 2023 the permanent population of Durham County will increase by 62,845 residents; and, by 2033 it will add another 62, 847; almost 126,000 more people. This is more people than currently reside in all but seven (7) of the State's current 553 municipal jurisdictions.[13] One result of course will be considerable residential, commercial and infrastructure development to accommodate this increase. And, while age group demographics should catch the attention of EMS and the county fire departments that serve as EMS first responders; the impact of the number of people alone should also capture the attention of the fire/rescue side of these same departments.

[13] North Carolina Office of Budget and Management

Research Triangle Park (RTP)
When considering what the "drivers" are for the past and projected growth, and what makes Durham County and the Raleigh-Durham area so attractive, the most prominent answers will inevitably include the area universities, the renowned hospitals and Research Triangle Park (RTP).

Today RTP, which rests on 7,000 acres in southern Durham and western Wake counties, is home to 170 companies, employing 49,000 FTE and contract employees in hundreds of buildings comprising 22.5 million square feet.[14]

With the publication of the *Research Triangle Park Master Plan* in November 2011, RTP is today poised to begin implementation of that plan. In the document's introduction it states that;

> *Transformative change is needed to meet 21st century challenges. The long-term benefits of the new RTP Master Plan to tenants, to the region, and to the State of North Carolina, will be considerable. The Plan shows how RTP could accommodate dramatically more development and employment over the next 50 years, in a sustainable and transformative way.*

Under the report heading Development Objectives, the first two are;

More Density and Nature, which reads in part: *". . . the research triangle Park will need to permit and even encourage increased density in certain locations to create new opportunities for growth and enable more urban models of development."*

The second objective, *21st Century Amenities,* reads in part: *"employees increasingly want to work in exciting, active locations that offer a range of amenities. Amenities that will help attract and retain workers will include:*

- *Improved Park visibility within the region and clear entryways.*
- *Creation of a vibrant central district.*
- *Active retail, focused on food and beverage.*
- *High quality, attractive multifamily housing located at key nodes.*

For the past 50 years RTP has become known world-wide for its research and technological discoveries. However, as the report states, *"its original (mid-20th century) development model must change to meet new challenges in the market place and inside the Park itself".* And, while RTP is embarking in some precedent setting changes; the public safety community, particularly in this instance, the fire services of both the County and City, must view this planned development from their own perspective as well.

Annexation
Thus far this report section has addressed the anticipated population growth, and the widespread development that is sure to accompany it, as well as the concentrated and significant development initiatives of RTP. While all will have an impact on what and how fire services are delivered in both County and City Fire Departments, there is yet another subject that must be considered and it is a potential game changer. That subject is *annexation*. The map of Durham County with the City and County fire districts outlined in different colors has been likened to "Swiss-cheese". That is of course because the municipal boundaries of the City are not contiguous. There are many, previously referred to in the report as "islands and "peninsulas" of city property that has been annexed by the city,

[14] www.rtp.org

principally for their property value and the associated tax revenues, lying within and among several of the County unincorporated fire districts.

The Land-Use Map that follows was provided by the Durham City/County Planning Department and identifies the projected plans for the limits of development within the County. The outer black line extending north and west of all now city property represents the currently identified extent of that development. In turn, the Fire District Map that follows the Land-Use Map illustrates the placement of that outer development limit line over the existing county fire district's land area. As noted, Bethesda and Parkwood have been consumed, as have approximately half of Redwood and Lebanon and the southern tip of Bahama. In all likelihood it will not be a matter of "if" the City of Durham will continue to annex what is now unincorporated Durham County, but rather, "when".

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Figure 22
Durham City/County Planning Land Use Map

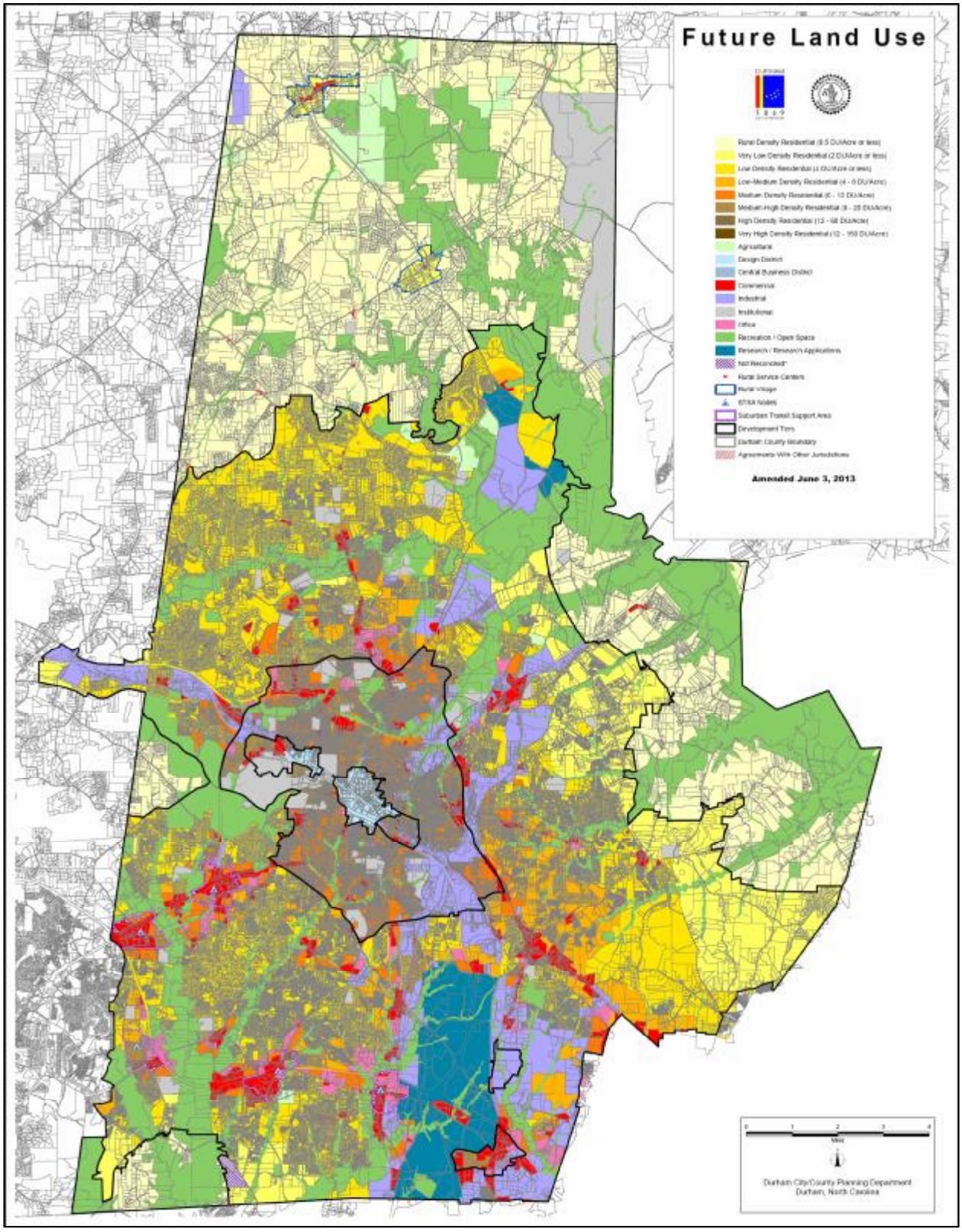
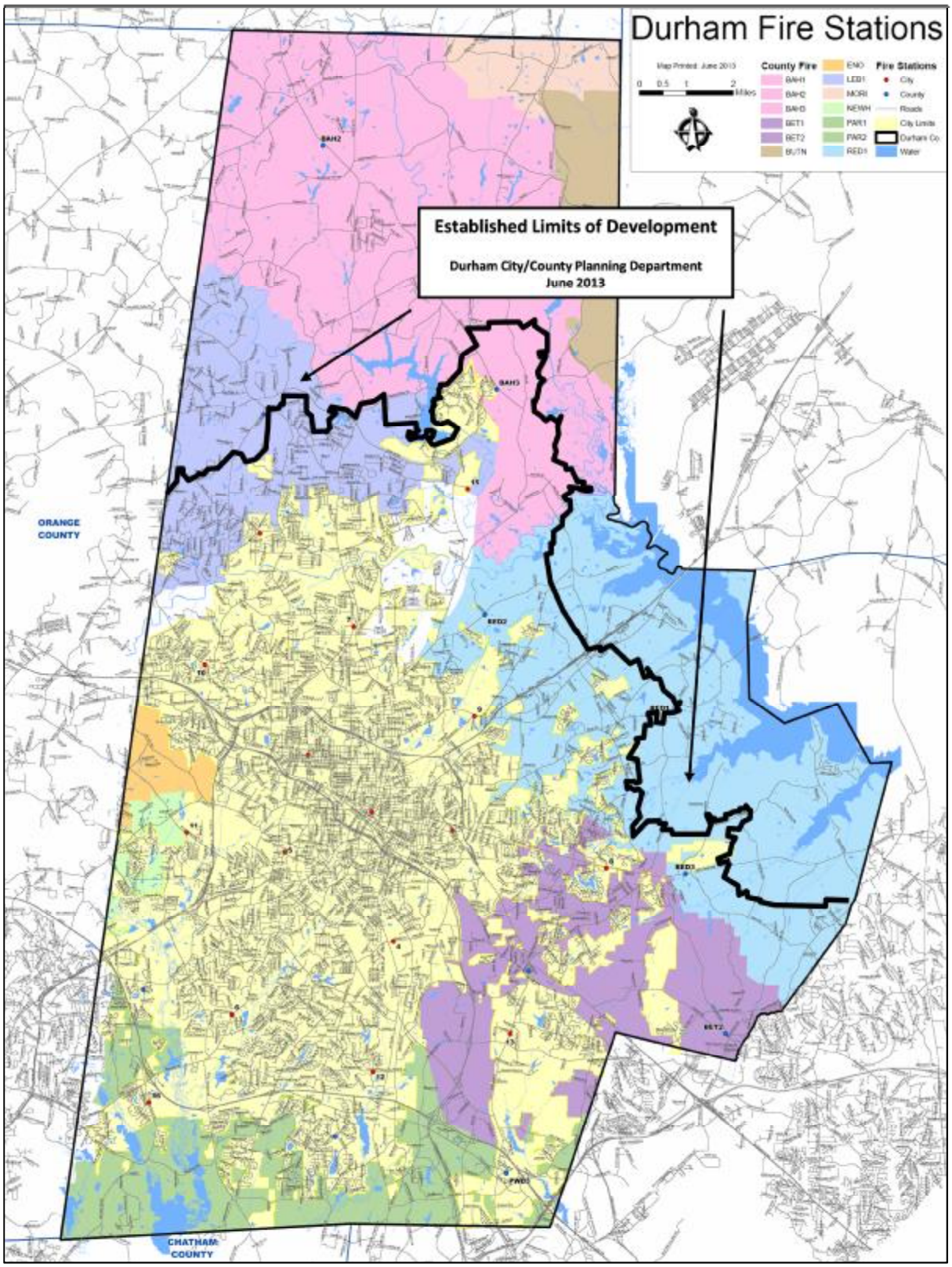


Figure 23
Limits of Development & Potential Impact on County Fire Districts



SECTION 4. SERVICE RATINGS & STANDARDS

Perhaps the two most influential organizations impacting public fire services today are the Insurance Services Organization (ISO) and the National Fire Protection Association (NFPA).

ISO is the organization that establishes *rating criteria* for public fire departments throughout the country. The "Fire Suppression Rating Schedule" (FSRS) is the assessment tool (document) which is used in the evaluation of available public fire suppression systems and facilities, and provides the basis for the Public Protection Classification or PPC rating for the insurance industry, which in turn is used by insurance carriers to establish homeowners and business owners' insurance rates.

The Fire Suppression Rating Schedule document utilized by ISO includes 12 major sections together with numerous tables, formulas, and charts for measuring and calculating the capabilities of a community's "fire suppression system"; i.e. fire department. The calculations that take place during a jurisdiction's fire service assessment eventually result in a PPC rating or number that ranges from 1 to 10. An ISO Rating of 10 represents a jurisdiction or area within a jurisdiction with less than the minimum recognized protection; i.e. "unprotected", while an ISO rating of 1 represents the best possible score achievable.

In North Carolina, since 2001, the Office of the State Fire Marshal (OSFM) has assumed responsibility for the initial certification, on-going evaluation, and the assignment of ratings to both public and volunteer fire departments within the state having resident populations of less than 100,000. The "North Carolina Fire Service Rating System" (NCFSRS) now determines the Fire Insurance District Rating Classifications, which in conversation and correspondence are still most commonly referred to as "ISO" ratings.

NFPA is a 110 year old international organization that addresses life safety issues in many areas and has developed specific codes and performance standards throughout the public safety industry; most notably in the area of fire protection. For example, NFPA publication 1710 is titled; *"Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments".* NFPA 1720 is the partner publication applicable to Volunteer Fire Departments.

Subsequently, NFPA is generally regarded as the leading advocate of fire prevention and is the authoritative source on public safety generally. In fact, NFPA's 300 codes and standards are said to influence literally every building, process, service, design, and installation in the United States. Examples of NFPA-developed codes include "NFPA 1, Fire Protection Code" which provides the requirements necessary to establish a reasonable level of fire safety and property protection in new and existing buildings.

Numerous NFPA standards publications are referenced and quoted in the report sections that follow. The basis for doing so has to do with the reputation of NFPA but perhaps more so with the credibility and depth of the data upon which their standards are based. Career fire service professionals have embraced them and many jurisdictions throughout the County have adopted them, particularly NFPA 1710 as their in house fire services operating standards.

That being said, the NFPA publications cited, for the most part, are *standards* versus "requirements". The "for "the most part" terminology is used because several standards publications or subsections thereof *have* been incorporated as "requirements"; i.e. NFPA 1500 by the North Carolina Department of Labor; and as the basis for several OSHA requirements, which are law; including 29 CFR 1910.134.

ISO Rating

It is the property owners that reside within each of the County's fire districts that are assessed and pay the annual fire district tax that funds their respective fire departments. Each fire district is assigned an ISO Rating based upon the North Carolina Response Rating System via evaluations conducted by inspectors assigned by the NCDOI Office of the State Fire Marshal (OSFM). The Fire District's ISO Rating is used by the insurance industry as the basis for establishing resident's annual homeowners' insurance premiums. Subsequently, a homeowner residing within a Fire District with an ISO rating of say 9 or 10 will pay considerably more than a homeowner residing within a Fire District that has an ISO rating of 6. The example shown here, provided by the NCDOI, illustrates the annual home insurance premiums for a new brick veneer home valued at $150,000 with no credits and a $250 deductible. While none of the Fire Departments have an ISO rating of 10, the difference between a 9 and a 6 in this example shows an annual premium reduction of approximately 30%; a difference of $205 dollars per year in homeowners' insurance premiums paid.

Figure 24
Insurance Premium/ISO Rating

ISO Class Rating	Annual Premium
10	$ 999.00
9	$ 825.00
9s	$ 825.00
8	$ 708.00
7	$ 648.00
6	$ 620.00
5	$ 620.00
4	$ 620.00
3	$ 620.00
2	$ 620.00
1	$ 620.00

When ISO develops a single Public Protection Classification (PPC™) for a community, all of the community's properties receive that classification. In many communities, ISO develops a split classification (for example, 5/9). Generally, the first class (Class 5 in the example) applies to properties within five road miles of a fire station and within 1,000 feet of a fire hydrant. The second class (Class 9 in the example) applies to properties within five road miles of a fire station but beyond 1,000 feet of a hydrant. ISO generally assigns Class 10 to properties beyond five road miles.[15]

An example of this would be the Redwood Fire District which currently has a split 5/9 ISO rating. Over the years the City of Durham has annexed previously unincorporated areas of Redwoods' district along its western boundaries. Upon doing so, the City has provided water to its residents which in turn have included pressurized fire hydrants. Subsequently, access to these hydrants has benefitted Redwood and many of its property owners with lower ISO ratings.

The detailed breakdown and explanation of all of the characteristics and criteria that are assessed during the rating process are extensive. Broadly, the major categories from which the Fire Departments' evaluation score is ultimately determined are as follows:

Receiving & Handling Alarms	10%
Water Supply	40%
Fire Department	50%

Receiving and Handling Fire Alarms-This involves an assessment of the communications system that is responsible for the receipt, handling and dispatching of fire (and medical) alarms; it's technical capabilities, facilities, and number and qualifications of the personnel assigned. The Durham (City) Emergency Communications Center is the official public safety answering point (PSAP) for both the City and County of Durham. The County contributes to its operation financially via an inter-local agreement with the City.

[15] Fire Suppression Ration Schedule Overview; www.isomitigation.com

Water Supply-At 40% of the total score water supply is a critical component of the overall evaluation. In fact, according to the OSFM, the availability of water (Water Supply) and the manner in which it is delivered (to where it can be used to fight a fire) together comprises 35% of the total 40% of this category. Urban and Suburban departments will typically have a significant advantage in this regard as their location near or colocation with a municipal pressurized water system will provide fire hydrants to deliver a continuous flow of water proximate the fire that is being combatted.

On the other hand, rural unincorporated areas; i.e. predominantly all or major portions of Bahama and Redwood Fire Districts; must more often than not rely on water obtained from accessible water points such as a river, lake or reservoir from which they must extract and transport the water to the scene of a fire versus pressurized fire hydrants. An alternative of course, at least to some extent and depending upon the area covered, the department can purchase a large capacity mobile water tanker (truck) that can be kept pre-filled and available to respond to a fire call in tandem with the assigned first out engine, typically a combination pumper/tanker.

Fire Department-the most significant single category evaluated is that of the Fire Department itself at 50% of the total score. The major sub categories that are evaluated are broken down as follows:

Company Personnel	15%
Engine Companies	10%
Training	9%
Ladder and/or Services Companies	5%
Pumping Capacity	5%
Distribution of Engine and Ladder/Service Companies	4%
Reserve Engine Companies	1%
Reserve Ladder and/or Service Companies	1%

As stated, the "ISO" Rating is the term still used that is, since 2001, officially the North Carolina Fire Services Rating System (NCFSRS).

Additional Resources
While NFPA and ISO may be among the more prominent acronyms in the vocabulary of fire service professionals there are numerous organizations and agencies that have over the years and continue to make significant contributions to the field via their participation, training programs, publications and resource materials, and research and testing; including:

- *The National Institute for Standards and Technology (NIST)*
- *The United States Fire Administration (USFA)*; which includes the National Fire Academy and oversight of the National Fire Incident Reporting System (NFIRS); to which the County Fire Departments contribute data.
- *The Center for Public Safety Excellence (CPSE)*; which oversees the Commission on Fire Accreditation International (CFAI) and the Commission on Professional Credentialing (CPC).
- *International City/County Management Association (ICMA)*

SECTION 5. ISSUES & CONCERNS

This section discusses the significant observations and issues of concern identified during the analyses of the various data collected, as well as the visual study of conditions found to exist. These observations together with the many conversations, formal interviews, and meetings held with Fire Chiefs, individual Firefighters and County staff provide the basis for the comments that follow.

