February 2018

# Data Analysis

Frederick County Life at the Top VIRGINIA

## Frederick County Fire Rescue, Virginia

*Prepared by:*

FITCH & ASSOCIATES

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**CONSULTANT REPORT**

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# METHODOLOGY

We collected three years of CAD data. In this report, we primarily focused our analysis on the 2016 calendar year. We focus on responses from Frederick County Fire and Rescue.

We utilized two distinct measures of call volume and workload. First, is the number of requests for service that are defined as either "dispatches" or "calls". Dispatches/calls are the number of times a distinct incident was created involving units from Frederick County Fire and Rescue. Conversely, "responses" are the number of times that an individual unit (or units) responded to a call. Responses will be utilized on all Agency, Station and Unit level analyses, which account for all elements of workload and performance. Calls have been categorized as EMS, Fire, Rescue, Hazard, Fire investigation, and Mutual aid calls respectively. We analyzed outcomes for the requests for EMS services. Transport calls are identified if any responding ambulance has recorded a unit transport time.

We analyzed dispatch and turnout time separately and concluded the separation of dispatch and turnout time was not reliable. Thus, dispatch and turnout time are reported together. In this report, dispatch and turnout time is calculated from the time a request or incident was created by the dispatcher through the time a unit reported enroute. The time it took the dispatcher to answer the phone and create the incident was not captured in the dispatch time. This report mainly analyzes dispatch time, turnout time, travel time, and response time of the first arriving units.

# COMMUNITY RESPONSE HISTORY

In the year of 2016, Frederick County Fire Rescue responded to a total of 10,250 incidents[1], which represented a 2.8% growth from 2015. EMS service requests totaled 8,133, accounting for 79.3% of the total number of incidents. The number of fire related calls were 1,379, which accounted for 13.5% of the dispatched incidents. Rescue and hazmat calls totaled 323, which accounted for 3.2% of the total incidents. A total of 382 incidents were mutual aid requests.

The number of individual unit responses will be more reflective of total workload since 54 percent of the calls resulted in multiple units responding. As summarized in Table 3, all units from the Frederick County Fire Rescue combined made 20,609 responses, and were busy on emergency calls 18,103 hours. On average, each response lasted 52.7 minutes from dispatched to clear.

***Table 1: 2014 – 2016: Number of Incidents Dispatched by Category***

| Call Category | Number of Calls 2014 | 2015 | 2016 |
|---|---|---|---|
| Cardiac and stroke | 1,013 | 1,010 | 1,138 |
| Seizure and unconsciousness | 687 | 673 | 731 |
| Breathing difficulty | 787 | 871 | 729 |
| Overdose and psychiatric | 144 | 125 | 152 |
| MVC | 505 | 578 | 582 |
| Fall and injury | 1,510 | 1,622 | 1,741 |
| Illness and other | 2,791 | 3,043 | 3,060 |
| **EMS Total** | **7,437** | **7,922** | **8,133** |
| Structure fire | 130 | 123 | 113 |
| Outside fire | 142 | 102 | 117 |
| Vehicle fire | 93 | 85 | 84 |
| Alarm | 493 | 437 | 476 |
| Public service | 282 | 354 | 424 |
| Move-up | 51 | 56 | 47 |
| Fire other | 96 | 120 | 118 |
| **Fire Total** | **1,287** | **1,277** | **1,379** |
| **Rescue** | 14 | 11 | 18 |
| **Hazmat** | 327 | 333 | 305 |
| **Fire Investigation** | 39 | 44 | 33 |
| **Mutual aid** | 383 | 380 | 382 |
| **Total** | **9,487** | **9,967** | **10,250** |
| **Calls per Day** | **26.0** | **27.3** | **28.1** |
| **YoY Growth** | **NA** | **5.1%** | **2.8%** |

[1] 296 incidents were in CAD that did not have any Frederick County units assigned and were excluded. Therefore, if these incidents were included, the total call count in 2016 would be 10,546.


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***Table 2: Number of Incidents Dispatched by Category in 2016***

| Call Category | Number of Calls | Calls per Day | Call Percentage |
|---|---|---|---|
| Cardiac and stroke | 1,138 | 3.1 | 11.1% |
| Seizure and unconsciousness | 731 | 2.0 | 7.1% |
| Breathing difficulty | 729 | 2.0 | 7.1% |
| Overdose and psychiatric | 152 | 0.4 | 1.5% |
| MVC | 582 | 1.6 | 5.7% |
| Fall and injury | 1,741 | 4.8 | 17.0% |
| Illness and other | 3,060 | 8.4 | 29.9% |
| **EMS Total** | **8,133** | **22.3** | **79.3%** |
| Structure fire | 113 | 0.3 | 1.1% |
| Outside fire | 117 | 0.3 | 1.1% |
| Vehicle fire | 84 | 0.2 | 0.8% |
| Alarm | 476 | 1.3 | 4.6% |
| Public service | 424 | 1.2 | 4.1% |
| Move-up | 47 | 0.1 | 0.5% |
| Fire other | 118 | 0.3 | 1.2% |
| **Fire Total** | **1,379** | **3.8** | **13.5%** |
| **Rescue** | **18** | **0.0** | **0.2%** |
| **Hazmat** | **305** | **0.8** | **3.0%** |
| **Fire Investigation** | **33** | **0.1** | **0.3%** |
| **Mutual aid** | **382** | **1.0** | **3.7%** |
| **Total** | **10,250** | **28.1** | **100.0%** |


