

Montpelier Fire Department



CREW SIZE AND EFFECTIVENESS

**A LOOK AT HOW THE NUMBER
OF FIREFIGHTERS ON DUTY
AFFECTS OUR EMERGENCY
RESPONSE AND DAY-TO-DAY
OPERATIONS**

Crew Size and Emergency Response



A REVIEW OF THE
“REPORT ON RESIDENTIAL FIREGROUND FIELD
EXPERIMENTS”
CONDUCTED BY THE
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
A DIVISION OF THE
U.S. DEPARTMENT OF COMMERCE
APRIL 2010

The Importance of the Study



“Local decision-makers are challenged to balance community service expectations with finite resources without a solid technical foundation for evaluating the impact of staffing and deployment decisions on the safety of the public and firefighters. For the first time, this study investigates the effect of varying crew size, first apparatus arrival time, and response time on firefighter safety, overall task completion, and interior residential tenability using realistic residential fires.”

Overview of the Study



(video of experiment overview)

http://www.nist.gov/el/fire_research/residential-fire-report_042810.cfm

The Results



- Obviously, more people doing a task will equal faster results.
- However, there are a few notable conclusions that the study came to that are not so obvious:

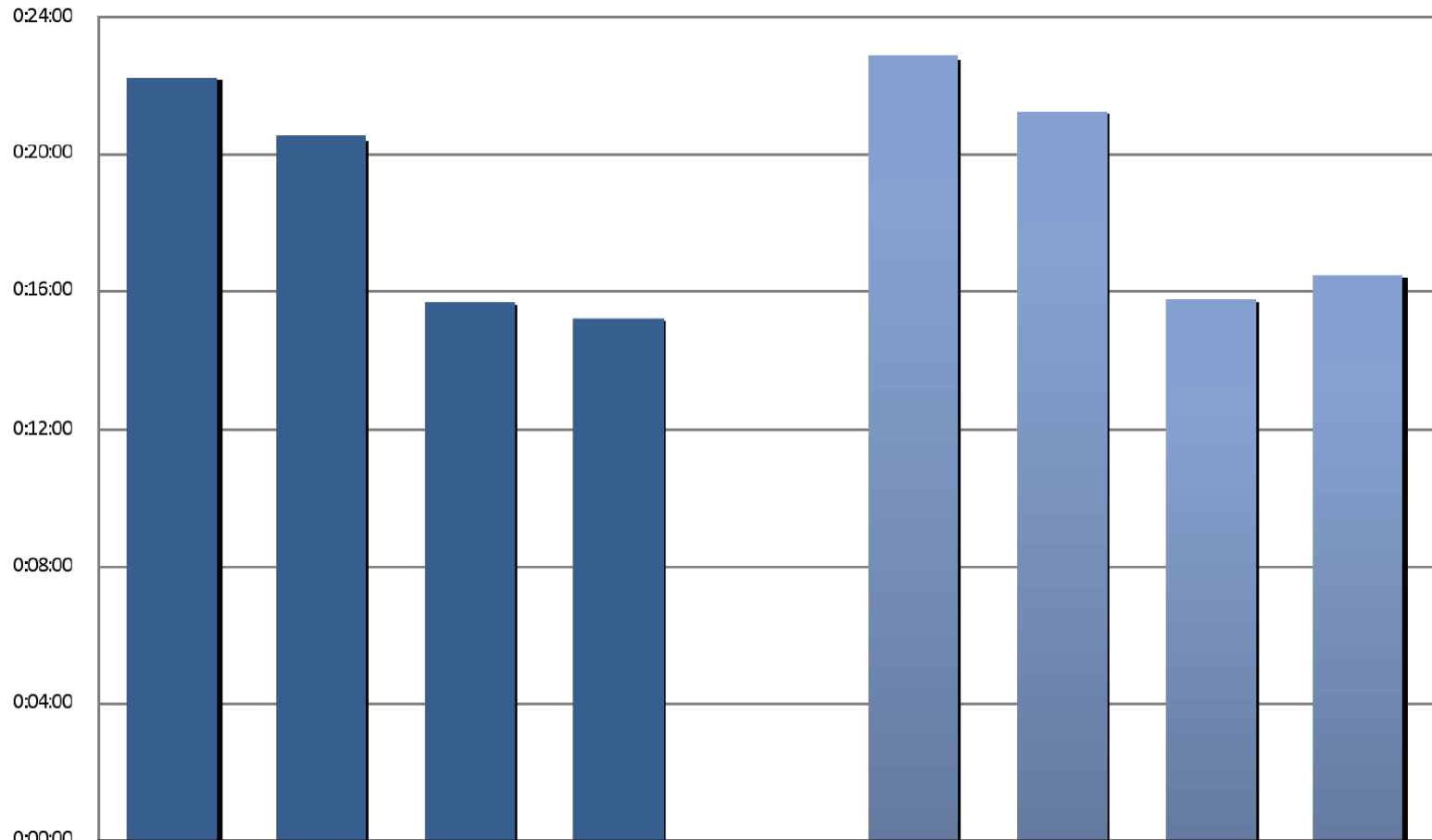
Crew Size and Effectiveness



Four-person crews are optimal.

- The most notable jump in effectiveness when changing the crew size by a factor of only one occurred when 3-person crews were changed to 4-person crews.
- “4-person crews completed all the tasks on the fireground (on average) seven minutes faster—nearly 30%--than the 2-person crews. The 4-person crews completed the same number of fireground tasks (on average) 5.1 minutes faster—nearly 25%--than the 3-person crews.”
- The increases in effectiveness when moving from 2- to 3-man crews and from 4- to 5-man crews were not nearly as notable as the increase from 3- to 4-man crews.

Overall Scene Time



	2-Person Close	3-Person Close	4-Person Close	5-Person Close		2-Person Far	3-Person Far	4-Person Far	5-Person Far
End Time	0:22:16	0:20:30	0:15:44	0:15:13		0:22:52	0:21:17	0:15:48	0:16:31
Start Time	0:00:00	0:00:00	0:00:00	0:00:00		0:00:00	0:00:00	0:00:00	0:00:00

Crew Size and Effectiveness



Two-person crews are extremely ineffective.

- “The fire modeling showed clearly that 2-person crews cannot complete essential fireground tasks in time to rescue occupants without subjecting them to an increasingly toxic atmosphere.”