Therefore, the issues identified as being of significant concern had to do with the following:

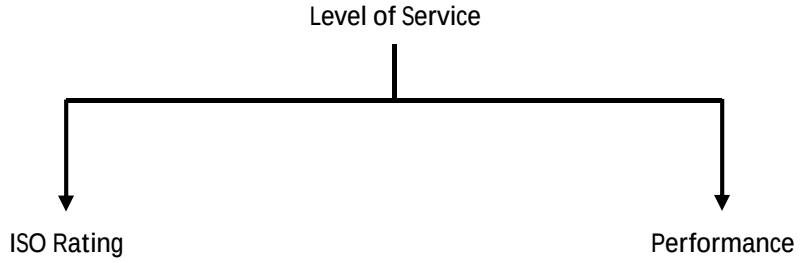
- Level of Service
- Contract Limitations
- Data
- Revenue Management
- Fire Stations & Fire Apparatus
- Volunteers & Department Staffing
- Consolidation

ISSUE #1: Level of Service

As referenced in Section 1, within the County's purpose statement for this study was included the objective that the consultant was to make recommendations regarding…. *The standardization of services and programs offered to the communities to provide a consistent level of service countywide.*

Considerable discussion occurred throughout the various stages of the study with regards to how "level of service" was to be defined and, in turn, what a fair basis for determining what a "consistent" level of service should be, particularly considering the land area and diverse characteristics of the five (5) fire districts being studied.

The discussion evolved and eventually formed around two characteristics considered essentially to be of parallel importance; each for different reasons.



ISO Rating

As discussed, a fire district's ISO rating is based upon a comprehensive evaluation of the fire department's *capabilities* in terms of the availability of qualified personnel, fire vehicles, fire equipment, the availability of water, and the receiving and handling of alarms.

In turn, the ISO class rating assigned following such an evaluation is a "score" which is used by the insurance industry to determine homeowner and business owner insurance premiums. A rating of 10 indicates that the home or business is outside the acceptable distance from the closest available fire department; i.e. essentially "not covered". Although some insurance companies will not write homeowners' insurance for residences located within an area having an ISO rating of 10, others will, however, the annual premiums in those instances can be quite high.

None of the five Departments included in this study have an ISO rating of 10. Two, however, include major areas within their boundaries rated at 9; i.e. Bahama and Redwood. Bethesda is a split district (4/9); the portion that remains a '9' is small in terms of land area and consists of approximately 20 residences and four small businesses. The basis for the '9'rating has to do with not having accessible fire hydrants in the area proximate to these homes and businesses. In turn, Lebanon's entire district is rated at an ISO 6 and Parkwood's entire district at an ISO 5. And, while neither district has accessible fire hydrants throughout its areas, each department *has* successfully implemented water-haul operations that have satisfied State ISO inspectors/NCOSFM that each meets the requirements of the district wide ISO rating each has received.

Of course, the lower the ISO rating the better, as far as the homeowner is concerned. As illustrated in Section 4, a homeowner residing in a fire district with an ISO rating of '6' is very likely paying as much as 30 percent *less per year* in property insurance than were the same house located in a fire district with an ISO rating of '9'.

For the period ending 30 June 2013, this table provides each fire district's ISO Rating along with the fire district tax rate and the Fire Departments' annual approved budget.

Figure 25
Fire District, Rating, Tax Rate and Department Budget

Fire District	ISO Rating	Fire District Tax Rate	Fire Dept. FY 2013 Budget
Bahama	9	0.0600	$ 820,778
Bethesda	4/9	0.1000	$ 1,704,059
Lebanon	6	0.1000	$ 1,145,628
Parkwood	5	0.1150	$ 1,614,691
Redwood	5/9	0.1125	$ 770,000

Discussions regarding the significance of these figures will vary; however, will include the observation that there appears to be a relationship between the ISO Rating and fire district tax rate and fire department annual budget. For example; Parkwood has the lowest *overall* district rating of '5', but it also has the highest fire district tax rate. In turn, Bahama has the lowest fire district tax rate but the entire district is rated at '9'. These issues will be explored further in the discussions that follow.

As discussed in Section 4, the ISO rating is based upon the major categories from which the Fire Departments' evaluation score is ultimately determined:

Receiving & Handling Alarms	10%
Water Supply	40%
Fire Department	50%

The availability of water is a big issue; however, as several of these departments have shown there are options for providing that water from other than pressurized hydrants.

Also, of the 50 percent of the ISO grade that is "Fire Department", 25 percent is comprised of personnel/staffing at 15% and fire apparatus at 10%. Does it cost money to go from a 9 to a 7 or 6?

Sure it does. But if that money is to ultimately benefit the citizen; i.e. the possible victim of an accident or fire, then who is to judge that it is not money well spent. For example, "that new tanker to transport water to the scene of a fire", "the additional two firefighters added to the day shift", or "the trade in of an out of date pumper and the purchase of new one" in many cases may have been needed for some time.

These are not "volunteer" departments anymore; they are "combination" departments with the cumulative majority of roster members being paid employees of their respective Fire Departments.

Should citizens then not expect "more" service or at least a more consistent level of service with regards to the ISO rating; if so, at what cost? Homeowners will experience decreasing insurance rates in most instances at each subsequent grade change from ISO '9' to ISO '6' at which time the rates will stabilize. Businesses, depending upon the type of business, structure, and occupancy will continue to experience some reduction in rates at rating levels below '6'.

A consistent level of service in this regard should be expected of each fire department that contracts with the County to provide the services subscribed to them. Should every district be expected to have the *same* ISO rating? Perhaps not, but improvements can be made.

Performance

Fire District ISO Ratings (NCFSRS in North Carolina) are "scores" based on meeting various criteria having to do principally with communications, water availability, vehicles and equipment, and the availability of personnel. It requires a considerable effort and commitment of time on the part of fire department personnel to achieve a lower; albeit "improved" ISO rating. Does this represent "performance" on the part of those instrumental in accomplishing that lower rating? Of course it does. This "rating" is important to the home and business owner in that it serves as the basis for establishing insurance rates. However, ISO (NCFSRS) *does not* address specific *performance* requirements having to do with *response to* an actual fire, rescue or medical emergency.

While the State's requirement that "at least one engine with four (4) personnel must respond to each reported structure fire" does in fact represent performance criteria, *The State of North Carolina/NCFSRS does not currently require nor have they established call response time standards.* Time standards have been developed by NFPA and others for career and volunteer departments based upon the study of thousands of actual fire alarm responses as well as actual incident reports and quantitative burn test results.

Response Time

The discussion that follows is applicable particularly to *serious* fire and medical emergencies. The vast majority of municipal/paid fire departments as well as many volunteer fire departments in North Carolina and the United States respond to fires as "firefighters" *and* to medical and other emergencies as "first responders" typically, at minimum, at the EMT-Basic level. Each of the Durham County Fire Departments does.

As previously addressed, "response time" in this context is the time from the initial alert or announcement by the 911/Communications Center of the reported emergency (also referred to as "tone", "page", or dispatch), to the time that the emergency service vehicle and appropriate personnel arrive on the scene.

Why is time so important?
According to the National Emergency Number Association (NENA), "The most elementary explanation of why time is important in a police, fire, or medical emergency has to do with the obvious; *serious injury and/or the potential loss of life and property*." Quite simply and literally, response time is important because it may mean the difference between life and death.

Factors impacting response time include of course the *distance* that must be covered, and the *speed* at which the emergency vehicle is able to travel, and under what conditions. For reference, the following formula can be used to calculate average travel time between two points; (NFPA 1720-A.4.3.2):

1.7 x Distance + 0.65 = Travel Time

As an example, from Parkwood's Station 3, traveling east/northeast on NC Highway 54 to its intersection with NC Highway 55 is approximately 3.3 miles. Utilizing the above formula the travel time would be estimated as follows:

1.7 x 3.3 miles + 0.65 = 6.3 minutes travel time

This travel time equates to an average speed of a little less than 35 miles per hour, which actually *is not* unusual for fire vehicles (or for rescue and EMS vehicles) for this distance considering acceleration, deceleration, time of day, road conditions, other traffic, etc.

Factors influencing the *quality* of the response have to do with not only the time it takes to get to the scene of the emergency but also the information communicated to the responding service unit, the skill of the personnel responding, and the availability of the proper apparatus and equipment to adequately address the emergency at hand.

Paramount, of course, is that any emergency service agency *must be prepared* to address the most serious scenario *each time* they are dispatched.

Notably then, the most serious calls to which a fire or fire/rescue agency charged with responding to emergencies are going to be those involving a structure fire, hazardous material situation, a "non-breathing", "man-down" or similarly serious medical emergency, and motor vehicle accidents; most notably any incident with the potential for the loss of property, serious injury, or death.

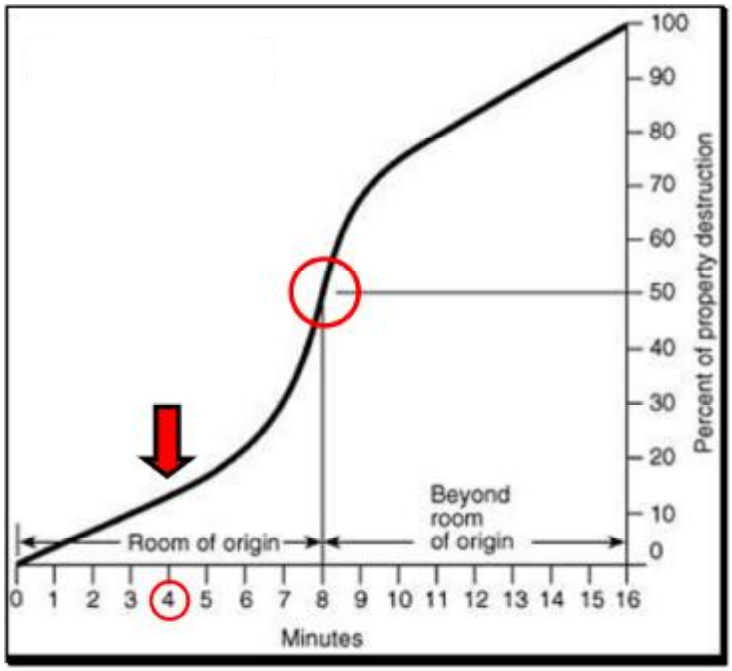
Fire Incident Response
The concern with regards to fire service response times is based upon research conducted by various national associations and agencies that study the critical nature of firefighting and fire incident response and have developed standards accordingly. Among them:

- *The National Fire Protection Association (NFPA) states that "if a fire is not suppressed in 8 to 10 minutes from the time of ignition, it will flashover, spreading outside the initial area or room of origin".*

- *"As a rule of thumb, first (fire/rescue) responders should arrive on the scene in less than five minutes, 90% of the time." (National Institutes of Health)*

- *"The fire department shall establish a response time objective of four minutes or less for the arrival of the first arriving engine company at a fire suppression incident, for not less than 90% of all incidents"; [NFPA Standard 1710 for the Organization and Deployment of Fire Suppression Operations; Section 4.1.3].*

Figure 26
Fire Propagation Rate



The adjacent diagram illustrates the basis for the NFPA standard regarding fire suppression response times.

At approximately eight (8) minutes from initial ignition (flame), a fire will move from the room of origin into the remaining area or rooms of the structure. As this occurs the likelihood of substantial damage and structural loss increases dramatically. At 16 minutes it is conceivable that property damage could be total.

For example, were this graphic applied to a house fire, and the fire were to start (combust) in the kitchen of the house at 4:00 am; by 4:08 am the fire would begin to spread beyond the kitchen and shortly thereafter "flashover" into the next adjoining room; i.e. dining room, living room, etc. Then, were the fire to go unabated for *another* eight (8) minutes, the likelihood that the home would be destroyed increases dramatically.

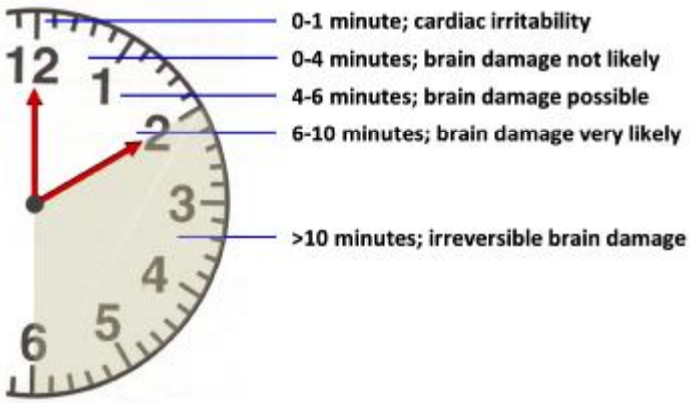
Medical Incident Response

With regards to response times to medical emergencies, the basis upon which pre-hospital emergency response criteria has been established is medical case history data regarding the body's need for oxygen. Simply, the human body needs oxygen to survive. While some cells may tolerate short periods without oxygen, most require a constant supply of oxygen to survive. The illustration and narrative that follow illustrate the significance of these findings.

As with fire incident response, the concerns and subsequent standards regarding emergency medical response times are based on the findings of various significant organizations and professional associations. Among these, the American College of Emergency Physicians (ACEP) and the American Heart Association has each similarly stated that:

The most important factor in successfully resuscitating a patient in cardiac arrest is the speed of response. The survival rate from untreated ventricular fibrillation decreases up to 10% for every minute that passes and definitive care is not provided.

Figure 27
Oxygen Deprivation Timeline



The American Heart Association, ACEP, and other highly respected organizations recommend that emergency medical responders should arrive on scene to deliver BLS (basic life support) skills within 3 to 4 minutes, with ALS (advanced life support) skills available within 6 to 8 minutes. The ALS within-8-minute concept developed from research that showed the survival rate of cardiac arrest victims decreases significantly with each passing minute, and that optimal probabilities for survival increase when BLS has been provided within 4 minutes followed by ALS within 8 minutes."[16]

Additionally, organizations that have published findings with regards to emergency medical response times have included:

- *NFPA, which states in 1710, that "deployment for the first responder/AED level to arrive within four minutes for 90 % of all calls."*
- *"For cardiac arrest, the highest hospital discharge rate has been achieved in patients for whom CPR was initiated within 4 minutes of arrest and advanced cardiac life support within 8 minutes". (American Heart Association)*
- *"In an incident involving lack of oxygen, brain damage is very likely at 6 to 10 minutes; irreversible after 10 minutes". (American Association of Orthopedic Surgeons)*

Additional Time Standards

The National Fire Protection Association's standards (NFPA 1710; 2010 Ed.) go on to further address performance requirements with regards to turnout time which require that:

- *A time objective of 80 seconds shall be established for turnout time;*
- *"The fire department's fire suppression resources shall be deployed to provide for the arrival of an engine company within a 4-minute response time and/or the initial full alarm assignment within an 8-minute response time to 90 percent of the incidents".*

In addition, for a Fire or EMS agency that responds to critical incidents involving medical emergencies, NFPA 1710 further states that:

- *"AED/Basic Life Support capabilities arrive within a 4-minute response time to 90 percent of the incidents. . . "*

[16] American College of Emergency Physicians; "Principles of EMS Systems"; 2006

Of note, is that NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations to the Public by Career Fire Departments* is frequently adopted at least in part by career fire departments located in what are referred to as "built-upon" areas. Understandably, the traditional volunteer or suburban or rural combination department may find it difficult to comply with many of the standards recommended due to the area that they serve, or simply the costs involved.

- At this time these are known as NFPA "Standards"; i.e. *not* "requirements". They are available to any authority having jurisdiction over a fire department to adopt, in whole or in part.
- However, the extensive work, research and accumulated data that have led to the establishment of these response time standards particularly, are substantial and cannot be discounted.
- Whether an individual department or jurisdiction choses to adopt any of these standards, does not change the fact that the characteristics of lack of oxygen for an accident or stroke victim, or a fire in a structure, will act or respond differently than the parameters cited.

Durham County

For all intents and purposes, today the five "Volunteer" County Fire Departments are so in name only. Certainly the significant role that existing department volunteers perform and the contributions they have made over the years must be praised. However, with the exception of Bahama, with paid employees comprising but 39 percent of its roster; the remaining four departments all have paid employees comprising at least 60 percent of their rosters, with Redwood at 87 percent. Subsequently, it is time to consider raising the bar with regards to performance in this regard.

A Fire Department's responsibility regarding response time begins *when it is notified of the alarm*. The total response time, as discussed, is the sum of the turnout time *plus* the travel time to the scene of the reported incident. The average total response times for each Department, for each of the years studied, for all calls to which they were dispatched, are illustrated in this table.

Figure 28
Total Average Response Time

Year	BAHAMA	BETHESDA	LEBANON	PARKWOOD	REDWOOD
2010	0:11:26	0:06:06	0:07:03	0:07:11	0:07:37
2011	0:09:44	0:05:25	0:08:22	0:07:49	0:08:13
2012	0:09:11	0:05:30	0:07:01	0:08:07	0:08:29

The 2012 times range from an average 5 minutes-30 seconds for Bethesda to 9 minutes-11 seconds for Bahama. Bahama of course is not only the largest district in land area, but also the most rural. Bethesda and Parkwood are suburban by virtue of the type and density of development found within their respective districts, as well as being the two smallest districts in land area; with each also having daytime population densities equal to most urban areas. Lebanon and Redwood serve combination rural and suburban-like areas with Redwood being the second largest district in land area and with considerable rural expanses similar to those of Bahama. The total "average of the annual averages" of all five departments for calendar year 2012 was 7 minutes-40 seconds.

The total, net travel and turnout interval times are provided in Section 2, page 24, and although current FIREHOUSE software does not provide a reliable means to extract specific total or average turnout times, a study of the data that was available and the fact that all departments have paid employees on duty suggested that an allowance of 90 seconds would be appropriate to use as an average time for turnout.

While, the total average annual response times of the each department indicated that while their average annual (travel) response times were not bad, their fractile times shown below were not good. Of course too, as with their *average* response times, their fractile times were based on *all* calls to which they were dispatched for the period or year noted including both those *within* their respective district boundaries as well as those mutual aide calls to which they were dispatched *outside* their district

"Average" is no longer acceptable

Current trends, including in some instances already published standards, including NFPA 1710 and NFPA 1720, suggest that *average* response time is no longer an adequate measure of performance in a life safety/emergency services environment. Average response time is just that; i.e. *average*. Which means that although any number of calls could have been responded to in *less than* (in Durham County's case) the overall average time of 7 minutes-40 seconds, an almost equal number of calls were likely responded to in greater *or even much greater time* than indicated by the *average*. Professional organizations as well as those associations who publish what are considered the prevailing standards for the industry have pushed for performance standards; i.e., response times; that are to be met (typically) *at least 90 percent of the time*.

Earlier, 4 and 8 minute intervals were discussed with regards to response time interval benchmarks for fire and medical emergencies. As a means of comparison, these tables (Figure 29) break down the annual four and eight minute fractile response times for each of the County's Fire Departments.

With regards to response time, if a *consistent* level of service is to mean that *each* department will be expected to meet *the same* response time standard for 90 percent of all calls, that expectation will not be met; nor is it realistic.