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*Figure 1: Percentage of Total Incidents Dispatched by Program in 2016*

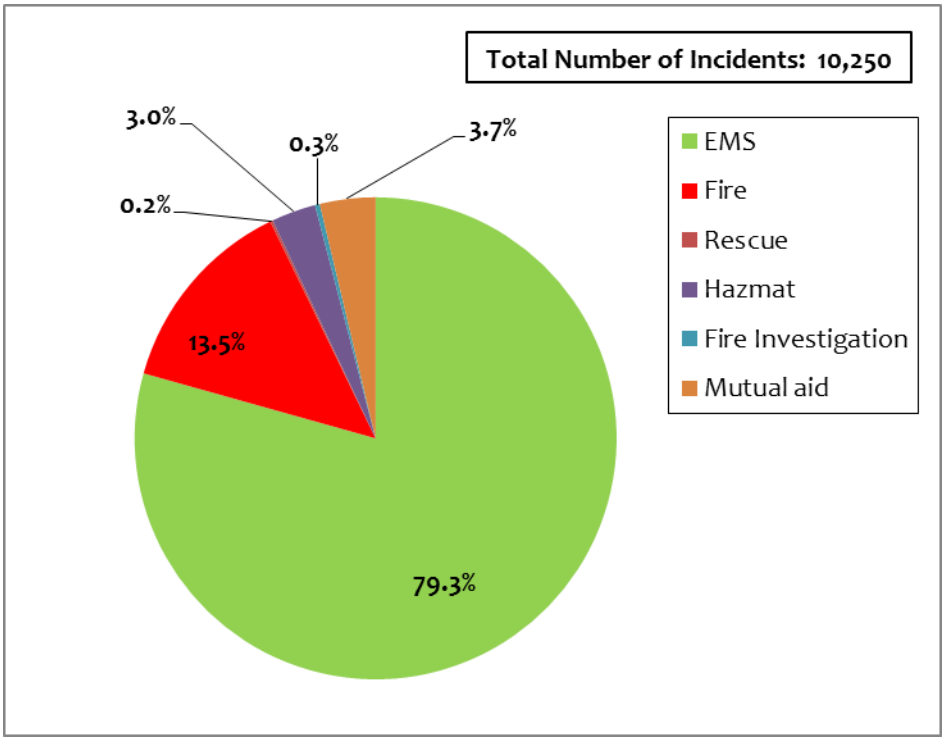


*Table 3: Number of Calls, Number of Responses, and Total Busy Time by Program in 2016*

| Program | Number of Calls | Number of Responses | Average Responses per Call | Total Busy Hours | Average Busy Minutes per Response | Percentage of Total Busy Hours[2] |
|---|---|---|---|---|---|---|
| EMS | 8,133 | 15,408 | 1.9 | 13,971 | 54.4 | 77.2% |
| Fire | 1,379 | 3,488 | 2.5 | 2,703 | 46.5 | 14.9% |
| Rescue | 305 | 804 | 2.6 | 488 | 36.4 | 2.7% |
| Hazmat | 18 | 70 | 3.9 | 40 | 34.1 | 0.2% |
| Fire Investigation | 33 | 43 | 1.3 | 158 | 220.2 | 0.9% |
| Mutual aid | 382 | 796 | 2.1 | 744 | 56.0 | 4.1% |
| **Total** | **10,250** | **20,609** | **2.0** | **18,103** | **52.7** | **100.0%** |

[2] Hours are for apparatus or unit hours and not specifically personnel hours. The total personnel hourly commitment would be calculated as the product of the total busy hours and the number of personnel assigned to each unit.


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***Table 4: Mutual Aid Workload by Unit***