- The fire department’s ability to quickly respond to a residential fire, rescue trapped occupants, and mitigate the effects of growing fire conditions is almost entirely lost when there are only two firefighters on duty.

Crew Size and Effectiveness



Not only do small crews hurt the fire department's ability to serve the public, they endanger firefighters.

- “Average heart rates were higher for members of small crews, particularly two-person crews.”
- “Danger is increased for small crews because the stress of fire fighting keeps heart rates elevated beyond the maximum [safe] heart rate for the duration of a fire response, and so the higher heart rates were maintained for sustained time intervals.”
- The leading cause of line-of-duty deaths for firefighters is heart attack.

Crew Size and Effectiveness



If this study is so important for dictating what constitutes a safe and effective crew size, why isn't there a national standard in place that utilizes this information?

Crew Size and Effectiveness



- There is, and it's known as NFPA 1710. It states that crews working for a career fire department, like Montpelier's, "shall be staffed with a minimum of four on-duty personnel."
- NFPA stands for the National Fire Protection Association, and it is a body that creates standards for all sorts of fire service-related issues.
- We make a point of following NFPA guidelines in all facets of our operation as a fire department, from the gear we wear to the trucks we drive.
- In fact, the only area in which the Montpelier Fire Department is not NFPA-compliant is crew size.

Crew Size and Effectiveness



- The crew size for the Montpelier Fire Department is three. During the weekdays, this 3-person crew is augmented by some daytime staff, as the majority of our calls for service come during the day. However, the vast majority of our structure fires occur at night.
- Every Thursday, Friday, Saturday, and Sunday between the hours of 6pm and 8am, there are only 3 firefighters on duty at the fire station.
- According to the U.S. Fire Administration, the majority “of civilian fire fatalities in residential buildings occur between the hours of 10 p.m. and 6 a.m.”

Crew Size and Effectiveness



- Thus, during the majority of the time that most fatal fires occur, the Montpelier Fire Department is staffed with a sub-standard amount of personnel.
- This lack of staffing results in increased danger to both the citizens of Montpelier and its firefighters.