Figure29
Annual 4 & 8 Minute Fractile Response Times

BAHAMA

Year	% of calls within 4 min.	% of calls within 8 min.
2010	12.5%	42.6%
2011	18.1%	47.1%
2012	16.8%	56.7%

BETHESDA

Year	% of calls within 4 min.	% of calls within 8 min.
2010	45.7%	87.2%
2011	51.8%	91.5%
2012	47.4%	91.4%

LEBANON

Year	% of calls within 4 min.	% of calls within 8 min.
2010	32.0%	80.0%
2011	21.9%	83.2%
2012	18.6%	80.9%

PARKWOOD

Year	% of calls within 4 min.	% of calls within 8 min.
2010	29.6%	76.2%
2011	21.7%	71.6%
2012	19.1%	70.6%

REDWOOD

Year	% of calls within 4 min.	% of calls within 8 min.
2010	28.0%	71.0%
2011	20.4%	63.6%
2012	16.9%	61.4%

Redwood, with three stations within its district of 49 square miles (16.3 square miles per station) cannot fairly be held to the same response time standards as Bethesda with two stations within a district of 19 square miles; i.e. 9.5 square miles per station.

On the other hand, with regards to the turnout time interval, all stations should be held accountable to the same time standard as, again, all have paid employees.

ISSUE #2: Contract Limitations

As noted, Durham County currently contracts with five in-County Fire Departments for "Fire & Rescue Services". The combined budget of these departments for fiscal year 2012-2013 as approved by the Board of County Commissioners was $6,055,156 dollars.[17] In turn these departments assume considerable responsibility to and for the taxpayers that provided these monies as evidenced by their response to 5,132 calls for service during this same funding period.

The contract itself, however, leaves much to be desired in terms of *specific* performance requirements and accountability

Contract language: *Services to be Provided. Fire Department shall furnish fire protection and EMS first responder services within the District twenty-four hours seven days per week and shall provide the necessary equipment, personnel and those things necessary for furnishing such protection in the District (hereinafter "Services"). The services shall be in accordance with the minimum standards set forth in this Contract.*

Comment: There *are no* standards stipulated within the contract specific to the referenced "necessary equipment, personnel and those "things" [namely vehicles] necessary . . ." Specific minimum staffing and vehicle standards are essential, including specific reference to NFPA 1901, Standard for Automotive Fire Apparatus, which is a *requirement* of the NCOSFM for any fire district with an ISO rating of 9s or better.

Contract language: *Health and Safety. Fire Department shall be responsible for initiating, maintaining and supervising all safety precautions and programs. Fire Department shall comply with all North Carolina OSHA regulations as they apply to volunteer fire departments.*

Comment: Essentially, the reference to the fire departments as "volunteer" is no longer valid as discussed. That being said OSHA requirements are law. North Carolina is an "OSHA State" with the NC Department of Labor charged with enforcement of OSHA laws as applicable. In terms of this contract wording, a general statement regarding compliance is fine; however, with regards to "enhancing firefighter safety" there are several specific federal and/or state imposed safety standards that will impact fire scene operations and vehicle (firefighter) safety. Examples include the Respiratory Protections Standard, 29 CFR 1910.134, NFPA 1500, Fire Department Occupational Safety and Health Program, and NFPA 1901, Standard for Automotive Fire Apparatus. Inclusion in the contract of specific language that quantifies or otherwise specifies the staffing, vehicle and/or operations "requirements" of these standards will remove any ambiguity as to the County's intent or the responsibilities of the fire departments.

[17] Durham County, North Carolina Approved Budget; FY 2012-2013

Contract language: *Inspection/Record Keeping; Fire Department agrees to submit its final completed financial records and data for the fiscal year to the auditor not later than the close of the last business day of September of the current fiscal year. . . . . Should the Fire Department fail to submit its financial records and data enumerated in Appendix 'A'* (of the contract) *"Information for an Annual Audit" to the County within the above time period, the County may suspend the payment of all funds immediately until the financial records are delivered as set forth above, except that the County's Finance Director may grant a reasonable submittal extension if the Fire Department is unable to deliver the financial records for reasons beyond the control of the Fire Department.*

Comment: The "Financial Statements and Supplemental Schedules" (Department annual audits) for four of the five departments, for the fiscal year ending June 30, 2012 were received in the offices of the Durham County Finance Department the week of July 15, 2013. Granted, per the above wording, the individual departments did not have to have the requested financial records to the independent auditor until September 30th of 2012. However, for the completion of these 12-15 page, fairly straight forward documents to take (in this case) 9½ months to complete is unacceptable and furthermore, counterproductive in that neither the County Fire Marshal, County Finance Department nor County Manager's Office was able to access the important information in these reports that should have been available to them to make decisions regarding the various departments' *current* year budget request that legally, had to be decided and voted upon at least (in this instance) *six (6) weeks prior* to the date the audits were finally turned in.

The Fire Department audit that was not among those submitted in mid-July was Bahama. It arrived several weeks later. *However*, it was for the fiscal year ending June 30th, 2010 . . . over three (3) years ago. Even the draft versions of Bahama's audits for the fiscal years ending June 30th, 2011 and June 30th, 2012 had yet to be received by the Finance Department. There is no record of the County imposing neither any penalty of the type suggested in the contract language nor the issuance of an official "reasonable submittal extension" by the Finance Department.

To Bahamas' credit, reported recent communications between the Finance Department and the Fire Department indicates that it (Bahama) is committed to getting caught up. No timeline however, has been established for doing so.

Contract Language: *Insurance Rating. The Fire Department shall maintain a minimum of 9S rating or better with the North Carolina Insurance Services Office.*

Comment: Pursuant to the previous issue discussion regarding ISO ratings, this requirement, as written, asks nothing more than that the fire department meet the absolute minimum standard required by the State OSFM for a "fire protection district". The benefits of lower (better) ratings to property owners are clear. This contract language might more appropriately be placed under the "Minimum Performance Standards" section of the contract and rather than with generic language, address each department specifically including their current ISO rating, the maintenance of that rating, performance improvement expectations, etc.

Contract language: *DISPATCHING PROTOCOLS: Fire Department shall comply with the Durham County Dispatching protocols as developed and amended from time to time by the Durham County Fire Marshal.*

Comment: In this context, "dispatching protocols" (assumedly) include whether "unit dispatch" or "department dispatch" will be utilized; i.e. which piece of apparatus is to be sent to each type of incident, and the number of personnel required to accompany and/or available to respond with each piece of apparatus when dispatched.

Contract language: *RESPONSE TIME: Fire Department shall have an average response time (time of dispatch until time of arrival) consistent with its rating by the State Fire Marshal's Office. The Fire*

Department shall submit an accurate estimate of the minimum and maximum times for a response to calls within the District.

Comment: There are no response time standards or requirements mandated by the State Fire Marshal's Office that relate to a districts' ISO rating; i.e. ". . . shall have an average response time consistent with its rating . . . " Also, the contract wording suggests that the Fire Department establish its own estimated minimum and maximum response to incidents within its district. While it may be the wording, response time needs to be included as a specific performance objective of the contract versus "estimated" by the Fire Department.

Contract language: *MANPOWER (ON SCENE): Fire Department shall have adopted standard operating guidelines that address the appropriate number of firefighters needed on all type fire calls . . . Each Fire Department shall have the goal of placing sufficient personnel on the scene to operate at least one pumper, one tanker (when necessary) and flow two 1.5" or 1.75" hose lines when making an initial attack on all structure fire calls.*

Comment: This is a "performance requirement"; the wording "shall have the *goal*" does not suggest that.

The following topics, discussed elsewhere in the study sections that follow, should be considered for inclusion in the body of the contract between the County and the individual fire departments. Common contract stipulations, not currently addressed include:

- Budget/budget development process
- Purchasing procedures; particularly with regards to capital assets
- Minimum vehicle and apparatus standards, including compliance requirements
- Vehicle and equipment replacement schedules
- Employee compensation guidelines

ISSUE #3: Data

Critical to any public safety entity which must routinely respond to emergencies, is data; specifically, the accurate reporting and documentation of those details regarding workload, incident characteristics, and agency/personnel performance.

Typically, the "go to" provider of this data is a jurisdiction's designated Public Safety Answering Point or PSAP; also commonly referred to as the 911/Communications Center. This is because PSAPs in North Carolina routinely collect and automatically organize and electronically store volumes of data within their respective computer aided dispatch (CAD) operating systems. Conceivably, thousands of bits of information can be collected on every 911 call received, dispatched and monitored by the Center. The advantages of these CAD systems is that they (typically) are capable of retrieving emergency call

information under any number of data fields quickly, are able to collate and sort selected fields of data for study and, upon analysis, request the cross tabulation of related data fields for further evaluation.

In Durham County the 911 Communications Center is a function of City government. However, in that it is the designated PSAP for Durham County and dispatches the County Sheriff, the County's EMS Service and the five County Fire Departments the County shares in its funding. Unfortunately, the Center was unable to address several requests for information to facilitate the development of this study.

Fortunately, the County's five fire departments and the Fire Marshal's Office do not rely solely on the Communications Center for their call and response data. As stated, the bulk of the information regarding the Fire Departments' performance, call volume, and incident reports was obtained via access granted to the *FIREHOUSE Software®* records management system used by each of the Departments and the Fire Marshal's Office. Subsequently, the level of confidence was quite high with regards to the accuracy of the major groups and subsets of information obtained and cited for this report.

Unfortunately, as found to be the case with other applications and practices, no two departments handled the details of data entry exactly the same way. In several instances many additional hours of work were required to retrieve, sort and collate information from multiple sources/fields/reports within FIREHOUSE, that were occurring in multiple formats, to assure an "apples-to-apples" assessment of the information sought.

For example, were the various data relevant to individual incident reports uniformly and consistently entered and the call type information uniformly and consistently categorized, the information sought could have been obtained by navigating through 3-5 screens of information instead of back and forth through 12-15 screens of information.

ISSUE #4: Revenue Management

It is the Board of County Commissioners that, by statute, is authorized to assess a fire district tax, collect that tax, contract for fire services with designated providers, and in turn distribute the tax revenues collected to those providers who in turn agree, in this instance, to provide fire protection and EMS first responder services.

Then, once received by the respective departments, the amounts varying currently from almost $800,000 to a little more than $1,700,000 dollars will be spent (or not) as dictated by (typically) the Board of Directors of that non-profit corporation known as "(name) Volunteer Fire Department".

Here it is important to recall the discussion in the Introduction to this report regarding "governing authority" as follows:

> *In both the Rural Fire Protection District and the Fire Service District, the relationship between the County and the Fire Departments is a contractual one. The Board of County Commissioners retains legal control over setting the district tax rate each year, as well as determining the fire services that are to be provided within the district and who will provide them. This means that, subject to any existing contractual agreements, a Board of County Commissioners may change service providers or the nature of the services that are being provided at any time.*[18]

Note that *"determining the fire services to be provided"* carries with it the authority to approve or

[18] Millonzi, Kara A.; *County Funding for Fire Services in North Carolina*, UNC School of Government Local Finance Bulletin, May 2011

disapprove of how the tax money collected is spent, as well as limitations on what is spent, what the money is spent for, what is saved, how much, and what the plans for any accumulated savings or fund balance are. Further;

> *Ultimately, the fire district's governing board (the Board of County Commissioners) enters into a contractual agreement with the fire department to procure services for the district. The fire department is a contracting agent for the district and as such the department and the department's governing boards' control over the services provided are dictated (and limited) by the terms of the contract with the County.*[19]

At present, the terms of the contract with the County read as follows:

> *Use of Funds. Service district (G.S. §153A-300) and/or rural fire protection tax district (G.S§69-25.5) funds levied and collected by the County and paid to the Fire Department by the County shall be used solely for Fire Department operations, which term is defined as "fire protection and first responder services in the Fire District and other areas of response as dispatched and to meet the standards established by this agreement".*

The "standards established by this agreement" are limited and lacking in direction, and detail. This is evidenced by the disparity in spending habits and/or priorities expressed, and what the respective departments have accomplished (or not) with the monies they have been allocated. At present the individual fire departments have no documented or coordinated "Plan" for the delivery of services now, much less the foreseeable future; nor does the County have a fire services *system wide* plan in place. While the lack of a fiscal management policy or a long term system plan by no means negates the authority of the County Board, it leaves open a great deal of leeway as to how the money is eventually spent (or not).

General directives and specific procedures are needed to address the use and management of the funds received and spent by the County's fire departments, *as well as* specific guidelines as to the accumulation of those funds; i.e. savings; including the documented basis for, limits of, and accessibility to those funds. Ultimately, the money collected and allocated to provide fire, rescue and medical first responder services in unincorporated Durham County belongs to the residents of the respective *fire districts not* the individual *fire departments*.

Budget Process and Purchasing

The annual budget form used by each department is typically 3-4 pages. The last page is titled Capital Budget. What defines a capital asset in terms of a single item's cost is not clear; at least it is not stated on the form. It is also apparent from reviewing these forms that each department completes this form differently. Some chose to itemize some do not. Some itemize "turnout gear" as a single item and a single unit cost; others chose to itemize the cost of each component of turn-out gear; i.e. boots, helmets, hoods, gloves, jackets, pants, etc. separately. It is also apparent that individual departments pay different amounts for the same thing indicating that joint purchasing is not a common practice.

While the practice of joint purchasing will very often yield efficiencies via cost savings; consider also that the standardization of what is purchased; including major fire apparatus, support vehicles, SCBA, Turnout gear, rescue equipment, etc. can serve to combine those cost efficiencies with *more effective* mutual aid operations.

[19] Ibid

A formal and consolidated Fire Services Capital Improvement Program (CIP) is needed. By definition a CIP is a *multiyear forecast of major capital building, infrastructure and equipment needs with a forecast period most often of five or six years although some may cover longer or shorter periods. The CIP not only identifies future capital needs but also the capital appropriations or estimated spending required to make these needs a reality, as well as the availability of sources of capital financing, and their impact on future operating budgets.*[20]

A "capital asset" is typically land, buildings, building renovations, vehicles, and equipment with a useful life of one year or more and an established value, which will vary from jurisdiction to jurisdiction, but typically anywhere from $500-$5,000 dollars. In this context, the amount should be more specifically defined by the County as it applies to those assets utilized (or needed) by the county fire departments.

ISSUE #5: Fire Stations & Fire Apparatus

Fire Stations

Fire stations today must support the needs of the fire department and the community in which it (the station) is located. The functions it must accommodate are diverse, and while the most prominent and visible tends to be the vehicle bays which house the apparatus, there are other functions as well. These include equipment storage, administrative space, equipment and vehicle maintenance space, restroom and shower facilities, materials storage, a dayroom and food preparation area, general storage, hazardous materials storage, decontamination shower and eye wash facilities, and in most instances, sleeping quarters.

Also, fire departments today are being asked to assume more responsibility for community education regarding fire safety as well as provide a focal point if necessary to conduct outreach and perhaps, community meeting space. Therefore, while the fire station's proprity is to facilitate the activities of fire department personnel and assigned functions, the facility may also need to accommodate public visitors for the purposes expressed.

Construction Standards

Interestingly, the National Fire Protection Association (NFPA) does not publish a specific document for fire station design or construction. And, although NFPA standards are voluntary, NFPA regulation wording from a number of its Standards publications is incorporated into Occupational Safety and Health Administration (OSHA) standards and regulations for fire stations-which *are* mandatory.

NFPA documents that address fire station design focus on facility and personnel safety with regards to construction and installation requirements; including briefly:

> NFPA 1: Fire Code requires all "new" facilities to have automatic fire sprinklers systems installed.
>
> NFPA 1500: Standard on Fire Department Occupational Safety and Health Program provides requirements for facility safety, maintenance and inspections.
>
> NFPA 1581: Standard on Fire Department Infection Control Program; has requirements to provide minimum criteria for infection control in the fire station, in the fire apparatus, during procedures at an incident scene, and at any other area where fire department members are involved in routine or emergency operations.

[20] Vogt, A. John; Capital Budgeting and Finance: A Guide for Local Governments; ICMA/UNC Chapel Hill Institute of Government; 2004

NFPA 1851: Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting, this standard provides safety requirements for storage and cleaning of personal protective equipment.

NFPA 1989: Standard on Breathing Air Quality for Emergency Services Respiratory Protection, this standard provides requirements on the installation of SCBA filling stations.

The five County Fire Departments currently have twelve (12) stations between them; Bahama has three, Bethesda has two, Lebanon has one, Parkwood has three, and Redwood has three.

The physical condition and functionality of the various stations vary.

- Bahama has the newest station that appears to be quite functional for the personnel assigned and vehicles that are staged within it.
- Those stations that could be put in the "fair" to "okay-for-now" category would include Bethesda's station 2, and Parkwood's station 2.
- Redwood's Station #2 is a two-bay garage and little else. The facility cannot accommodate personnel assigned to that location at this time. Personnel essentially go to this facility, if on duty, from Station 1 to pick up fire apparatus on their way to the incident to which they are dispatched. This of course raises questions with regards to the response and level of service provided to the area of the district that this station is assigned to cover.
- Redwood's Station 3 is essentially the same as Station 2; however, this facility has an additional unused vehicle bay that could, perhaps together with a modest addition, provide the necessary accommodations to enable the assignment of personnel to it.

Station Locations

A map of Durham County is included on page 56 that follows. It highlights the five Durham County and Durham City fire district boundaries. The County fire stations are represented by blue dots and the Durham City Stations by red. The yellow dot in the southeast corner of the map is the approximate location of the City's planned new Station 17.

Bahama-Stations are located as well as they could be considering the size of the area to be covered. Should Station 2 at some point be considered for new construction or relocation, a location to the west of the existing station should be considered to pick up additional area currently south and west of the existing location. This would further open the northeast area of the district which, depending on economic considerations, may allow the County to assume responsibility for the current Butner and Moriah areas, which could then make way for a future Bahama Station 4.

Bethesda-Station 1 is well located to provide good access to the majority of its district which includes a major portion of Research Triangle Park (RTP).

Lebanon- Its single station is centrally located within the district to provide good coverage. The small "island" of district area furthest east and interrupted by a strip of city property has, since publication of the map, been assumed for coverage purposes via a Memorandum of Understanding with the Durham City Fire Department.

Parkwood-With the growth of the City of Durham and the associated annexation/development that has extended south from the downtown area in recent years, Parkwood's original fire district boundary and subsequent land area has shrunk considerably since it was established in 1968. In fact, all three of Parkwood's current fire stations are now located within the City limits of Durham.

Redwood-With the exception of a portion of its southwest boundary that it shares with Bethesda, the remaining and most substantial portion of Redwood's western boundary abuts the City of Durham; either directly or by contact with the many "islands" and "peninsulas" of city property extending into its original, now former, district. Future station locations, depending largely on the extent of future annexation into the district, could very well involve moving Stations 2 and 3.

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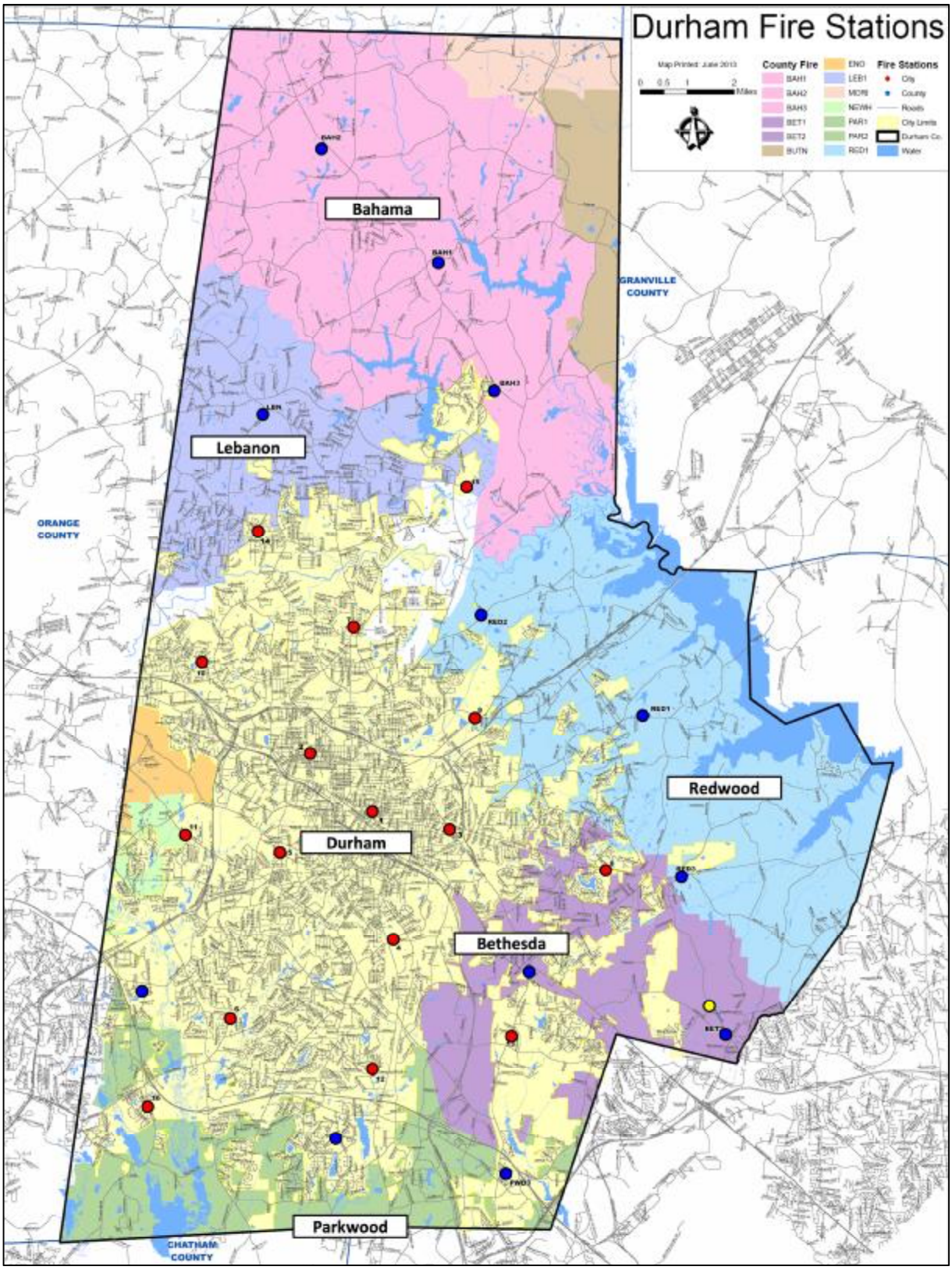
Figure 30
County Fire District & Durham City Station Locations



Fire Apparatus

As addressed in Section 2; the 5 County Fire Departments are currently responsible for 53 fire, rescue, and utility vehicles, which range from a 2013 F-550 Brush Truck to a 44 year old reserve status engine (pumper/tanker) and a 33 year old active duty engine (pumper/tanker); this number also includes three (3) designated reserve vehicles.

Of the current inventory of vehicles, sixteen (16) vehicles are more than 20 years old, eight (8) are between 25-30 years old, and three (3) are more than 30 years old. More significant perhaps is that of the 39 pieces of major *fire* apparatus; i.e. pumpers, tankers, combination units, aerial/ladder trucks, and reserve vehicles, eleven (11) were manufactured prior to 1991.

This is important because current NFPA standards (NFPA 1911, 2012 Edition) regarding the *Standards for Automotive Fire Apparatus* recommend that; "*. . . apparatus manufactured prior to 1991, that is less than 25 years old, that has been properly maintained, and that is still in serviceable condition should be placed in reserve status and upgraded to incorporate as many features as possible of the post-1991 fire apparatus. Apparatus that is not manufactured to the applicable NFPA fire apparatus standards or that is over 25 years old should be replaced.*"

NFPA also states that:[21]

To maximize firefighter capabilities and minimize risk of injuries, it is important that fire apparatus be equipped with the latest features and operating capabilities. In the last 10 to 15 years, much progress has been made in upgrading functional capabilities and improving the safety features of fire apparatus. Apparatus manufactured prior to 1991 usually included only a few of the safety upgrades required by the 1991 and subsequent editions of fire department apparatus standards or the equivalent Underwriters Laboratories (UL) standards. Because the changes, upgrades, and fine tuning to NFPA 1901, Standards for Automotive Fire Apparatus, since 1991 have been truly significant, especially in the area of safety, fire departments should seriously consider the value (or risk) to firefighters of keeping pre-1991 apparatus in first-line service.

Experience has shown that refurbishing a fire apparatus that is over 20 years old, other than to paint or repair the apparatus, is a very poor investment.

A fire apparatus is an emergency vehicle that must be relied on to transport firefighters safely to and from an incident and to operate reliably and properly to support the mission of the fire department. A piece of fire apparatus that breaks down at any time during an emergency operation not only compromises the success of the operation but might jeopardize the safety of the firefighters relying on that apparatus to support their role in the operation. An old, worn out, or poorly maintained fire apparatus has no role in providing emergency services to a community.

Currently, based on these criteria alone, nine (9) of the current first line fire apparatus should be replaced. Several of the later model vehicles identified for replacement may be appropriate as reserve status apparatus. A listing of existing fire department vehicles is provided in Section 2, page 27.

Ultimately, although NFPA Standards are "voluntary" as opposed to "required", this is an issue of *personal firefighter safety* rather than one of simply whether or not to comply with a "standard"; albeit a well-established standard.

[21] NFPA 1911; Standard for the Inspection, Testing, and Retirement of In-Service Automotive Fire Apparatus; Annex D.1

Durham County currently has a "Vehicle/Equipment Replacement Policy" (Revised 04/18/08) that identifies when vehicles of a certain type, age, and mileage are eligible for replacement. Included in the list of vehicles is "Trucks, Heavy Duty GVW >10,000"; the category in which existing fire "engines" would most likely be included. Based on the criteria listed for vehicles of this type, they can be considered for replacement when 8 years or older and with 135,000 miles. The table does not indicate whether both or only one of the two criteria must be met.

There is also a separate policy section entitled "Volunteer Fire Department", which lists additional information with regards *"to the replacement of vehicles/equipment for the Volunteer Fire Department"*. Wherein there is no actual *criteria* listed but rather narrative that discusses the receipts required upon purchase.

ISSUE #6: Volunteers & Department Staffing

All five County Fire Departments have evolved from their all-volunteer days to that of the "combination" departments they are today; i.e. a combination of volunteer and paid personnel that work together.

While the volunteers are very much appreciated, the management of a combination department can be a challenge. In this case, as evidenced in discussions with department personnel during the course of the study, the combination in reality involves a three-way mix of volunteer, part-time and full-time employees each with different perspectives, objectives, and expectations.

Volunteers

The level of Fire, Rescue and Emergency Medical Services available in Durham County today would not exist were it not for the hundreds of volunteers who have given countless hours of their time over the years. There is little that could ever be done that would adequately thank or compensate so many for so much.

That having been said, the issue here *is* the volunteer. The truth of the matter is that neither individual communities nor incorporated municipalities, much less entire counties, can rely any longer solely on volunteers to provide necessary emergency services on a regular basis. And, at the same time, remain up to date with currently accepted yet ever changing medical practices, fire suppression technology, certification criteria, operational standards, and legal issues surrounding their service area of interest.

The reasons for the rapidly decreasing involvement of citizen volunteers are many and varied but seem to essentially consist the following:

Employment Conditions The circumstances of employment and the requirements placed on volunteers by employers today make it much more difficult to respond to emergencies when they arise. The competitive business environments of today offer very few employment opportunities that will permit an employee to "drop everything" in order to respond to an emergency that may take him or her out of the workplace for two or three hours or more. Further, in those instances where individuals may be able to respond, many find that they are working further and further away from the area or community in which they volunteer and are not be able to respond in a manner that is in any way timely.

Eligibility Volunteering with the fire service has changed significantly from years past. More and more fire departments are implementing formal eligibility criteria and moving towards a much more

structured process of volunteer recruitment, training, duty assignments, and service hour requirements. As an example, the Durham County Fire Marshal's Office Volunteer Policy is ten (10) pages long. Page one is shown here.

Operations Manual Policy and Procedures	DURHAM COUNTY FIRE MARSHAL EMERGENCY MANAGEMENT Durham County Fire & Rescue Services	**Effective Date:** **07/01/2013**	**Number:**
Signature:		**Subject:** Volunteer Program	

13.0 Volunteer Program

The DCF&R Volunteer Program Policy will detail specifics pertaining to the volunteer program that do not apply to career members of the department.

13.1 Selection Process for the New Volunteer

The selection process is a method to ensure a consistent fair process is utilized in the selection of volunteer firefighters and Fire Corps members for DCF&R. Those wishing to volunteer with DCF&R must first fill out an online application at www.dconc.gov.

Selection process steps:

- Application reviewed – accepted/rejected
- Employment and reference checks
- Agility test – For Volunteer Firefighter applicants only
- Interview
- Criminal Background Check and Drivers License Check
- Physical exam "fit for duty" – For Volunteer Firefighter applicants only
- Drug screen
- New Volunteer Paperwork
- Personnel Info. Entry into FireHouse software
- Volunteer Orientation
- Uniform & Gear Issuance
- ID Badge issuance

Of course then the question arises; does a policy such as this *encourage* or *discourage* the perspective volunteer? To the casual volunteer, he/she may decide that it's much more of a commitment than was expected and opts not to get involved. Yet, to the serious volunteer, particularly one wishing to explore the career opportunities that might be available within the fire service, the rigors of the program could very well serve as a catalyst for not only their commitment to serve as a volunteer, but the pursuit of a career, in this case with Durham County

Training Requirements Today in the State of North Carolina the requirements for certification as a Firefighter I requires a minimum 228 hours of formal training; for certification at the "Basic" level as an EMT, 169 hours; and as a certified Rescue Technician, 186 hours. Levels of certification beyond basic of course require even more hours. When one considers the commitment a volunteer must make, one must also consider that these *basic* requirements *do not* include:

- In-service hours spent responding to calls
- Attendance at required monthly meetings
- Time spent completing paperwork and fundraising
- Time in continuing education classes required to maintain level of certification

Societal Change Societal change, as it has impacted volunteerism in the emergency service environment, can be summarized by the phrases;

"Pace of Life", and "Evolving Standards"

The pace at which change is occurring in our everyday lives, impacted particularly by technology, population migration, dual working households, and the like-leaves much less time to devote "free" to the community; particularly if, in order to provide that service you must also complete a couple of hundred hours of training first . . . on your own time, and often at your own expense.

Citizen expectations, ever evolving legal requirements and liability concerns surrounding performance issues, and continuously changing certification and operational standards means that volunteering in any emergency service/public safety discipline has become at minimum, a very demanding hobby; and very likely, one that is destined to become even more complex and demanding in the years to come.

The current number of Fire Department roster members that are volunteers are identified here.

Figure 31
Existing Volunteers by Department

Department	Roster	No. Volunteers	Paid: Part-Tme	Paid: Full-Time	Total Paid	% Volunteer
Bahama	67	41	26	0	26	61%
Bethesda	65	24	22	19	41	37%
Lebanon	47	17	19	10	30	36%
Parkwood	67	25	13	29	42	37%
Redwood	53	7	46	0	46	13%

Bahama is the only remaining Department with greater than 50% of its membership volunteers. Bethesda, Lebanon and Parkwood currently maintain 24, 17, and 25 volunteers on their respective rosters. Redwood has evolved to a predominantly paid department at this point.

And, while all departments have shown an interest in recruitment, retention, and utilization of volunteers the potential liability and risks incumbent in the fire service has prompted Durham County and many other governmental jurisdictions to develop and document specific policies and procedures for those wishing to volunteer in the fire service. The Durham County policy (included in the Appendix) is quite specific as to its requirements and expectations of its volunteers.

Department Staffing

The composition of each department's current roster in terms of volunteer, part-time, and full-time personnel is provided on the previous page. This discussion addresses "staffing"; principally, the type, number, scheduling, and deployment of department personnel necessary to effectively deliver the services promised.

Chief Officer

Currently, Bethesda and Parkwood have full-time paid Chief Officers. The Chief Officers at Bahama, Lebanon and Redwood are part-time. The International Association of Fire Chiefs has suggested that call volume significantly increases the business aspect of running a fire department. A department that responds to 750 calls per year, which is an average of two calls per day, should consider providing a "compensated leadership" position for developing and executing an organizational plan. And, the Association adds further, that while there is no hard and fast rule, another indicator as a basis for enlisting compensated leadership is a budget that exceeds $500,000 per year.[22]

All of the Departments have budgets in excess of $500,000 per year and all but Bahama respond to more than 750 calls per year. Although Bahamas' call volume is not *yet* 750 calls per year, the logistics of managing call response and day to day operations from three staffed fire stations within a fire district of almost 60 square miles are likely to warrant the attention of full-time personnel.

Response Personnel

The brunt of the issue with regards to response personnel; i.e. firefighters; is how many? Add to this that the variation in an individual department's incident response deployment may have to do with whether or not (for example) it has seven (7) full-time employees on duty at one station or four (4) part-time employees on duty but distributed among two or three stations; or something in between. Then too, all of the departments respond to fire calls, rescue calls and medical assist (EMS first response) calls; each having different issues to address and each with different demands and opinions with regards to the number of personnel/response personnel required.

For one perspective, NFPA 1710 offers the following:

5.2.3.1 Fire companies whose primary functions are to pump and deliver water and perform basic firefighting at fires, including search and rescue, shall be known as engine companies.

5.2.3.1.1 These companies shall be staffed with a minimum of four on-duty personnel.

[22] A Leadership Guide for Combination Fire Departments; International Association of Fire Chiefs; 2008

5.2.3.1.2 In jurisdictions with tactical hazards, high-hazard occupancies, high incident frequencies, geographical restrictions, or other pertinent factors as identified by the AHJ, these companies shall be staffed with a minimum of five or six on duty members.

5.2.3.2 Fire companies whose primary functions are to perform the variety of services associated with truck work, such as forcible entry, ventilation, search and rescue, aerial operations for water delivery and rescue, utility control, illumination, overhaul, and salvage work, shall be known as ladder or truck companies.

5.2.3.2.1 These companies shall be staffed with a minimum of four on-duty personnel.

5.2.3.2.2 In jurisdictions with tactical hazards, high-hazard occupancies, high incident frequencies, geographical restrictions, or other pertinent factors as identified by the AHJ, these companies shall be staffed with a minimum of five or six on duty personnel.

Now consider the following structure fire scenario:[23]

> *5.2.4.2.2 The initial* <u>*full alarm*</u> *assignment to a structure fire in a typical 2000 ft2, two-story single-family dwelling without basement and with no exposures shall provide for the following:*
>
> *(1) Establishment of incident command outside of the hazard area for the overall coordination and direction of the initial full alarm assignment with a minimum of one individual dedicated to this task;* one (1) person
>
> *(2) Establishment of an uninterrupted water supply of a minimum of 400 gpm for 30 minutes with supply line(s) maintained by an operator;* one (1) person
>
> *(3) Establishment of an effective water flow application rate of 300 gpm from two hand lines, each of which has a minimum flow rate of 100 gpm with each hand line operated by a minimum of two individuals to effectively and safely maintain the line;* four (4) persons
>
> *(4) Provision of one support person for each attack and backup line deployed to provide hydrant hookup and to assist in laying of hose lines, utility control, and forcible entry;* min. one (1) person
>
> *(5) Provision of at least one victim search and rescue team with each such team consisting of a minimum of two individuals;* two (2) persons
>
> *(6) Provision of at least one team, consisting of a minimum of two individuals, to raise ground ladders and perform ventilation;* min. two (2) persons
>
> *(7) If an aerial device is used in operations, one person to function as an aerial operator and maintain primary control;* one (1) person
>
> *(8) Establishment of an IRIC consisting of a minimum of two properly equipped and trained individuals;* two (2) persons

[23] NFPA 1710, Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Volunteer Fire Departments, 2010 Edition; Section 5.2.4.2

Depending on how each of these tasks 1-8 above is interpreted it could add up to *14 or more* personnel for this one event.

Two points:

1. Any one of the five County fire departments would itself be hard pressed to mobilize this many people at the scene of such an event in the time it would take to effectively suppress the fire described.
2. The Mutual Aid agreements in place between the county fire departments and, between each of the five departments and the City of Durham Fire Department are vital to achieving the on-scene manpower requirements at incidents such as that described.

Three of the expectations identified by the County for this study stated in part:

"Enhance firefighter safety"
"Coordinate and optimize the use of resources"
"Optimize coordination with other public safety providers"

Whether considering the scenario addressed above, reviewing fire service/professional association publications and standards or talking with a Firefighter I or Chief Fire Officer personally; addressing these expectations will inevitably include the responses "adequate manpower" and "appropriate equipment". Of course implied within those comments are that adequate manpower means adequately trained and certified personnel, and appropriate equipment means the appropriate type of equipment, support vehicle(s), and major fire apparatus.

Whether mutual aid is automatic and dispatched simultaneously with the district "owning" the incident, or requested by the first arriving on scene unit/crew that recognizes help is needed; *knowing* the *type* of apparatus and *number* of personnel that are actually coming is critical to the incident commander on scene.

Scheduling & Staff Level

Fire departments operate 24 hours a day. It is the nature of their business. One never knows when the next call will come in. Whether staffed with volunteer, part-time, or full-time employees or a combination of these, work "shifts" per employee or position are often 24 hours in duration. 12-hour shifts are also used, however, not as frequently; 10-hour and 8-hour shifts are rarely used. The reasons given to support 24-hour shifts vary but often include;

- Employees only work 7-10 days per month; albeit they are 24 hour days; it gives the employee an opportunity to pick up a second job.
- It does not take as many people to staff a 24-hour position.
- Not needing as many people means it doesn't cost as much.

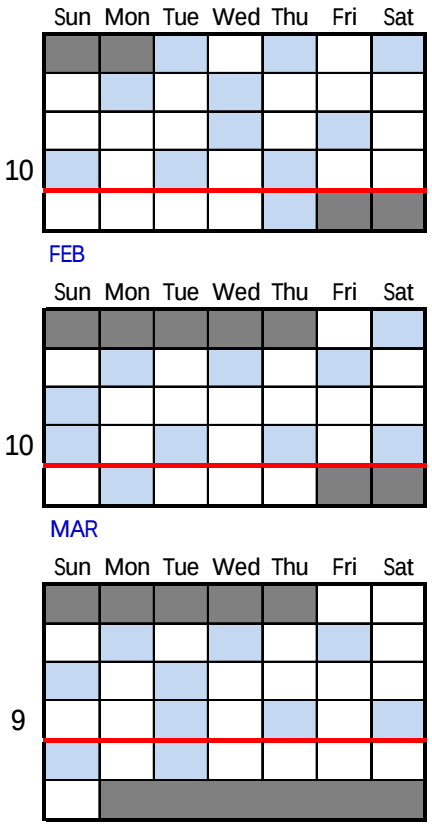
Currently Bethesda, whose full-time personnel are County employees, works a rotating 24-on, 24-off schedule followed by; (after five 24-hour days are worked); 6 consecutive days off. Their designated "work period" is 28 days.