Crew Size and Effectiveness



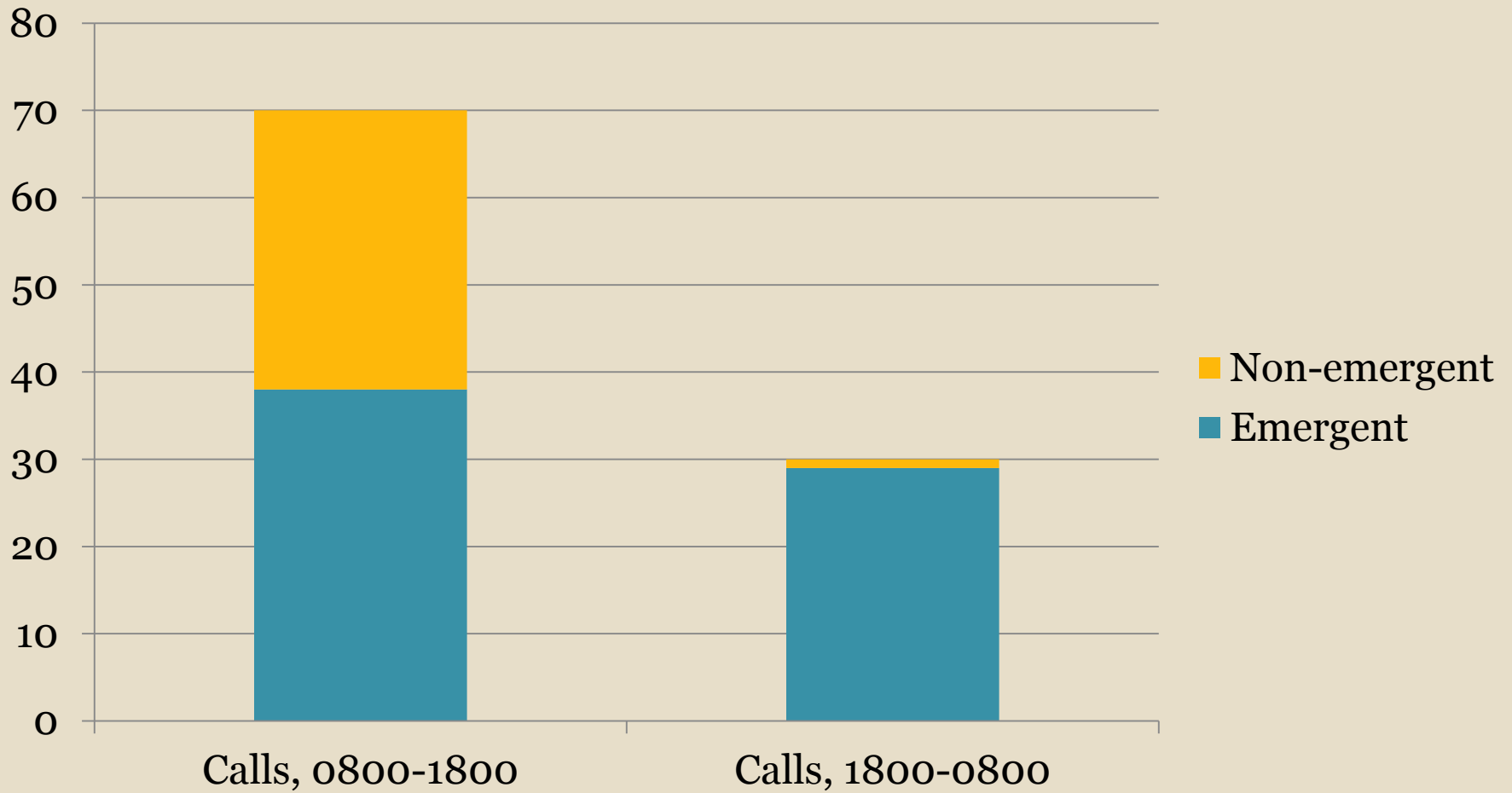
- So far, we've only considered crew size and its effects on our fire response. But it also plays an important role in our ability to answer ambulance calls.
- As mentioned earlier, the Montpelier Fire Department responds to more calls during the day than it does at night. However, during the nighttime hours, though call volume is down, the nature of the call, whether fire or ambulance, is generally more serious.

Crew Size and Effectiveness



- For example, 100 ambulance calls from the month of January 2011 were taken as a random sample. The calls were analyzed by both time of day and seriousness.
- What we found was that while daytime calls accounted for 70% of our call volume, only 54% of those daytime calls were of a highly serious, “true emergency” nature. Conversely, 97% of our nighttime calls were of a highly serious nature.

Crew Size and Effectiveness



An Overview of What We've Covered So Far



- In 2011, the Montpelier Fire Department responded to 2,181 requests for service. That's a record high for the department.
- Of those, roughly 70% (1,527 calls) occurred between the hours of 0800 and 1800.
- Of the roughly 30% of total calls that occurred between 1800 and 0800, 97% (634) were of a highly serious, life-threatening nature.

Handling Multiple Calls



- 289 calls (13%) last year occurred while our firefighters were already out on another call.
- When we only have 3 firefighters on duty, we must call in mutual aid from another town to handle a second call. One firefighter will respond and begin rendering service, but can only do so much before mutual aid arrives.
- If we only had 2 firefighters on duty, we would not be able to even send one person to a second call. To frame this in last year's terms, there would have been 289 times when a Montpelier resident called for help and had to wait for emergency personnel from Barre City to arrive before they received any service at all. That's an average of a roughly 7 minute wait.

Crew Size and Response Times



- So, given the last slide and the earlier information from the NIST report, diminishing crew size would definitely slow response times and the accomplishment of certain critical tasks on both fire and ambulance scenes.
- Obviously, slower response times from a fire and ambulance department are a bad thing. But exactly how bad is it to be even just a couple minutes later than what our citizens have come to expect?

Fire Response and Flashover

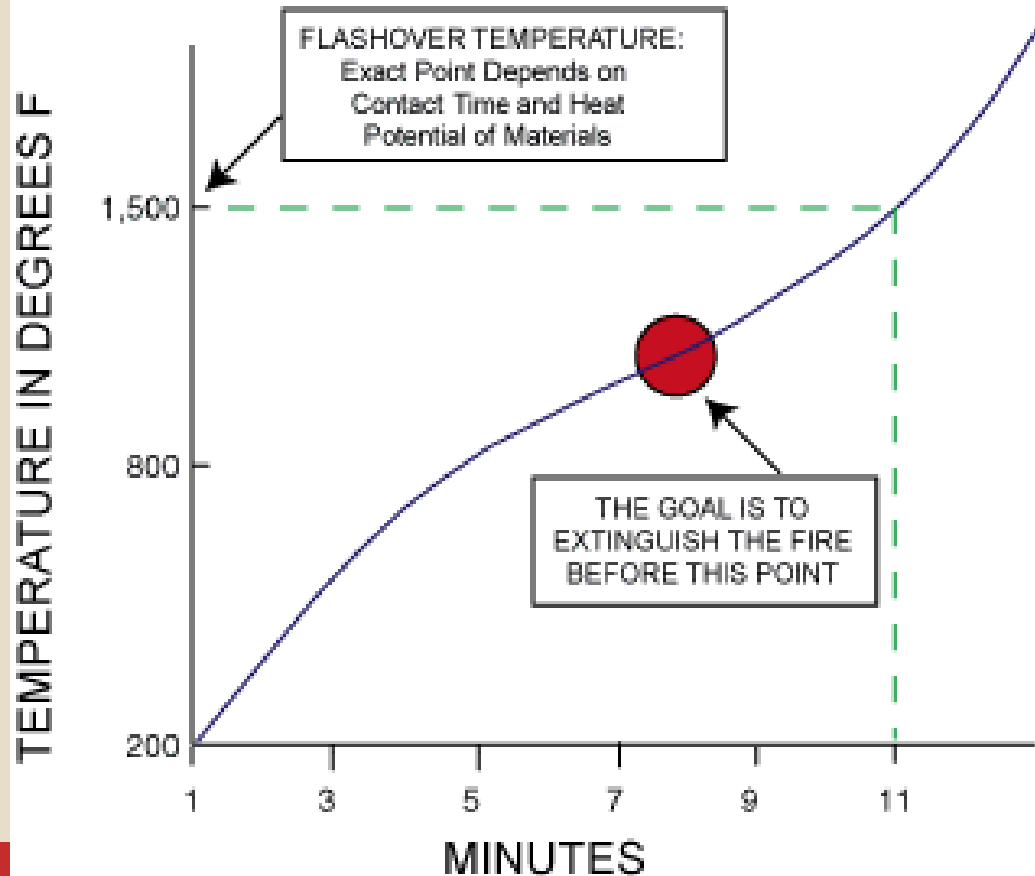


“The chart that follows shows a typical “flashover” curve for interior structure fires. The point in time represented by the occurrence of “flashover” is critical because it defines when all of the contents of a room become involved in the fire. This is also the point at which a fire typically shifts from “room and contents” to a “structure” fire – involving a wider area of the building and posing a potential risk to the structures surrounding the original location of the fire.” (Matrix Report, p. 61)