Figure 32 that follows illustrates the first 3 months of 2013. Assuming that the first day worked was January 1st, (first blue square), the schedule for the first 28-day work period of the year ends at the

horizontal red line in January and includes ten (10) 24 hour (blue) days worked. The next two 28-day work periods, during February and March, include 10 and 9, 24-hour work days respectively.

Year 2013 includes 13, 28-day work periods; 5 of those include 10, 24-hour work days and 8 include 9, 24-hour work days. Note also the six consecutive days off (white squares) following the fifth day worked during each 28-day period.

Figure 32
28-Day Work period Example



As an example, the 4 week/28-day work period beginning with the last week of January and ending after the third week of February, the hours worked per week would be as follows:

Week #1	48 hours
Week #2	72 hours
Week #3	24 hours
Week #4	96 hours
Total 28-Day Work Period Hours:	240 hours

In most instances, were a 12 or 8-hour/day employee to log this many hours in a 28-day period they would be entitled to 72-80 hours of overtime pay at time and one-half their regular hourly rate. Which, if either worked this schedule throughout the year (as firefighters do) they would accumulate between 936-1,040 hours of overtime; i.e. 5-6 times more hours than the firefighter is eligible to claim. *Why?* The federal Fair Labor Standards Act (FLSA) provides an exemption to local governments that specifically addresses firefighter (and law enforcement) work schedules. 29 CFR 553.230 states in part:

For those employees engaged in fire protection activities who have a work period of at least 7 but less than 28 consecutive days, no overtime compensation is required under section 7(k) until the number of hours worked exceeds the number of hours which bears the same relationship to 212 as the number of days in the work period bears to 28.[24]

The following illustrates how the firefighter's overtime pay would be calculated:

Calendar Year 2013						
5, 28-day work periods w/10-24 hour shifts worked each;	Worked	5	x	240	hours	1200
	Allowed	5	x	212	hours	1060
	Difference; Allowable OT Hours					140
8, 28-day work periods w/9-24 hour shifts worked each;	Worked	8	x	216	hours	1728
	Allowed	8	x	212	hours	1696
	Difference; Allowable OT Hours					32
Total overtime hours Firefighter may claim for 2013:						172

[24] 29 CFR 553.230; Maximum Hour Standards for Work periods of 7-28 days; Section 7(k); Application of Fair Labor Standards Act to employees of State and Local Governments.

This table offers a final comparison of the 8-hour (A), 12-hour (B), and 24-hour (C) shift/work day based on commonly found shift configurations for each model. The "Days worked/28-day period" and the "Hours worked per 28-day period" for 'C' (24-hour shift) are averages. As illustrated, the number of 24-hour shifts per 28-day work period varies throughout the year. Also, there is no consideration given in this table for personal or sick leave taken, nor for holidays. The numbers still beg the question, however; is it fair? Perhaps, perhaps not, but-it's legal-*and,* very popular in the fire service.

Figure 33
Comparison of 8, 12 & 24 Hour Shift Assignments

Work Period	A	B	C
Length of work day	8	12	24
Days worked/28 day period	20	14	9.38
Days worked/year	260	182	122
Hours worked /28 day period	160	168	225.23
Hours worked/year	2080	2184	2928

Health & Safety

The more significant questions that arise have to do with firefighter health and safety and, peripherally, the safety of pedestrians whom they serve. In researching the risks of fatigue in 24 hour operations, as well as the related costs in terms of productivity and absenteeism the preponderance of information suggests 24 hour shifts are not good for the human body.

In 2011 the Ontario (Canada) Association of Fire Chiefs in association with the Ontario Municipal Human Resources Association published a discussion paper on the *Health & Safety Impacts of 24 Hour Shifts in Fire Departments;*[25] which highlighted the following:

- This paper reviewed more than 60 published research studies which focused solely on the health and safety impacts of extended work shifts on employees; the majority being peer-reviewed studies published in scientific journals.
- The reviewed studies were consistent in their conclusions that night shifts and extended shifts (those over 16 hours) present safety and health risks for workers. Combining long shifts with night time work compounds the risks.
- The studies found that the rate of accidents and injuries increase with hours on the job. After 16 hours on the job, fatigue has a major impact. If work tasks require alertness, sleeping on the job may present a safety risk due to sleep inertia or waking.
- Shift workers working extended shifts face an increased risk of sleep disorders, gastrointestinal disorders, diabetes, cancers and heart disease.
- Under health and safety legislation the employer must take every precaution reasonable for the protection of workers. If a critical injury or fatality occurs and it was later attributed to the 24-hour shift, the Employer could be liable.

Significant also was that the published studies that were evaluated originated from many prominent international sources, including the New England Journal of Medicine, the American Medical Association and, the Massachusetts based global 24/7 workforce performance and safety consulting firm, Circadian.

[25] The Health & Safety Impacts of 24 Hour Shifts in Fire Departments; Ontario Association of Fire Chiefs and Ontario Municipal Human Resources Association; March 2011.

Part-time vs. Full-time
Each department utilizes part-time employees differently; some rather efficiently, some not. Ultimately, it is much more efficient, and less cumbersome administratively, if a volunteer or part-time person is scheduled for no less than a twelve or 24 hour shift, versus filling in gaps of time for those same shifts with 2, 3, or even 4 different persons.

Employee Compensation
Currently, Bethesda and Lebanon utilize the County's pay scale for paid full-time Firefighters as the basis for setting salaries and hourly rates for their employees. Bahama, Parkwood, and Redwood have their own rates. In turn, the starting hourly rates for Firefighter I/EMT certified personnel vary from $10.00 to a little more than $15.00 per hour. There were also varying hourly rates in some instances between day shifts and night shifts. The fire services "system" would benefit from a consistent pay scale with the specific benefits identified for full-time employees as well as those not full-time but with enough on duty time to qualify for benefits. Likewise a uniform pay scale for part-time employees would provide consistency within the system as well.

ISSUE #7: Consolidation

The County's original request for proposals to conduct this study stated that *"the consultant will conduct a review of the current fire delivery system . . . and include consideration of partial, functional or full consolidation"* of the existing County fire districts.

The project approach taken has in fact been to *not* look immediately or specifically at whether the five county departments should be consolidated, totally or in part. Rather, it was to look first at the fire services that were being provided to the unincorporated areas of the County and the individual Departments that were providing those services; as well as the "system" that they were part of to examine the actual operations, capabilities, resources, and performance of those departments individually. The objective for doing so was to identify first, any significant issues or concerns and discuss their basis. Then develop recommendations that addressed those concerns.

Now, having identified the conditions that exit with regards to workload, available resources and performance, and having discussed the issues of concern associated with those conditions, there are a number of system characteristics around which a case for consolidation can be made. Not necessarily a *total system* consolidation, however.

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SECTION 6. RECOMMENDATIONS

The issues identified and discussed thus far have run the gamut of the fire service; from the adequacy of fire apparatus, call volumes, firefighter safety, and fire district tax rates to staffing requirements, dispatch protocols, and revenue management. In all, there were seven (7) issue topics discussed.

In this section, the individual issues are reiterated and followed, in most instances, with several recommendations that correspond with each issue. There are a total of 64 recommendations. Most, although not all, of these recommendations focus on the most frequent overriding concerns identified; those being: *consistency, coordination, and well-articulated performance expectations.*

And, while timelines for the implementation of these recommendations were discussed in meetings that included County management, the fire chiefs, and the consultant, it was determined that the actual timelines could more appropriately be addressed once the report was submitted and the County staff, together with the fire chiefs, had the time to evaluate and further consider the time requirements, the immediate and long term cost implications, and where, in the yet to be implemented Fire Service Capital Improvement Program (CIP) plan, the individual recommendations would each rank.

Issue: Level of Service
RECOMMENDATIONS:

ISO Ratings

1. Include language in the contracts with Bethesda, Lebanon, and Parkwood that each is *to maintain* their current ISO Rating while continuing to pursue opportunities to improve that rating.

2. Include language in the contracts with Bahama and Redwood that they are *to submit a plan to the County Fire Marshal by the end of the current fiscal year, which identifies the specific action steps they will take to pursue and attain an ISO Rating of 6,* including a projected timeline and associated cost, if any.

3. Following discussions with each fire department, the Fire Marshal will identify a timeline and submittal requirements for inclusion as performance objectives in each department's next annual contract. As well, in anticipation of the lead time required for scheduling an NC Department of Insurance ISO inspection, the department's request for an inspection should be submitted to NC OSFM via the County Fire Marshal no less than 9-12 months prior to the target date they wish the inspection to occur.

Response Times

4. Identify in the County/Fire Department contract(s), the specific response time performance objectives as follows:
Bahama, Lebanon & Redwood will be expected to achieve a response (travel time) of their first arriving unit of *no more than 6 minutes to 90% of all calls* to which they are dispatched within their fire district; and that "travel time" be from the recorded time that the responding vehicle radios "enroute" to the time the responding unit radios "on scene" with wheels stopped.

5. Bethesda and Parkwood will be expected to achieve a response (travel time) of their first arriving unit of *no more than 5 minutes to 90% of all calls* to which they are dispatched within their fire district; and that "travel time" be from the recorded time that the responding vehicle radios "enroute" to the time the responding unit radios "on scene" with wheels stopped.

6. *All* Departments will be expected to achieve a turnout time of *no more than 90 seconds to all calls* to which they are dispatched *regardless of whether* the dispatch is *within or outside their own fire district;* and that "turnout time" be from the time that the incident dispatch is first received to the time that the responding vehicle radios "enroute"; which will be when the passengers in the responding vehicle have seatbelts secure and with the responding vehicle's "wheels moving".

7. All *response and turnout times* will be recorded in the appropriate FIREHOUSE report format (TBD) with quarterly reports submitted by each department to the Fire Marshal's Office no later than the 5th day following the end of each quarter.

Issue: Contract Limitations
RECOMMENDATIONS:

Personnel
1. Minimum staff on duty 24/7, at the Fire District's primary/main station should be no less than five (5) Firefighter I/EMT dually certified persons; paid *or* volunteer BUT scheduled.

Comment: As previously stated, the North Carolina OSFM has established that the minimum response staffing required in a 9s ISO rated district, with the first out engine, be no less than four (4) personnel to any structure fire or automatic fire alarm to which the department is dispatched.

Further, the National Institute for Standards and Technology (NIST) has studied the impact of fire crew sizes and their effectiveness in protecting lives and property on scene at low hazard structure fires. In an April 2010 publication[26], NIST reported that five person crews outperformed 2, 3, and 4 person crews in three of five major fire ground performance categories measured; overall scene time, time to water on fire, ground ladders and ventilation, primary search, and hose stretch time. It was noted further that while adding an additional person to a four-person crew did not decrease overall scene time in the low hazard environment, the additional person becomes quickly significant in medium and high hazard fire ground settings.

2. Minimum staff on duty 24/7, at any district substation, should be no less than three (3) Firefighter I/EMT dually certified persons; paid *or* volunteer BUT scheduled. The department will submit its plan to the County Fire Marshal as to how it intends to meet State ISO requirements to have the 4th certified Firefighter notified and able to accompany the substation crew to structure fire and/or automatic alarm dispatches; (may include Chief Officers and/or utilization of members from main station).

Comment: It is generally assumed that the "primary/main" fire station in Bahama, Bethesda, Parkwood, and Redwood is what is currently referred to in each of these districts as "Station 1"; which assumes via the recommendation that the "main" station be staffed with a minimum of five (5) personnel and each substation with a minimum of three (3), that the main station responds to more calls than either substation. If this assumption is *not* now correct, or if in the future this call dynamic changes, it should be the respective department Chiefs' prerogative to reallocate the "main" and "substation" personnel accordingly, providing call volume or other circumstances can provide the basis for that decision.

[26] Report on Residential Fire Ground Experiments; National Institute of Standards and Technology (NIST; April 2010

Apparatus (minimum first out allocation)
3. Bethesda & Parkwood-Main Station
Two (2) pumper/tankers, 0ne (1) Ladder, one (1) Service vehicle and/or QRV; (note "equivalent" vehicles okay but stipulated). Existing Heavy Rescue Truck and Brush Truck (Bethesda), and Air Truck (Parkwood) to be staged and deployed as needed;

4. Bethesda, Parkwood-Substation (each)
Two (2) Pumper/Tankers, one (1) Service Vehicle and/or QRV.

5. Bahama, Lebanon, Redwood-Main Stations
Two (2) Pumper/Tankers, one Tanker (min 1500 gal) One Brush Truck, one (1) Service Vehicle and/or QRV.

6. Bahama-Substation (each)
One (1) Pumper/Tanker, one (1) Tanker (min 1500), one (1) service vehicle and/or QRV.

7. Redwood-Substation (each)
One (1) Pumper/Tanker, one (1) Tanker (min 1500), one (1) service vehicle and/or QRV.

Apparatus Standards/Minimum
8. The first out apparatus identified for each department's main and substation(s) shall, at minimum, be compliant with the standards or standard subsections referenced in the list that follows *or*; as ultimately adopted by the County hereafter as policy.

- NFPA 1500-*Standard on Fire Department Occupational Safety and Health Program*; per the North Carolina Department of Labor, Occupational Safety and Health Division NFPA 1500 is listed as a "required standard"; along with 29 CFR 1910.120 *Hazardous Waste Operations and Emergency Response* and 29 CFR 1910.134 (see also NFPA 1989 below).[27]

- NFPA 1710-*Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments;* all applicable sections of Chapter 5 relating to staffing and apparatus to be deployed.

- NFPA 1901-*Standard for Automotive Fire Apparatus*; minimum, Chapter 14.

- NFPA 1911-*Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus*; applicable portions of Annex D-*Guidelines for First-Line and Reserve Fire Apparatus*.

- NFPA 1989-*Standard on Breathing Air Quality for Emergency Services Respiratory Protection*; chapters 5, 6, and 7. [Coincides with 29 CFR 1910.134]

9. The County Finance Department/Budget Division, with assistance from the Fire Marshal's Office should update its Vehicle/Equipment Replacement Policy as it applies to fire apparatus. NFPA 1911, referenced previously (Section 5, page 57) should be used to establish the basis for replacement. (See also Purchasing subsection that follows).

[27] North Carolina Department of Labor Standards Notice 63A; Fire Department Occupational Safety and Health Programs

Financials

10. Enforce deadlines for year-end and quarterly reporting requirements including suggested penalties for non-compliance; particularly the September 30th deadline for materials submission to the independent auditor.

11. Impose on the accounting firm (independent auditor) assigned to conduct each fire departments' annual audit the performance requirement *that all audits be completed no later than March 31st of the year following the department's submittal of information (or sooner)*; to enable review by the Fire Marshal and the County *prior to* approval of new fiscal year budgets.

12. Emphasize a budget process that is based on each department achieving the performance criteria they are contracted to provide rather than simply submitting a budget prepared and submitted, and based on the amount of tax revenue that is received and/or expected to be collected.

13. Identify reasonable performance objectives for each Department consistent with their individual district needs and issues; for example:

- Savings accumulated during year earmarked for CIP purchases of new apparatus or, equipment
- Efforts made towards accomplishment of an improved ISO rating
- Quarterly fractile response times to incidents within their district
- Individual and cumulative training hours achieved
- Community education/outreach programs conducted

14. Develop and document personnel position classifications; i.e. position titles and responsibilities; along with compensation guidelines for each fire department position. Implement, as policy, these guidelines throughout the County Fire Departments utilizing existing County Fire Suppression Services Division position classification and pay scale.

Purchasing

15. Develop and implement a formal, all department, consolidated *Fire Service Capital Improvement Program (CIP)*.

By virtue of its definition and purpose, the CIP will:

- Enable individual departments and the county overall to anticipate and budget for major capital expenditures.
- Enable (based on the projected cost of those expenditures) the individual departments and the county to determine financing/payment options that are sensitive to the capital needs and the tax and/or cost to the district's citizens.
- Facilitate joint purchasing of significant equipment; including turnout gear.
- Require the development of vehicle standards that emphasize vehicle and firefighter safety as well as functionality and maintenance costs.
- Utilize an updated vehicle and equipment replacement schedule to determine the appropriate date of retirement and/or replacement of essential apparatus.

- Assure that apparatus purchased with County tax dollars is secured with a funding agreement that stipulates how the vehicle will be purchased and that it will be returned to the County at the end of its designated life cycle to be disposed, resold, etc. with the funds being placed back into the CIP vehicle replacement account. *Note: this same funding agreement needs to be implemented now for all existing apparatus in use and previously purchased with County tax dollars.*

16. The preparation of the CIP should involve and be a joint effort of the Fire Marshal's Office and the Chief Officers of each Fire Department.

ISO Requirements (Previously addressed)

Dispatch Protocols
17. Identify specific type(s) apparatus, by type and unit number, to be dispatched to each major type of call; i.e. automatic fire alarm, Medical Assist (EMS First Response), HAZMAT call, Structure Fire, Technical Rescue, Motor Vehicle Accident, Vehicle Accident with Entrapment, etc.

18. Identify the specific number of staff, by position title, to be dispatched with each type apparatus.

19. Develop and implement, with participation and input from each Fire Chief, Unit Dispatch standard operating procedures (SOP's) to be applicable to and implemented *consistently* by all departments.

20. The Fire Marshal's Office will coordinate this effort and oversee the development of the specific protocols by the fire departments as well as establish the due dates for submittal and; once approved, submit to the 911/Communications Center for entry and to identify a start-up date for going live with the Unit Dispatch protocols.

Response Times (previously addressed)

Contract Attachments
21. For each fire department contracting with the County include a copy of that department's fire district response area map with each contract.

Issue: Data
RECOMMENDATIONS:

FIREHOUSE
1. The Fire Marshal will develop written FIREHOUSE reporting/data field requirements for each major report that is (or will be) required of each Department, to include at least, but not be limited to:

- Number and type of calls dispatched
- Fractile turnout and fractile travel response times
- Breakdown of in-district vs. mutual aid calls
- Incident reports involving fire damage greater than $250,000 damage
- Incident reports involving any firefighter injury
- Other reports deemed essential by the County/Fire Marshal's Office

2. The Fire Marshal will provide a Data Manager dedicated to working with FIREHOUSE, the 911/Communications Center, and each Fire Department to develop consistent procedures for the accurate and timely reporting of, sharing of, and utilization of the data to be gathered.

3. In turn, each department will identify a designated "data manager" (contact person) who will be responsible for all data entered, the review of that data for quality/accuracy purposes, and the extraction and formatting of the data required for reporting purposes; i.e. the "resident expert".

4. The Fire Marshal's Office Data Manager will also be responsible for receiving, reviewing for quality (accuracy) purposes, and collating and distributing monthly reports; as well as providing training to individual fire department data managers as needed.