Fire Response and Flashover



Generalized Flashover Curve



Fire Response and Flashover



“Note that this chart depicts a fire from the moment of inception – not from the moment that a fire is detected or reported. This demonstrates the criticality of early detection and fast reporting as well as rapid dispatch of responding units. This also shows the critical need for a rapid (and sufficiently staffed) initial response. By quickly initiating the attack on a fire, “flashover” can be averted.” (Matrix Report, p. 61)

Ambulance Response and Survivability



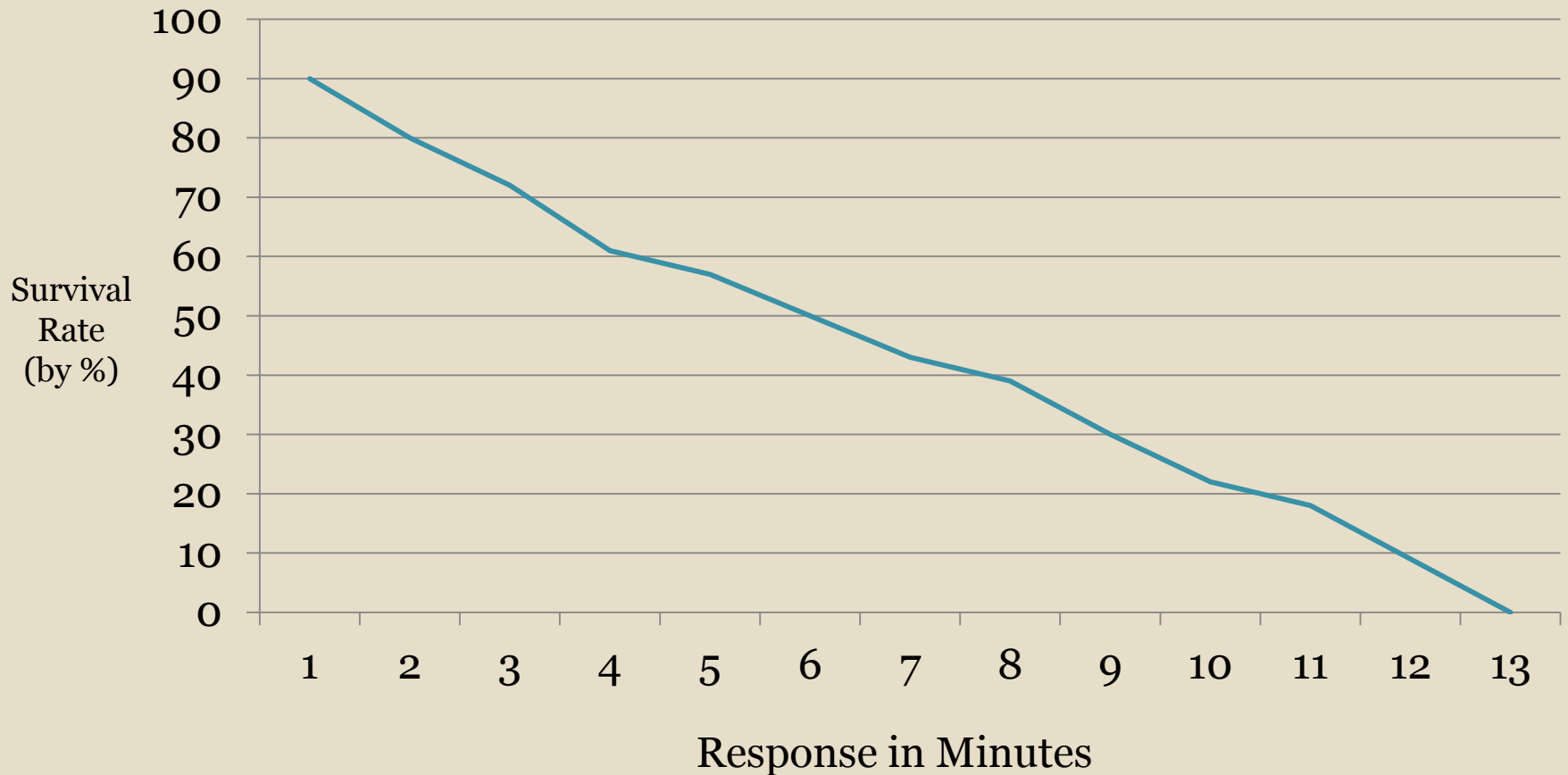
Every minute a fire is allowed to grow larger, the chances of saving trapped occupants and endangered property decrease greatly. Response to medical emergencies shows a similar finding, as highlighted by the Matrix Report:

“The chances of survival of cardiac arrest diminish approximately 10% for each minute that passes before the initiation of CPR and/or defibrillation...”(p. 62)

Ambulance Response and Survivability



% Survival Rate



Ambulance Response and Survivability



- The research behind the previous chart “results in the recommended objective of provision of basic life support within 4 minutes of notification...” (Matrix Report, p. 62)
- If staffing levels are cut and a patient in cardiac arrest happens to be one of the 289 calls we received last year while we were already out on another call, then that resident’s chances of survival drop from 75% to about 40%.

Operational Responsibilities



- When Montpelier firefighters are not actively responding to one of roughly 2,200 calls per year, we work hard to ensure that we are the most well-prepared, best-trained, cost-effective fire department that we can be.
- The size of our crew dictates how much time we are able to spend tackling behind-the-scenes needs, from training to maintenance, fire prevention education to community enhancement projects.

Training



Training is paramount at the Montpelier Fire Department. Significant time is spent every single day bettering our fire and emergency medical skills:

- ✦ Each crew spends a minimum of 1 hour on fire-related training every single day. Additionally, a minimum 1 hour is spent on EMS training every other day.
- ✦ Every Tuesday includes a departmental training on an EMS topic. Every Wednesday is dedicated to a departmental fire training. These trainings usually take several hours and include both practical and text-based learning.
- ✦ Firefighters are constantly taking courses offered by the Vermont Fire Academy as a condition of career advancement. A large portion of day-to-day time is spent preparing for these classes.

Training (cont.)



- ✦ Every firefighter who has less than 6 years of service at Montpelier Fire must display proficiency annually in an evaluation process known as a “6 Hour Test,” wherein practical and theoretical skills are critiqued and subsequently improved upon.
- ✦ Every Montpelier firefighter takes a street test annually, in which he or she must show exact knowledge of all Montpelier street locations.
- ✦ Every Montpelier firefighter takes an annual emergency vehicle driving test to ensure proficiency and safe operation of all of Montpelier Fire’s emergency vehicle fleet.

Vehicle Maintenance



Ensuring the ability of our emergency vehicles to respond in any conditions is one of the highest priorities of Montpelier firefighters:

- ✦ Every morning, every emergency vehicle is checked to ensure its ability to respond immediately, safely, and fully-stocked.
- ✦ Additionally, each vehicle is inspected in detail each week. All mechanical functions are checked in detail, and all equipment is inventoried and restocked as need.
- ✦ All vehicles are cleaned often and waxed twice per year.
- ✦ The department's maintenance officer coordinates and contracts any additional work that needs to occur on the vehicles that firefighters cannot take care of at the station.
- ✦ Our thorough care of our vehicles allows our fire trucks to operate safely and effectively for twenty year spans of service, lowering costs to taxpayers for replacement trucks and out-of-department service.
- ✦ Montpelier firefighters also research and write their own grants which just recently saved the City \$142,500 towards the purchase of a new fire engine.

Equipment Maintenance



Our extensive training cannot be utilized effectively without properly functioning emergency equipment:

- ✦ All power equipment (e.g., chain saws, hydraulic extrication equipment, generators, etc.) is inspected and operated on a weekly basis.
- ✦ All hand tools are inspected on a weekly basis, and any repairs (e.g., repainting, sharpening, etc.) are taken care of in-house.
- ✦ Our self-contained breathing apparatus is an essential piece of equipment, with all active-use packs checked daily and reserve packs checked weekly. The air bottles are filled in-house with an air compressor system that we help to maintain. And all air bottles must be scheduled for hydrostatic testing once every five years.
- ✦ All fire hose must be pressure tested annually. While many departments hire contractors to do this labor-intensive process, Montpelier firefighters do it themselves, and keep detailed computerized records of all results.