5. Fire Marshal shall Identify call type and incident code protocols to be used, AS WELL AS those that are not.

6. The designated fire department data manager will forward all required monthly and period reports on behalf of his/her department to the Fire Marshal's Office no later than five (5) calendar days following the last day of each month.

Issue: Revenue Management
RECOMMENDATIONS:

1. At a minimum, all nonprofit Fire Departments that contract with the County shall have on hand, as of the end of the fiscal year, both available and unrestricted net assets and liquidity totaling at least 5% of the annual County appropriation identified in their annual audited financial statements.

2. At their discretion, individual departments may maintain a fund balance (including any accumulated savings) between 5-10% of their operating budget to allow for flexibility in managing their operating funds; providing the designated use of these excess funds is identified in the aforementioned Fire Service CIP.

3. Fire Departments with fund balance and reserves exceeding 10% of the department's annual operating budget are expected to have a plan in place, approved by the Fire Marshal, for the use of these resources for planned capital purchases, retiring debt, or emergency one-time purchases.

4. Accordingly, a department with reserves in excess of 10% of its operating budget must choose from one or more of the following uses for the excess funds:

- Retire existing debt.
- Finance apparatus, station improvements, or other capital needs that have been identified as priorities by the Fire Marshal's Office and approved by the County in the Fire Services CIP.
- Reserve funds for future capital projects that have been identified as priorities by the Fire Marshal's Office and approved by the County in the Fire Services CIP (funds must be reserved formally with the department's auditor and annual financial statements must reflect all such reservations).
- Make emergency non-budgeted expenditures for unanticipated repairs.

- Replacement of essential firefighting equipment; one-time purchases for such equipment as SCBA and personal protection equipment/gear (PPEs) with the specifications of same having been pre-approved by Fire Marshal's Office and included in the Fire Service CIP.
- Another option, approved by the Fire Marshal's Office.

5. Departments will include in their annual budget request/submittal a listing of any outstanding debt, as well as a complete listing of salaries, by position classification with associated benefits to ensure compliance with the compensation/benefit policy that will be developed.

6. Should the Department wish to modify, transfer, or adjust the amount(s) originally approved in one budget account (line item) to another; a written request including the basis for doing so will be submitted to the Fire Marshal's office prior to transfer or expending the funds.

7. Each department will participate annually, and/or periodically as necessary, in the development of the County Fire Service CIP.

8. The Fire Service CIP, will stipulate guidelines for the fire departments' planning for or purchasing capital items and/or professional services; i.e. limits of spending, when formal bids are required, etc.

9. A procedure for the reporting and verification of revenue/funds received and designated as "donations", "contributions" or "income from fundraising events" should be developed and submitted with each department's quarterly financial report.

Issue: Fire Stations & Fire Apparatus
RECOMMENDATIONS

Fire Stations
1. All requests for the purchase of capital assets shall be submitted to the Fire Marshal's Office for inclusion in the Fire Service CIP; which will include proposed new or relocated fire stations as well as renovations and additions to existing stations.

2. Redwood should prepare a plan for the renovation, addition to, or relocation of Station 2 for inclusion in the Fire Service CIP.

Comment: While the location of Station 2 is not bad, its 3.2 mile/6 minute response time perimeter covers quite a lot of City of Durham property while leaving portions of its own district outside of that same perimeter; i.e. areas adjacent and along Interstate 85 towards the eastern boundary of the County. The station also cannot now accommodate the assignment of personnel

3. Redwood should prepare a plan for the relocation of Station 3 for inclusion in the Fire Service CIP.

Comment: Station 3, for all intents and purposes, abuts the eastern edge of Bethesda's district and its 3.2 mile/6 minute response perimeter extends well into Bethesda and the City of Durham. Moving the station further east, perhaps along 98 could enable coverage of the area of the district now outside the 3.2 mile/6 minute response perimeter to cover the areas of its district south and east. It also cannot now accommodate the assignment of personnel; a new station could be planned to do so.

4. The Fire Marshal's Office, together with Bahama Fire Department, should conduct a feasibility study to assess whether it would be practical and economical for Bahama to assume responsibility for coverage of the areas now identified as being covered by Butner and Moriah. The study should include at least the following topics:

- Land area and population to be served.
- Potential revenue available via district tax assessments.
- Accessibility to the areas from existing Bahama stations *and* within the 3.2 mile/6 minute response time perimeter.
- Appropriateness of an additional fire station to service these areas.
- A target location for a fire station if it is determined appropriate.

Fire Apparatus
(See also Recommendations under Contract Limitations)

5. The County Fire Marshal, the County Risk Management Officer and if/as appropriate a certified Fire Apparatus/emergency vehicle mechanic should evaluate the previously referenced NFPA 1911 requirements *and* assess the condition and safety of the six (6) first line vehicles and two (2) reserve vehicles in the current inventory of the County Fire Departments that are over 25 years old, to determine the viability of retaining them at all, or as reserve vehicles. The emphasis of NFPA, the NHSTA, and OSHA with regards to this recommendation *is* firefighter safety.

6. The appropriate findings of this evaluation should be incorporated into the centralized Fire Service CIP and into the agreement with the City of Durham Fire Garage.

Issue #6: Volunteers & Department Staffing
RECOMMENDATIONS

Volunteers
1. The County and the Fire Marshal's Office should continue to support individual department efforts to recruit and retain volunteers.

2. Each County Fire Department will adopt and implement for its use, the Volunteer Policy currently in place at the Fire Marshal's office.

3. If changes to the policy are requested by one department, they must be approved by the Fire Marshal's Office and the remaining fire departments in order to maintain the consistent application of the policy.

Department Staffing (Previously addressed)

Response Personnel
(Refer to previous comments, this section, regarding Unit Dispatch protocols and the associated personnel necessary to man the apparatus designated for the required response vehicles.)

4. Plan for and implement the transition from part-time to full-time personnel, for at least each department's main; i.e. "busiest"; station assignment.

5. With regards to substations; if full-time employees are not available, sub-stations may be staffed with part-time employees and/or volunteers, however, with the requirement that any shift/hours assigned be not less than twelve (12) hours; or, 24 hours, *if* 24 hour shifts are commonly assigned to full-time personnel.

Compensation

6. In order to establish a consistent level of compensation among the departments, for both the full-time and part-time employees of each department, the County's existing fire services pay scale should be adopted.

7. With guidance from the Durham County Human Resources Department, and at such time as individual department budgets will permit, plan for the transition of fire department paid employees to "County Employee" status, beginning first with full-time employees then part-time employees based on the number of hours worked.

Comment: The development of personnel position classifications, including position titles and responsibilities has been addressed in a previous recommendation. In this instance the development of a consistent pay scale among the five departments and the transition of paid employees of the departments to "county employee" status have been recommended. In fact the existing County Fire Suppression Services Division pay scale would be most appropriate. *However*, the transition of fire department employees to "County employees" must be considered and carefully scheduled for several reasons;

> *Cost*-if a full-time employee classified as a "Firefighter I/Driver", with two years' experience makes $16 per hour; a part-time employee classified the same, with the same experience, should make $16 per hour. However if that part-time employee over the course of a year or more works equal to or more than 50 percent of the hours worked by the full-time employee, that part-time employee is entitled to benefits proportional to the hours worked. Which, in this instance, *could* range anywhere from $1,500 to possibly as much as $15,000 per year depending upon the hours worked. And, that is for *one* person filling but a portion of a 24/7/365 position.
>
> Subsequently, the individual departments, particularly in this case Bahama, Lebanon and Redwood, must be provided the flexibility to continue to hire "their own" employees as they do now, at least for the foreseeable future. The part-time employees now working for these departments are all appropriately certified and in many instances over qualified for the part-time positions they hold. Typically, their availability to fill these part-time positions *without the added costs of benefits* is because of their own full-time employment elsewhere.
>
> *Demand;* in this context, demand refers to call volume. The minimum staffing recommended for each department's main/primary and substations of five (5) and three (3) 24/7 positions respectively and the basis for those numbers have been discussed. The question is then, do these positions, if not yet in place, have to be hired all at once? The consideration is one of both cost *and* efficiency.
>
> Take Bahama for instance, a study of the department's calls/hour/year reflect that the busiest 12 hours of the day during 2012 were between 10:00am and 10:00pm. Their calls after 10:00pm until 10:00 am the following morning ranged from six (6) between 5:00am-6:00am

(one call every 73 days) to 24 calls between 7:00am-8:00am (one call every 15 days) for the entire fire district. Based on their own assessment of that call demand Bahama, or any other department for that matter, may wish to schedule the recommended three (3) person crew at one of its substations from 10:00am-10:00pm and, assuming the current single 24/7 position remains in place at each substation, delay hiring the other four positions (two per substation) until the call volume increases.

*Experience; t*he department chiefs at Bethesda and Parkwood are full-time employees of the County and of Parkwood Fire Department respectively. The department chiefs at Bahama, Lebanon, and Redwood are *part-time* employees of their respective departments. None of these three chiefs, for various reasons, would benefit personally or professionally from becoming County employees at this time. Yet collectively they bring considerable fire service experience and local knowledge to their respective departments. Also, having participated in this study and the various meetings in recent months that discussed the findings and recommendations documented in this report, each chief will serve a very important role in overseeing and working with the Fire Marshal's Office to appropriately implement those recommendations that will affect their department.

Issue: Consolidation

RECOMMENDATIONS

1. Consolidate Bethesda and Parkwood Fire Departments into a single (suburban) Fire Service District.

- Each department's existing/designated Chief Officer will remain responsible for the on-going day-to-day operations within their existing fire district boundaries.
- All Mutual Aid agreements will remain in place.
- The County will evaluate each department's most current financial reports, existing assets, existing liabilities, condition and age of apparatus, staffing levels and any additional information it deems appropriate to make a determination of a tax rate to be assessed of property owners within the consolidated fire service district.

2. Consolidate Bahama, Lebanon, and Redwood Fire Departments into a single (rural) Fire Service District.

- Each department's existing/designated Chief Officer will remain responsible for the on-going day-to-day operations within their existing fire district boundaries.
- All Mutual Aid agreements will remain in place.
- The County will evaluate each department's most current financial reports, existing assets, existing liabilities, condition and age of apparatus, staffing levels and any additional information it deems appropriate to make a determination of a tax rate to be assessed of property owners within the consolidated fire service district.
- The County will, however, withhold an exact determination of that tax rate and likewise the implementation of it until after the results of the 2014 scheduled ISO evaluation in the Bahama Fire District are delivered to the County by the Office of State Fire Marshal/DOI.

3. The County should commence discussions with the City of Durham/City of Durham Fire Department with regards to the City assuming fire service coverage of those areas of the County currently covered by Orange County's Eno and New Hope Fire Departments; and, assuming the favorable outcome of those discussions, negotiate a Memorandum of Understanding/Contract with the City of Durham to do so.

- Criteria for consideration by the County in its discussion with the City will of course include the cost of services to be provided; however, the priority that must also be addressed is that the ISO ratings of each area; i.e. the current rating of '6' in new Hope's area must remain at that level or lower, and the rating of '9' in Eno's area lowered, preferably to at least a '6' as well.

- Once an agreement is reached with the City, notification should be given immediately to the Orange County Fire Departments (Eno and New Hope) and a specific date of the transfer of services identified.

4. The County should commence discussions with the City of Durham/City of Durham Fire Department with regards to how the city might transition to and assume coverage of and responsibility for the current Bethesda and Parkwood fire service districts; focusing of course on costs, level of service, the maintenance and/or improvement of existing district ISO ratings, station locations, apparatus, equipment and personnel, including the potential retention of existing county and/or department employees; and, assuming the favorable outcome of those discussions, negotiate a Memorandum of Understanding/Contract with the City of Durham to do so.

5. The consolidation of various activities and practices, currently addressed separately by each department, and the implementation of new policies and/or procedures have been recommended which, in each instance, the individual fire departments will be expected to participate in and support. Primary among these are:

- A Consolidated Fire Service Capital Improvement Program (CIP).
- Implementation of a vehicle and equipment replacement policy.
- The development and implementation of a single (agreed upon) Unit Dispatch protocol.
- The adoption of a single, uniform compensation and benefits plan for full-time employees.
- The stipulation of minimum staffing and vehicle requirements at main and substations.
- The adoption of a single County Fire Service Volunteer Policy.

6. Create the position, within the Fire Marshal's Office, of Administrator, Fire Suppression Services Division*;* the Division of the Fire Marshal's Office under which the County Fire Departments will be placed organizationally for reporting purposes, and with whom each existing department's chief officer will work and communicate directly with, as necessary, to accomplish the objectives identified in this study.

7. Create the position, within the Fire Marshal's Office, of Data Manager*;* dedicated to working with FIREHOUSE, the 911/Communications Center, and each Fire Department to develop consistent procedures for the accurate and timely and efficient reporting of, sharing, and utilization of all necessary data to be collected, and to assess the quality and accuracy of that data for reporting purposes.

Authority

8. In that the Bahama-Lebanon-Redwood consolidated fire *district's* governing authority is, by statute, the Board of County Commissioners; and the Board's designated agent with oversight of the county's fire departments; henceforth "Rural Fire Service District"; will be the County Fire Marshal, it will be the Fire Marshal with and via the *Administrator, Fire Suppression Services Division,* that will be responsible for the development and implementation of the recommendations included in this report section.

Of course the final format and content, as well as the schedule(s) for implementation of each of these recommendations, will be that adopted formally by the County following staff review and the ongoing input and assistance of the existing and included fire department Chief Officers.

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SECTION 7. PROBABLE COSTS

As with the recommendations just addressed, setting specific dates for their implementation should involve a joint effort involving county staff and the fire chiefs once this report is submitted and accepted by the County. Likewise, the same determination was made with regards to the identification of the specific costs associated with those recommendations that would require funding.

As addressed in the comments that accompanied several of the recommendations, there will be options. For example, *when* additional personnel are hired and then, whether they are part-time or full-time. There are still individuals willing to serve as volunteers, and certified to do so. The availability of volunteers varies considerably from department to department, however, must certainly be considered. Also, once the Fire Service CIP is developed the consensus among the county staff and fire chiefs as to the immediate priorities may have changed or less costly options identified.

Figure 34
Recommendations Requiring Funding

Issue Addressed	Recommendations	
	Number	Requiring Funding
Level of Service	7	0
Contract Limitations	21	5
Data	6	1
Revenue Management	9	0
Fire Stations & Fire Apparatus	6	0
Volunteers & Department Staffing	7	3
Consolidation	8	1
Total Recommendations:	64	10

Figure 34 Identifies the total number of recommendations offered within each issue category discussed, as well as the number of recommendations requiring funding. The comments that follow include brief descriptions of those requirements. Note that the number of each comment corresponds to its listing under each issue category in the previous report section. For example, under "Contract Limitations" there are 21 recommendations; of those, recommendations 1, 2, 5, 6, and 7 include requirements for funding:

Contract Limitations

1. Recommends additional personnel to bring minimum 24/7 staffing at main/primary stations to five (5)
2. Recommends additional personnel to bring minimum 24/7 staffing at substations to three (3)
5. Minimum apparatus required; assumes purchase of large capacity tanker; Redwood
6. & 7. Depending on the requirements identified in the Fire Apparatus Vehicle Replacement Schedule (to be developed per previous recommendation); may require replacement of engine(s) and/or additional tanker at Bahama and Redwood.

Data

2. Recommends the addition of a Data Manager position in the Fire Marshal's Office

Volunteers & Department Staffing

4. Recommends transitioning from part-time to full-time employees at the departments' main/primary stations
5. Recommends transitioning from part-time to full-time employees at department substations; or staffing with part-time employees or volunteers, however, with specific shift requirements
6. Recommends implementation of a consistent pay scale for all departments; assumes increases in some.

Consolidation

6. Recommends the addition of Fire Supression ServicesDivision Administrator in the Fire Marshal's Office

Additional Comments Regarding Costs

The funding requirements of the 10 recommendations just discussed have to do with funding for either personnel, including personnel salary adjustments, or fire apparatus/vehicles. The remaining 55 recommendations are principally procedural, reporting, and policy directives having to do with the specific issues from which they were derived. Overall, the recommendations provided in response to the issues discussed, were intended to address the specific issues initially elaborated in the County's original stated objectives for this study, as well as the concerns identified during the study with regards to the County's fire services generally.

While the recommendations themselves may not have costs associated with them *now,* the results of the planning efforts and policy or procedural changes suggested, once implemented, could very well result in the need for additional funding. Examples include:

- *Fire Vehicle Apparatus Replacement Policy*
  NFPA standards have been cited in the report as a basis for replacing fire vehicles that have reached a certain age. Based on those standards alone as many as nine (9) vehicles in the current, combined vehicle inventory would need to be replaced. However, as stated also, those are "standards", not "requirements". Once the recommended *Fire Vehicle Apparatus Replacement Policy* is developed and implemented as policy by the County, those decisions can be made.

- *Redwood Fire Stations*
  Recommendations are included that Redwood Fire Department prepare and present *a plan* for the renovation, addition, and/or relocation of its two substations. A plan, by itself, developed by Redwood with input and assistance from the County Fire Marshal's office, OSFM, or others does not require funding per se. However, once that plan is presented and approved for inclusion in the Fire Service CIP, funding requirements will need to be identified.

Cost Basis

The primary categories of major costs discussed include fire apparatus, fire stations, and personnel.
The illustrations and discussion that follow are provided for planning purposes and are based on research as to current (2013) estimates of probable costs for various classifications of fire apparatus and of fire station construction. The scenario that addresses personnel salary costs utilizes the County's existing Fire Services classification and salary scale as provided by the Human Services Department.

Figure 35
Apparatus Costs

Type	Year Purchased	Purchase Price	Source	Adjusted Price*
Engine (Pumper/Tanker)	2013	$ 406,000	Durham City	$ 401,000
Tanker	2010	$ 325,000	Bahama	$ 364,000
Brush Truck	2013	$ 95,000	Lebanon	$ 95,000
Service Vehicle	2013	$ 35,000	Lebanon	$ 35,000

*Price escalation from Year Purchased to Adjusted Price column calculated @ 4% per year.
The specifications of the engine purchased by the City included a 1,500 gpm pump & 500 gallons tank.
The tank capacity of Bahama's Tanker is 3,000 gallons.

An estimate of the probable construction cost of a new fire station in today's dollars (2013) is provided in the table that follows. The basis for the size in GSF for the 3-bay and 2-bay station options is the consultant's own work in developing space needs and architectural program requirements for fire stations in other jurisdictions.

The source of the cost data is the 2013 edition of the *R.S. Means Square Foot Cost*s index. It is a national publication that is updated annually, and although average costs are used, specific area multipliers are provided for calculating the costs in specific metropolitan areas of each state. Durham is specifically cited as one of those areas for North Carolina.

Figure 36
Estimate of Probable Fire Station Construction Costs

Station Description	GSF	$/SF	Constuction*
3-Bay, single story, drive through station	7,200	$ 127.30	$ 916,560
2-Bay, single story, drive through station	6,100	$ 130.00	$ 793,000

* GSF Cost is building construction only; does not include site development or architecure/engineering services.