Station Maintenance



We take great pride in the upkeep of our 1924 firehouse:

- ✦ Montpelier firefighters are responsible for all cleaning and upkeep of the building. Cleaning (vacuuming, mopping, etc.) is done daily by crews.
- ✦ Every year, each area of the station is cleaned with great detail as part of a “Spring Cleaning” effort.
- ✦ Montpelier firefighters clear snow and ice from the sidewalks adjacent to the station.
- ✦ Many repairs are taken care of by on-duty staff, from electrical issues to dry-wall repair.
- ✦ Montpelier firefighters create extensive training props that we utilize often in the basement of the firehouse. Many departments buy the sort of props that we routinely fashion on our own with salvaged equipment and building materials.
- ✦ We have an extensive flood plan to ensure that no equipment is lost in case of high water inundating the station.

Emergency Preparedness



In addition to training and maintaining equipment, Montpelier firefighters are hard at work preparing for potential emergencies:

- ✦ Montpelier firefighters walk through and pre-plan commercial buildings in the city to familiarize ourselves with layouts and hazards, advise building owners and managers on ways that they could improve safety, and make ourselves accessible to the general public.
- ✦ Every morning, a Montpelier firefighter reviews river gauges and sends a report on his findings to the city manager, police chief, and fire chief.
- ✦ Every year, Montpelier firefighters check every single one of Montpelier's hydrants to ensure that it's in good working order.

Community Outreach



Montpelier firefighters are involved at so many levels of the community:

- ✦ Our newly-formed EMS Bike Patrol is out during major events (e.g., July 3rd, Corporate Cup) to quickly and safely access patients in high pedestrian-traffic areas.
- ✦ Several Montpelier firefighters are certified CPR instructors and regularly teach classes to the general public at hardly any cost.
- ✦ Montpelier residents and visitors stop into the firehouse all the time, for tours of the station, fire prevention education, or free blood pressure checks.
- ✦ Montpelier residents can check-out the department's chimney cleaning equipment to prevent potential chimney fires. Also, Montpelier fire trucks carry numerous spare smoke and CO detectors so that we can loan them out if a resident is without one.

Community Outreach (cont.)



- ✦ Every year, Montpelier firefighters change the batteries in the smoke and CO detectors of elderly or disabled residents who are unable to do so on their own.
- ✦ Montpelier firefighters are involved in all of Montpelier's schools, helping with fire and clear-the-halls drills, serving as a member of the high school's Emergency Response Committee, and reading at Union once a week. A staffed Montpelier ambulance also is on standby at every Montpelier high school football game.
- ✦ Montpelier firefighters use their tower truck often to help community members, be it installing a new lanyard on the high school's flag pole, putting up banners at the Mountaineer's stadium, or hanging July 3rd bunting on City Hall.
- ✦ If a Montpelier resident locks himself out of his house, Montpelier firefighters use it as a training opportunity and work to gain access at no charge to the resident.

Community Outreach (cont.)



- ✦ Montpelier firefighters are ready and willing to help residents and businesses with water emergencies. Often we respond to pump out flooded basements or vacuum up large quantities of water from frozen sprinkler or heater pipes. Not all fire departments are so willing to help during non-fire emergencies.
- ✦ Every year, Montpelier firefighters orchestrate pet rescues, be them from trees, rivers, or other entanglements. We also carry equipment on our trucks that allows us to administer oxygen to a pet if they're exposed to smoke at a house fire.
- ✦ Montpelier firefighters collect stuffed animals and give them to children who are scared or anxious during fire and ambulance calls.
- ✦ Children from Middlesex donate thousands of candy canes to Montpelier firefighters every December so that we can distribute them at area nursing homes to elderly residents.

Crew Size and Effectiveness



- Cutting staffing at the Montpelier Fire Department not only will significantly effect our ability to save lives and property, it will substantively change the role this department plays in the community.
- We will have less time to train, since less firefighter swill be tasked with keeping up with our increasing call volume and all of our maintenance needs.
- Vehicles, equipment, and the station will not receive as much time and attention as they do now, which will lead to increases in maintenance fees and earlier replacement dates.

Crew Size and Effectiveness



Montpelier firefighters pride themselves on giving the people of Montpelier the best fire and ambulance service available, and also on being an active member of this vibrant community. We want to always be there whenever anyone, resident or visitor, is in need. And we want to do so with well-maintained vehicles and equipment. Cutting our staffing, even by one, will cut our ability to operate as safely and effectively as we do now.