The building notes/assumptions identified as the basis for the cost/gross square foot (GSF) included:

- Story height of 14 feet
- Face brick with concrete block back-up
- 6" reinforced concrete slab with vapor barrier and gravel base
- Roof construction; metal deck, with open web steel joists, beams, and columns
- Roof covering of built-up tar and gravel with flashing and composite insulation
- Building to be sprinklered and include HVAC throughout
- Vehicle bays to be heated

In the event that renovation of an existing building or a building addition is considered, the costs *may* not vary by much, in that recent North Carolina public construction projects have indicated that the costs per square foot for major renovations/building additions varied by only 10-12% (lower than) new construction and at times, if asbestos or lead abatement was required, equaling or even exceeding new construction costs.

With regards to personnel; the following information on position classifications and salary grades for the Fire Suppression Division of the County Fire Marshal's Office was provided by Durham County Human Resources.

Figure 37
Position Classification & Salary Schedule

JOB CODE	CLASSIFICATION TITLE	SALARY GRADE	MINIMUM SALARY	MAXIMUM SALARY
C467	Fire Chief	41	56,885	97,930
C462	Fire Captain	35	42,298	72,816
C464	Fire Lieutenant	31	34,714	59,763
C468	Firefighter/Driver	29	31,449	54,143
C461	Firefighter/Driver	28	29,933	51,534

Accompanying the table were two additional notes having to do with the calculation of employee benefits:

- The cost of fringes: 19.72%; includes FICA @ 7.65%, Local Government Retirement System @ 7.07%, and Supplemental Retirement (401K) @ 5%.
- Estimated costs of Flexible Health and Dental Benefits: $7,882 per permanent position; 50% or greater work percentage, prorated for 50%-99.99%.

The calculations that follow are the consultant's, as are the examples and assumptions that are cited. County Human Services Department personnel were *very* helpful in explaining the nuances of calculating employee benefits, personal and vacation leave hours, and how overtime was considered and calculated for firefighters assigned to work 24-hour shifts. Subsequently, any incorrect assumptions that are noted are the consultant's and *not* Human Resources.

Fire Department Personnel

The salary grades shown in Figure 37 include grade 28-Firefighter and grade 29-Firefighter/Driver, which apparently gives credit for the additional training and certification required to drive a major piece of fire apparatus. What is not shown, but is critical in Durham County, is a salary grade that also offers credit for the EMT certification that is required of firefighters that enables them to respond to medical emergencies as "medical first responders", which all county fire departments currently do.

For purposes of this discussion we will create a salary grade of 30, at a minimum salary 5% higher than grade 29; $33,021; and assign the position title of Firefighter/Driver/EMT. Then, utilizing the figures provided by Human Resources, calculate the total cost of the position as follows:

Figure 38
Salary & Benefit Calculations

Position Classification	Base Salary	Calculated Rate/Hour	Est. County Benefits @ 45%	Total Annual Salary + Benfts.	Adjusted Rate/Hour
Firefighter/Driver/EMT	$ 33,021	$ 15.88	$ 14,859	$ 47,880	$ 23.02

Note that the hourly rate identified is for comparison purposes. It is calculated on the basis of a traditional 40-hour work week which for one year is 2,080 hours worked; i.e. $33,021 divided by 2080 = $15.88 /hour. It will also be used to estimate the cost of part-time employees.

For purposes of these calculations it is assumed that the county fire departments will eventually adopt the 24-hour shift configuration that is currently used by Bethesda (Durham County) for full-time employees. With the exemption from overtime that is allowed under 29 CFR 553.230, subsection 7(k), when averaged out over a 28-day work period actual hourly rates will vary depending upon actual hours worked, leave taken, overtime worked, etc. See also Section 5, pages 63-65.

What will remain constant is the annual full-time gross salary allocation of $47,880; which (here) equals the total annual cost of one (1) full-time Firefighter/Driver/EMT; without overtime and starting at the entry level of salary grade 30.

Using calendar year 2013 as the example, each Firefighter/Driver/EMT is *scheduled* to work 2,928 hours during the year which, if he/she actually worked that many hours would collect their base salary plus approximately $2,731 in net overtime pay; 172 eligible overtime hours x $15.88/hour. See also page 64.

Again, the actual hours worked will vary from employee to employee depending on the number of vacation, holiday, and personal leave days taken. For purposes of the calculations that follow, it is assumed that each full-time employee takes 264 hours in combined holiday, vacation, and personal leave during the year, plus an additional 40 hours for required continuing education classes, for a total of 304 hours each.

Number of Personnel Required per Position

If each Firefighter/Driver/EMT is scheduled to work 2,928 hours/year, less the 304 hours leave and education time taken away from their active duty assignment the calculations to determine the number of "people" necessary to fill one 24/7/365 Firefighter/Driver/EMT position for a year would yield the following:

$$8{,}760 \text{ hrs./yr.} \div [2{,}928 - 304] = 8{,}760 \div 2{,}624 = 3.4 \text{ persons}$$

The likely response to this 3.4 figure is that the "4/10ths of a person" can be filled with part-time personnel.

Now, assume that the recommendation for minimum staffing at each departments main/primary station is five (5) "positions" on duty 24/7/365; and, that all 5 are Firefighter/Driver/EMTs'.

5 positions x 3.4 persons/position = 17.00 FTEs'

As it happens the math works out to equal 17.00 employees (FTEs'). The simple math to calculate the total annual cost of salaries for these 5 positions would be:

$47,880/employee (per Figure 38) x 17 = $813,960/year

This scenario offers the convenience of knowing that it will take an even 17 people to cover five (5) positions 24/7/365, and they can all be full-time employees.

An additional scenario, albeit more cumbersome administratively, would be to utilize part-time employees for the "4/10ths of a person" calculated above without regard to what the "salary x number of positions" multiplication results are. Then, as is the practice now for the departments' part-time employees, pay only the net hourly rate without the benefits.

$15.88 net/hour x [2,928 hours x .40] = $15.88 x 1,171 hours/position = $18,595/year/PT position
One part-time person working 1,171 hours/year/position x 5 positions = $92,975

Ironically, this figure ($92,975) is only $2,785 less than the sum of the two additional full-time employees calculated in the first scenario.

Note: This exercise was intended to illustrate the simpler "mechanics" of staffing calculations for use by the fire departments in planning for their staffing requirements and associated costs. What it has *not addressed* are the nuances of overtime calculations for full-time employees or, *when* the application of proportional benefits kicks in for part-time (County) employees and *how* they are calculated when employed at 50% or more of the hours of their full-time counterparts. The final issue of course will be the configuration and management of the shifts themselves.

SECTION 8. NOTES & FUTURE CONSIDERATIONS

During the fall of 2010 Durham County took the first steps towards the development of its Strategic Plan. In February 2012 the Durham County Strategic Plan summary document was published. The Introduction offered a brief overview of the strategic planning process and the questions that it was designed to answer. The first question was: "Where are we now?"

Similarly, the approach taken during this study and addressed in this report was in fact *not* to look immediately or specifically at whether the five in-county fire departments should be consolidated, totally or in part. Rather, it was to look *first* at the fire services that were being provided to the unincorporated areas of the County now, the individual Departments that were providing those services, and the service delivery "system" that they were part of in order assess the actual operations, capabilities, resources, and performance of those departments individually and collectively; i.e. *Existing Conditions*; i.e. "Where are we now?".

This process provided a basis from which to identify significant issues and concerns having to do with current conditions and practices, determine and discuss the reasons for those concerns, document and to the extent possible quantify the issues those concerns represented, and *then* develop recommendations that addressed the issues. Subsequently, only *two* of the recommendations offered began with the word "Consolidate". The 62 remaining recommendations suggested specific policy and procedural changes and the articulation of specific performance objectives that, when implemented, addressed in turn the specific pre-study perceptions regarding the consistency, coordination and level of fire services provided.

In fact, a substantial case can be made that every one of the 64 recommendations addressed at least one, and in most cases *several,* of the stated requirements of the County's published request that this study "was to make recommendations that":

- *Enhance firefighter safety*
- *Enhance cost control and containment of mobile fire equipment*
- *Enhance cost control and containment of fixed fire building locations*
- *Increase Efficiency*
- *Increase Effectiveness*
- *Coordinate and optimize the use of resources to eliminate duplication of services*
- *Standardize services and programs offered to provide a consistent level of service countywide*
- *Optimize coordination with other public safety providers in Durham County*
- *Identify alternative methods to meet the County's needs*

Further, an additional but eventual outcome of implementing the recommendations offered in this report, is that they will directly reinforce and support several of the objectives and initiatives of the County Strategic Plan's "Major Goal #3: A Safe and Secure Community". Those objectives and initiatives include:

- *Improve coordination within the public safety system*
- *Enhance capacity to respond to emergencies*
- *Increase efficiencies and streamline operations within Durham County public safety functions*
- *Standardize response capabilities to improve outcomes*

Initial Feedback

The title of this report and the preceding study is: *Fire District Consolidation Feasibility Study*. The bulk of the work necessary to compile the information documented in these pages occurred between early February and early August of this year. Yet the publication date noted on the cover of this report is November 2013.

Between and including the dates of July 17th and October 29th, four (4) meetings were held, which included as participants the five Fire Department Chiefs, the County Manager, the Deputy County Manager, the County Fire Marshal, Deputy Fire Marshal, and the consultant. The meetings of July 17th and August 19th discussed study findings regarding existing conditions and discussed operational, procedural, and performance issues in general terms, particularly with regards to level of service; i.e. staffing, apparatus, response time and ISO ratings. Meetings on October 16th and 29th were for the purpose of discussing the draft report itself which had been distributed previously to all attendees and identified specific issues, the first of the formal recommendations to address those issues, and the extent to which consolidation, in whatever form it might take, could occur. The duration of these meetings varied from 2-3 hours each.

The importance these meetings, more specifically the *value* of these meetings were that;

- They provided a venue to for open discussion and interaction between those that would ultimately be charged with implementing and administering (in some form) the recommendations presented in the report, and those that would ultimately be affected most directly by those recommendations.

- They offered the consultant the opportunity of yet another context within which to assess the meeting participants' reaction, thoughts, criticisms, questions and concerns with regards to the issues and recommendations presented. To the extent that, in several instances, it required further investigation, research, and work to supplement, clarify and/or correct information presented in that draft document. Those that had the opportunity to read that draft and this final document will recognize those changes.

Future Considerations

So, what lies ahead for Durham County and the Fire Departments that will continue to provide services to the unincorporated areas of the County? Change, certainly. In what form and to what extent that change will ultimately manifest can only be anticipated at this point. The immediate future, however, will see changes in the day-to-day operations of these fire departments once this report's recommendations are implemented; whether having to do with revenue management, station staffing and deployment, dispatch protocols, or the participation in and development of a centralized Fire Service Capital Improvement Program (CIP) plan; it is certain that in one form or another these recommendations will be addressed.

Beyond the "immediate" future:

- Durham County will experience a significant increase in population over the next 20 years.

- Annexation of currently unincorporated areas of the County, by the City of Durham, will continue; fire operations and fire service CIP planning efforts should anticipate accordingly.

- The fire service will be recognized as the only public safety entity that is capable of responding to fire, technical rescue, *and* medical emergencies on a consistent basis; a fact that must be emphasized to both to the general public and to those officials who approve agency funding.
- Pressure will continue to be exerted on local and State regulatory and assessment organizations (NC OSFM/DOI) to mandate specific performance standards for public safety agencies; specifically, fire service providers.

Beyond this, an examination of countless articles, publications, white papers, and conference/academic presentations will find that there are as many opinions regarding future trends as there are individuals offering them. Currently, some of the common reoccurring themes being discussed include:

- As the fiscal capacities of jurisdictions funding fire services decrease, consolidation, merger and regional sharing concepts will continue to be explored and considered.
- There will continue to be calls to justify workload versus deployment ratios; i.e. the number of staff versus the number of calls/actual hours worked.
- The demand for firefighters to respond to medical emergencies as first responders will continue to increase at a greater rate than requests to respond to fire, hazmat or rescue emergencies.
- However, the individual specific skill sets must continue to be maintained even if they are not used that often.
- Fire departments must anticipate, plan, and train for the likelihood of a regional or area disaster response.
- Efforts are needed to increase public understanding of what criteria and measurements constitute the performance and service quality standards of a fire department.

In the final analysis, the preparedness of the *fire service*, including both its organization and its component departments, to respond to the demand for the services requested, and the proficiency with which it provides that response, will dictate its future more profoundly than any currently perceived trends or predictions.

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SECTION 9. APPENDIX

9.1 Mutual Aid Agreement

9.2 Volunteer Policy

9.3 NIST Study-Executive Summary

9.1 Mutual Aid Agreement (Example)

BETHESDA VOLUNTEER FIRE DEPARTMENT
AUTOMATIC AID AGREEMENT

Pursuant to G.S. 58-83--, this agreement between **Bethesda Volunteer Fire Department** of Durham County, North Carolina and the **City of Durham Fire Department** of Durham County, North Carolina is for the purpose of providing an automatic aid response from the **City of Durham Fire Department** to all structure fires in the area known as the **Bethesda Fire District** within Durham County.

The Durham County Emergency Communications Center upon receiving notification of a structure fire or possible structure fire in the aforementioned area shall automatically dispatch the **City of Durham Fire Department** to respond with personnel and fire protection equipment including a piece of apparatus capable of carrying a minimum of 500 gallons of water to assist the **Bethesda Volunteer Fire Department**. The first arriving fire department shall notify the Durham Emergency Communications Center of the situation found and the Durham Emergency Communications Center shall notify all other responding units. If a **City of Durham Fire Department** fire unit is the first to arrive on scene they will be in command of the scene until arrival of a **Bethesda Volunteer Fire Department** fire unit, and at the same time the **City of Durham Fire Department** fire unit will coordinate firefighting activities with the **Bethesda Volunteer Fire Department** fire units. The **Bethesda Volunteer Fire Department** fire unit's shall be the only fire units authorized to cancel further response.

During any actual fire situation, the **Bethesda Volunteer Fire Department** units shall coordinate activities with the **City of Durham Fire Department** units to allow the **City of Durham Fire Department** units to return to their respective City response area at the earliest convenience.

This agreement shall be in effect for a period of five (5) years from the effective date hereof and shall be automatically renewed for a successive periods of five (5) years as to all parties executing the same except that agreement can be cancelled by giving notice of the intention by the party who intends to cancel by registered mail to the other party to this agreement.

Bethesda Volunteer Fire Department Date:_____

_____ _____
President, Board of Directors Fire Chief

City of Durham Fire Dept. Date:_____

_____
Fire Chief

9.2 Volunteer Policy

9.3 NIST Study-Executive Summary

Operations Manual Policy and Procedures	Durham County Fire & Rescue Services	**Effective Date:** **07/01/2013**	**Number:**
Signature:		**Subject:** Volunteer Program	

13.0 Volunteer Program

The DCF&R Volunteer Program Policy will detail specifics pertaining to the volunteer program that do not apply to career members of the department.

13.1 Selection Process for the New Volunteer

The selection process is a method to ensure a consistent fair process is utilized in the selection of volunteer firefighters and Fire Corps members for DCF&R. Those wishing to volunteer with DCF&R must first fill out an online application at www.dconc.gov.

Selection process steps:

- Application reviewed – accepted/rejected
- Employment and reference checks
- Agility test – For Volunteer Firefighter applicants only
- Interview
- Criminal Background Check and Drivers License Check
- Physical exam "fit for duty" - For Volunteer Firefighter applicants only
- Drug screen
- New Volunteer Paperwork
- Personnel Info. Entry into FireHouse software
- Volunteer Orientation
- Uniform & Gear Issuance
- ID Badge issuance

13.2 New Volunteer Orientation

The purpose of the New Volunteer Orientation is to ensure that new members do not feel alone and lost when they join DCF&R. Volunteer personnel will begin their career with DCF&R as a group and proceed through the orientation as a group whether seeking to perform work in emergency or non-emergency roles. The orientation process will strive to eliminate new members who are unfamiliar with the fire service from becoming overwhelmed by the workings of the fire department. Studies have shown that when personnel become overwhelmed it often leads to feelings of incompetence and feeling intimidated thus leading to quitting the program. The orientation process will provide a structured beginning to a structured program that will ensure new personnel are trained for their job and integrated as seamlessly as possible into DCF&R. Orientation will consist of several topics:

- Introduction to DCF&R (personnel, SOG's, policies, scheduling duty time, training, etc)
- Customer Service the Durham County Way
- Unlawful Workplace Harassment & Respectful Workplace Policy
- Station tours at each station location to introduce new members to each station and some of the career personnel assigned to each station. Topics to include, station familiarization, apparatus familiarization, area familiarization (high hazards).

At the conclusion of the orientation, personnel are released to the Operations division or Admin division to function as a volunteer within their assigned category: Volunteer Firefighter, Volunteer Recruit, Volunteer EMT , or Fire Corps member and must adhere to the requirements as set forth in "Maintaining membership as a Volunteer

13.3 Maintaining membership as Volunteer Firefighter, Volunteer Recruit, Volunteer Fire Officer, or EMT

All personnel both career and volunteer must take individual responsibility and take appropriate measures to familiarize themselves with stations, equipment and personnel.

- Volunteers will respond to calls and schedule duty time by contacting the on duty Captain.
- Documentation of Duty Time - Volunteers MUST sign in utilizing the Daily Log located at each station and administration. The company officer on duty at the time the duty time was performed or the Officer the volunteer is assisting (i.e. training, logistics, administration) is responsible for entering the hours in FireHouse software. It is the responsibility of the volunteer to document their hours in the Volunteer Duty Time Log.
- Documentation of Call Response – Volunteers responding per call MUST remain at the station until the apparatus and crew report back to the station. Upon the return of the crew the Volunteer MUST, make contact with the Company Officer to be given credit in FireHouse software for call response. The Volunteer's duty as it pertains to that call includes returning the apparatus and equipment to a state of readiness and will remain at the station until cleared by the Company Officer. Failure to do so will result in the Volunteer NOT receiving credit for the call.
- Turn out gear ***SHALL*** be kept at the station at all times, with the exception of attending training.
- Volunteers ***SHALL NOT*** respond via POV to the scene. Only Volunteer Officers will be allowed to do such. All volunteers shall report to the station to staff the 2nd out apparatus for possible 2nd page out. Failure to follow this ***SHALL*** result in disciplinary action.
- If the Volunteer Officer responds to the scene, they must respond back to the station at the conclusion of the incident to help return equipment to a state of readiness.
- Red lights are ***PROHIBITED*** in volunteer POV per County Policy. The County Risk Management does not allow volunteers to respond with red lights in POV and all traffic laws MUST be adhered to during response.
- Volunteer Officer's arriving POV to the scene are allowed to turn on their POV red lights once on scene to give warning and notification to those in the area of the emergency scene or hazard. Personnel doing such need to leave adequate room for arriving apparatus, ambulances and other emergency vehicles.
- Volunteers must follow IMS on all call responses.

To maintain membership as a volunteer firefighter, members must meet the following requirements. Volunteers are subject to suspension or dismissal from the program if the requirements are not met:

- Obtain 72 hours of training each year.
- Perform 72 hours of duty time: responding to calls, special projects, and public education events – to be evaluated on a six month basis
- Schedule 36 hours per month station / shift duty, to be scheduled with the District Chief. Would be scheduled in 12 hour blocks.
- Every Monday night will be considered a Volunteer training night, with the exception of additional training as scheduled.
- Annual Fit for Duty Physical – required of any personnel functioning on the fire ground actively engaged in any fire ground activity and offered to all Fire corps – to be scheduled in the month of the birthday of the volunteer.
- Annual Fit Test/Administrative information update – to be scheduled in the month of the birthday of the volunteer with the Logistics Captain and Administrative Assistant respectively.
- Once a year completion of the physical fitness assessment at time at scheduled by the department.
- Scheduling duty time should be done prior to arriving or as soon as arrival at station with the company officer. Duty time will be done in a minimum of 1-hour blocks and volunteer personnel must be in uniform. Uniforms are not required when responding per call.
- FF I & II certification- efforts towards obtaining certification within 1 year.
- EMT - efforts towards obtaining certification within a 2 year time frame.
- May obtain class B license if funds available.
- EVD within 12 months - Restricted on driving any vehicle until personnel obtain. Even if obtain EVD, certain members are unable to drive county vehicles until DL check is clear per County Policy – Personnel also must be 18 to drive staff vehicles.
- D/O Pumps and Aerials certifications- efforts towards obtaining certification but must achieve FF I & II prior. Personnel may obtain a qualification card for each apparatus and be cleared to

drive prior to obtaining D/O certification. Personnel MUST be 21 years of age in order to operate apparatus.

- TR, Ropes, VMR certifications - efforts towards obtaining Rescue certification.
- NIMS 100, 200, 700, and 800 certifications.
- Annual training – Blood Borne Pathogens, HazCom and HazMat refresher.

Personnel can choose to become a volunteer EMT with the understanding that only one position on a first out apparatus will be designated as an EMT only position. EMT only positions could staff a medical squad with a minimum of two personnel EMT-B certified.

Requirements to maintain membership:

- Obtain EMT certification within 1 year of joining
- HazMat Ops certification
- EVD certification
- ICS/NIMS 100, 200, 700, and 800
- MUST meet time requirements, training and duty time, and fit for duty requirements as set forth in the Volunteer Firefighter requirements

13.4 Maintaining membership as Volunteer Fire Corps member

The Fire Corps program was created under the Department of Homeland Security as a grassroots effort to allow any persons wishing to volunteer and give of their time to their local Fire Department. DCF&R created the Fire Corps program as a means for all to have a place within DCF&R moving forward through and after the consolidation. The Fire Corps members' roles and responsibilities will be varied and designed to match the talents, skill sets and specialties that each individual brings to the department. ***All Fire Corps members are afforded the same benefits and incentives as offered to those in the Volunteer Firefighter program.***

All personnel both career and volunteer must take individual responsibility and take appropriate measures to familiarize themselves with stations, equipment and personnel.

Some areas envisioned where Fire Corps personnel could assist would be:

- Technology (i.e. data entry, website, statistical research & analysis etc.)
- Administrative Functions (i.e. filing, answering phones, create documents and presentations)
- Assist with Fire and Life Safety Education programs
- Child Passenger Seat Clinics
- Bilingual Assistance
- Fire ground activities:
    - Rehab
    - Back at station: assisting with placing apparatus back in service
- Preplans
- Hydrants
- Deliver supplies to stations
- Equipment/Building/Apparatus maintenance & repair
- Build training props
- Assist training division with filing and tracking of training records
- Marketing committee (to include recruitment and retention for volunteer firefighters & Fire Corps)
- Any other duties or needs that arise based upon skills and talents of those in the Fire Corps program

Currently there are two tracts of Fire Corps members: those wishing to become Volunteer Firefighters but who are under 18 and those not wishing or unable at this time to become Volunteer Firefighters.

Fire Corps (Junior Firefighter/those under18 and above the age of 15)

- 36 hours training per year
- No minimum duty time as school MUST be the priority for these members.
- This category will not be allowed to respond in emergency apparatus. They may pull duty time at the station but are not allowed to ride in emergency apparatus at any time.
- This category may participate in fire certification classes with the approval of the D/C of Operations in conjunction with the training division.
- Must maintain a C average in each class
- Will be assigned a mentor within the department

- Training for career & volunteer personnel associating with junior under 18 members
- Include parents/guardians in orientation process – permission forms signed
- Monitor closely by mentor
- Distinguished on gear as junior under 18 member
- Annual Fit for Duty Physical
- Physical Fitness Assessment twice a year.

Fire Corps – ***(Volunteers that do not wish to become a full volunteer)*** subject to suspension and / or dismissal from the program if these requirements are not met. *:*

- 36 hrs training per year – can participate if desired in classroom portion of FF training but not practical's.
- 72 hrs per year project time or station duty time (adjusted on case by case basis if needed) – on a six months basis
- Fire Corps members. May ride in support vehicles to scenes non-emergency.
- § May function in rehab on fire ground if trained and rehab requested by IC.
- § Volunteers must follow IMS on all call responses.
- Roles & responsibilities TBD case by case based upon skills and specialties.
- Documentation of Duty Time - Volunteers MUST sign in utilizing the Volunteer Duty Time Log located at each station and administration. The company officer on duty at the time the duty time was performed or the Officer the volunteer is assisting (i.e. training, logistics) is responsible for entering the hours in FireHouse software. It is the responsibility of the volunteer to document their hours in the Volunteer Duty Time Log.

13.5 Volunteer Officers

Volunteers can progress through the ranks as a volunteer firefighter to the role of a Volunteer Lieutenant, Captain and Assistant Chief. The member must complete the DCF&R Officer Development Program prior to participating in a Volunteer Officer Promotional Process.

Volunteer Officers will be expected to meet the same requirements as career officers of the same rank. Volunteer Officers also must meet the same time requirements as set forth in the "Maintaining membership as Volunteer Firefighter/Officer/EMT" section.

A promotional process will be held as needed to create a volunteer officer eligibility list from which volunteer officer vacancies will be filled. Volunteer Officers will hold their rank until demoted or promoted as is for career.

Volunteer Officer Requirements:

- FF I & II certification
- EMT-B – within 2 years
- 5 yrs experience incl. 2 years of progressively responsible supervisory experience

Commitment to work on and complete in timeframe:

- EVD within 6 months
- Fire Instructor II - The requirement will be adjusted to match the standards set by the state.
- D/O Pumps and Aerial, TR, Ropes, VMR within 4 years
- Fire Officer I ***(Lieutenant)*** and Fire Officer II ***(Captain and above)***
- Will be assigned additional roles/responsibilities as determined.

13.7 Benefits of Volunteering with DCF&R

§ Membership in the North Carolina State Fireman's Association which includes:
-State Line of Duty Death Benefit
-NC Firemen's Pension Fund
-Federal Public Safety Officers Death Benefit – as of 10-01-10
-Local Relief Fund
-Educational Benefits both to active members and an Educational Death Benefit
-Fraternal Insurance
-Doctors Vision Center (25% off exams and eyeglasses)
-Local Government Federal Credit Union
-Staples Business Advantage
-Life Insurance and AD&D provided by Provident

§ Life Insurance through VFIS

- Training opportunities through the County Fire Delivery Service and DTCC
- Volunteer progression to officer ranks
- All Volunteers may use fitness equipment at the stations. However, each member must consult with their physician prior to beginning any fitness routine. All fitness equipment is used "at their own risk".

13.8 Staffing the Second Out Apparatus

If three or more Volunteer Firefighters, Recruits or Officers arrive at a station they may place a second out apparatus in service with communications to be available for dispatch to a second call in the district. The requirements to do such are:

- Volunteers must follow IMS on all call responses.
- The volunteer driving MUST be checked off on the apparatus per DCF&R requirements.
- Responding to emergency scene where additional personnel are requested. A Volunteer Officer will be the Officer for the crew on the apparatus and arrival on scene. All personnel on the apparatus will function as a member of that crew under the Officer and will NOT deviate once on scene. The crew may be broken up to be placed with crews on scene as determined by the IC.
- If an Officer does not respond to the station the senior volunteer will function as the 'Officer' until arrival on scene and IC places all arriving members with crews to utilize the manpower.
- Responding as first unit to a scene (second call in district and first out apparatus is still tied up on scene).
    - The volunteer driving MUST be checked off on the apparatus per DCF&R requirements.
    - At least two personnel on the apparatus MUST be Firefighter I & II certified and EMT-B certified.
    - Once the above requirement is met any Volunteer Firefighter, Volunteer Recruit or Volunteer Officer may fill vacant seats.
    - Only ONE position per apparatus may be designated as an EMT-B only position and only after at least two personnel on the apparatus are Firefighter I & II certified and EMT-B certified.

- A Volunteer Officer will be the Officer for the crew. If an Officer does not respond to the station then the senior volunteer will function in an 'Acting Officer' capability and all additional personnel will function as members of that crew.
- All Policies and Procedures for response will be followed.
- The person functioning as the 'Officer' is responsible for the documentation of the incident in FireHouse software.

13.9 Chain of Command

While performing duty time or responding per call the Volunteer reports to the Company Officer or Volunteer Officer for the crew they are assigned. Personnel assisting with projects report to the Officer they are assisting. Any issues need to follow the chain of command and proceed through the ranks. If at any point the Volunteer does not feel comfortable proceeding through the chain of command they may utilize the Volunteer Program Coordinator for operational issues. The Volunteer Program Coordinator will work in conjunction with the Volunteer and the appropriate Operations personnel to address the issue.

13.10 Conduct of the Volunteer

Volunteer personnel are expected to present a professional image to the public while on or off official capacity. Any behavior deemed to be conduct unbecoming, either on or off official capacity, will result in termination from the Durham County Fire & Rescue Volunteer Program.

It is expected that all Volunteers will follow all DCF&R rules and regulations, SOP's and any other policies, written or verbal, or be subject to removal from the Durham County Volunteer Program.

Executive Summary

Both the increasing demands on the fire service - such as the growing number of Emergency Medical Services (EMS) responses, challenges from natural disasters, hazardous materials incidents, and acts of terrorism — and previous research point to the need for scientifically based studies of the effect of different crew sizes and firefighter arrival times on the effectiveness of the fire service to protect lives and property. To meet this need, a research partnership of the Commission on Fire Accreditation International (CFAI), International Association of Fire Chiefs (IAFC), International Association of Firefighters (IAFF), National Institute of Standards and Technology (NIST), and Worcester Polytechnic Institute (WPI) was formed to conduct a multiphase study of the deployment of resources as it affects firefighter and occupant safety. Starting in FY 2005, funding was provided through the Department of Homeland Security (DHS) / Federal Emergency Management Agency (FEMA) Grant Program Directorate for Assistance to Firefighters Grant Program — Fire Prevention and Safety Grants. In addition to the low-hazard residential fireground experiments described in this report, the multiple phases of the overall research effort include development of a conceptual model for community risk assessment and deployment of resources, implementation of a generalizable department incident survey, and delivery of a software tool to quantify the effects of deployment decisions on resultant firefighter and civilian injuries and on property losses.

The first phase of the project was an extensive survey of more than 400 career and combination (both career and volunteer) fire departments in the United States with the objective of optimizing a fire service leader's capability to deploy resources to prevent or mitigate adverse events that occur in risk- and hazard-filled environments. The results of this survey are not documented in this report, which is limited to the experimental phase of the project. The survey results will constitute significant input into the development of a future software tool to quantify the effects of community risks and associated deployment decisions on resultant firefighter and civilian injuries and property losses.

The following research questions guided the experimental design of the low-hazard residential fireground experiments documented in this report:

1. How do crew size and stagger affect overall start-to-completion response timing?

2. How do crew size and stagger affect the timings of task initiation, task duration, and task completion for each of the 22 critical fireground tasks?

3. How does crew size affect elapsed times to achieve three critical events that are known to change fire behavior or tenability within the structure:
   a. Entry into structure?
   b. Water on fire?
   c. Ventilation through windows (three upstairs and one back downstairs window and the burn room window). 4. How does the elapsed time to achieve the national standard of assembling 15 firefighters at the scene vary between crew sizes of four and five?

In order to address the primary research questions, the research was divided into four distinct, yet interconnected parts:

- Part 1— Laboratory experiments to design appropriate fuel load
- Part 2 — Experiments to measure the time for various crew sizes and apparatus stagger (interval between arrival of various apparatus) to accomplish key tasks in rescuing occupants, extinguishing a fire, and protecting property
- Part 3 — Additional experiments with enhanced fuel load that prohibited firefighter entry into the burn prop — a building constructed for the fire experiments
- Part 4 — Fire modeling to correlate time-to-task completion by crew size and stagger to the increase in toxicity of the atmosphere in the burn prop for a range of fire growth rates.

The experiments were conducted in a burn prop designed to simulate a low-hazard' fire in a residential structure described as typical in NFPA 1710® *Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments.* NFPA 1710 is the consensus standard for career firefighter deployment, including requirements for fire department arrival time, staffing levels, and fireground responsibilities.

Limitations of the study include firefighters' advance knowledge of the burn prop, invariable number of apparatus, and lack of experiments in elevated outdoor temperatures or at night. Further, the applicability of the conclusions from this report to commercial structure fires, high-rise fires, outside fires, terrorism/natural disaster response, HAZMAT or other technical responses has not been assessed and should not be extrapolated from this report.

Primary Findings

Of the 22 fireground tasks measured during the experiments, results indicated that the following factors had the most significant impact on the success of fire fighting operations. All differential outcomes described below are statistically significant at the 95 % confidence level or better.

Overall Scene Time:

The four-person crews operating on a low-hazard structure fire completed all the tasks on the fireground (on average) seven minutes faster — nearly 30 % — than the two-person crews. The four-person crews completed the same number of fireground tasks (on average) 5.1 minutes faster — nearly 25 %— than the three-person crews. On the low-hazard residential structure fire, adding a fifth person to the crews did not *decrease* overall fireground task times. However, it should be noted that the

1 A low-hazard occupancy is defined in the NFPA Handbook as a one-, two-, or three-family dwelling and some small businesses. Medium hazards occupancies include apartments, offices, mercantile and industrial occupancies not normally requiring extensive rescue or firefighting forces. High-hazard occupancies include schools, hospitals, nursing homes, explosive plants, refineries, high-rise buildings, and other highlife hazard or large fire potential occupancies.

benefit of five-person crews has been documented in other evaluations to be significant for medium- and high-hazard structures, particularly in urban settings, and is recognized in industry standards?

Time to Water on Fire:

There was a 10% difference in the "water on fire" time between the two- and three-person crews. There was an additional 6% difference in the "water on fire" time between the three- and four-person crews. (i.e., four-person crews put water on the fire 16% faster than two person crews). There was an additional 6% difference in the "water on fire" time between the four- and five-person crews (i.e. five-person crews put water on the fire 22% faster than two-person crews).

Ground Ladders and Ventilation:

The four-person crews operating on a low-hazard structure fire completed laddering and ventilation (for life safety and rescue) 30 % faster than the two-person crews and 25 % faster than the three-person crews.

Primary Search:

The three-person crews started and completed a primary search and rescue 25 % faster than the two-person crews. The four- and five-person crews started and completed a primary search 6 % faster than the three-person crews and 30 % faster than the two-person crew. A 10 % difference was equivalent to just over one minute.

Hose Stretch Time:

In comparing four-and five-person crews to two-and three-person crews collectively, the time difference to stretch a line was 76 seconds. In conducting more specific analysis comparing all crew sizes to the two-person crews the differences are more distinct. Two-person crews took 57 seconds longer than three-person crews to stretch a line. Two-person crews took 87 seconds longer than four-person crews to complete the same tasks. Finally, the most notable comparison was between two-person crews and five-person crews — more than 2 minutes (122 seconds) difference in task completion time.

Industry Standard Achieved:

As defined by NFPA 1710, the "industry standard achieved" time started from the first engine arrival at the hydrant and ended when 15 firefighters were assembled on scene.' An effective response force was assembled by the five-person crews three minutes faster than the four-person crews. Based on the study protocols, modeled after a typical fire department apparatus deployment strategy, the total number of firefighters on scene in the two- and three-person crew scenarios never equaled 15 and therefore the two- and three-person crews were unable to assemble enough personnel to meet this standard.

Occupant Rescue:

Three different "standard" fires were simulated using the Fire Dynamics Simulator (FDS) model. Characterized in the *Handbook of the Society of Fire Protection Engineers* as slow-, medium-, and fast-growth rate, the fires grew exponentially with time. The rescue scenario was based on a non-ambulatory occupant in an upstairs bedroom with the bedroom door open.

Independent of fire size, there was a significant difference between the toxicity, expressed as fractional effective dose (FED), for occupants at the time of rescue depending on arrival times for all crew sizes. Occupants rescued by early-arriving crews had less exposure to combustion products than occupants rescued by late-arriving crews. The fire modeling showed dearly that two-person crews cannot complete essential fireground tasks in time to rescue occupants without subjecting them to an increasingly toxic atmosphere. For a slow-growth rate fire with two-person crews, the FED was approaching the level at which sensitive populations, such as children and the elderly are threatened. For a medium-growth rate fire with two-person crews, the FED was far above that threshold and approached the level affecting the general population. For a fast-growth rate fire with two-person crews, the FED was well above the median level at which 50 % of the general population would be incapacitated. Larger crews responding to slow-growth rate fires can rescue most occupants prior to incapacitation along with early-arriving larger crews responding to medium-growth rate fires. The result for late-arriving (two minutes later than early-arriving) larger crews may result in a threat to sensitive populations for medium-growth rate fires. Statistical averages should not, however, mask the fact that there is no FED level so low that every occupant in every situation is safe.

Conclusion:

More than 60 full-scale fire experiments were conducted to determine the impact of crew size, first-due engine arrival time, and subsequent apparatus arrival times on firefighter safety and effectiveness at a low-hazard residential structure fire. This report quantifies the effects of changes to staffing and arrival times for residential firefighting operations. While resource deployment is addressed in the context of a single structure type and risk level, it is recognized that public policy decisions regarding the cost-benefit of specific deployment decisions are a function of many other factors including geography, local risks and hazards, available resources, as well as community expectations. This report does not specifically address these other factors.

The results of these field experiments contribute significant knowledge to the fire service industry. First, the results provide a quantitative basis for the effectiveness of four-person crews for low-hazard response in *NFPA 1710*. The results also provide valid measures of total effective response force assembly on scene for fireground operations, as well as the expected performance time-to-critical-task measures for low-hazard structure fires. Additionally, the results provide tenability measures associated with a range of modeled fires.

Future research should extend the findings of this report in order to quantify the effects of crew size and apparatus arrival times for moderate- and high-hazard events, such as fires in high-rise buildings, commercial properties, certain factories, or warehouse facilities, responses to large-scale non-fire incidents, or technical rescue operations.

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2 NFPA Standard 1710 - A.5.2.4.2.1 ...Other occupancies and structures in the community that present greater hazards should be addressed by additional fire fighter functions and additional responding personnel on the initial full alarm assignment.

3 NFPA 1710 Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments. Section 5.2.1 — Fire Suppression Capability and Section 5.2.2 Staffing.

4 As defined in the handbook, a fast fire grows exponentially to 1.0 MW in 150 seconds. A medium fire grows exponentially to 1 MW in 300 seconds. A slow fire grows exponentially to 1 MW in 600 seconds. A 1 MW fire can be thought-of as a typical upholstered chair burning at its peak. A large sofa might be 2 to 3 MWs.