| Station | Unit | Unit Type | Avg. Busy Minutes per Response | Annual Busy Hours | Annual Total Responses |
|---|---|---|---|---|---|
| Clear Brook | E13 | Engine | 44.1 | 23.5 | 32 |
| | W13 | Wagon | 37.2 | 12.4 | 20 |
| | T13 | Tanker | 69.8 | 15.1 | 13 |
| | A132 | Medic Unit | 25.2 | 1.7 | 4 |
| | B13 | Brush | 32.0 | 1.6 | 3 |
| | **Clear Brook Total** | | **45.3** | **54.3** | **72** |
| Gainesboro | CH16 | Chief Officer | 77.5 | 41.3 | 32 |
| | T16 | Tanker | 63.7 | 30.8 | 29 |
| | ALS1 | ALS Chase Unit | 102.7 | 24.0 | 14 |
| | TW16 | Aerial | 108.7 | 25.4 | 14 |
| | AT16 | Attack | 140.9 | 21.1 | 9 |
| | B16 | Brush | 59.8 | 8.0 | 8 |
| | W16 | Wagon | 106.5 | 10.6 | 6 |
| | MO16 | Mobile | 155.3 | 12.9 | 5 |
| | E16 | Engine | 98.5 | 8.2 | 5 |
| | A162 | Medic Unit | 153.4 | 5.1 | 2 |
| | **Gainesboro Total** | | **90.7** | **187.5** | **124** |
| Gore | E14 | Engine | 75.9 | 12.7 | 10 |
| | T14 | Tanker | 69.0 | 9.2 | 8 |
| | AT14 | Attack | 126.5 | 12.6 | 6 |
| | B14 | Brush | 105.0 | 10.5 | 6 |
| | CH14 | Chief Officer | 118.9 | 7.9 | 4 |
| | SV14 | Serve | 136.0 | 4.5 | 2 |
| | A142 | Medic Unit | 12.6 | 0.2 | 1 |
| | W14 | Wagon | 13.0 | 0.2 | 1 |
| | **Gore Total** | | **91.4** | **57.9** | **38** |
| Greenwood | Q18 | Aerial | 41.8 | 23.0 | 33 |
| | ALS2 | ALS Chase Unit | 18.9 | 6.0 | 19 |
| | E18 | Engine | 36.5 | 7.9 | 13 |
| | A183 | Medic Unit | 16.4 | 1.4 | 5 |
| | CH18 | Chief Officer | 43.6 | 1.5 | 2 |
| | A181 | Medic Unit | 75.3 | 1.3 | 1 |
| | **Greenwood Total** | | **33.7** | **41.0** | **73** |
| Middletown | RE12 | Rescue Engine | 21.7 | 23.1 | 64 |
| | A122 | Medic Unit | 26.2 | 8.7 | 20 |
| | ET12 | Engine | 59.7 | 15.9 | 16 |
| | A121 | Medic Unit | 17.7 | 3.8 | 13 |
| | ALS12 | ALS Chase Unit | 35.1 | 5.3 | 9 |


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| Station | Unit | Unit Type | Avg. Busy Minutes per Response | Annual Busy Hours | Annual Total Responses |
|---|---|---|---|---|---|
| | AT12 | Attack | 41.1 | 4.1 | 6 |
| | CH12 | Chief Officer | 8.5 | 0.3 | 2 |
| | MO12 | Mobile | 17.0 | 0.3 | 1 |
| | **Middletown Total** | | **28.2** | **61.6** | **131** |
| Millwood | E21 | Engine | 48.6 | 13.8 | 17 |
| | RE21 | Rescue Engine | 5.4 | 0.8 | 9 |
| | A211 | Medic Unit | 0.6 | 0.0 | 1 |
| | **Millwood Total** | | **32.4** | **14.6** | **27** |
| North Mountain | T19 | Tanker | 61.6 | 4.1 | 4 |
| | B19 | Brush | 69.9 | 3.5 | 3 |
| | CH19 | Chief Officer | 68.5 | 3.4 | 3 |
| | AT19 | Attack | 78.4 | 2.6 | 2 |
| | W19 | Pumper | 174.1 | 5.8 | 2 |
| | A191 | Medic Unit | 47.5 | 0.8 | 1 |
| | **North Mountain Total** | | **81.0** | **20.2** | **15** |
| Public Safety Building | BTL10 | Duty Officer Vehicle | 56.0 | 58.8 | 63 |
| | CH10 | Chief Officer | 3.8 | 0.1 | 2 |
| | FM103 | Fire Marshal | 0.2 | 0.0 | 1 |
| | FM1 | Fire Marshal | 0.1 | 0.0 | 1 |
| | FM102 | Fire Marshal | 60.2 | 1.0 | 1 |
| | TN10 | Chief Officer | 189.6 | 3.2 | 1 |
| | BTX10 | Duty Officer Vehicle | 8.1 | 0.1 | 1 |
| | **Public Safety Building Total** | | **54.2** | **63.3** | **70** |
| Reynolds Store | E20 | Engine | 59.4 | 50.5 | 51 |
| | T20 | Tanker | 70.2 | 45.7 | 39 |
| | AT20 | Attack | 80.4 | 25.4 | 19 |
| | CH20 | Chief Officer | 28.9 | 4.8 | 10 |
| | RE20 | Rescue Engine | 18.7 | 2.5 | 8 |
| | B201 | Brush | 10.0 | 1.2 | 7 |
| | B203 | Brush | 3.5 | 0.2 | 3 |
| | MO20 | Mobile | 49.1 | 2.5 | 3 |
| | B202 | Brush | 146.7 | 4.9 | 2 |
| | A201 | Medic Unit | 7.2 | 0.2 | 2 |
| | A202 | Medic Unit | 28.4 | 0.5 | 1 |
| | **Reynolds Store Total** | | **57.2** | **138.3** | **145** |
| Round Hill | E15 | Engine | 27.6 | 17.9 | 39 |
| | RE15 | Rescue Engine | 42.8 | 5.0 | 7 |
| | CH15 | Chief Officer | 34.5 | 2.3 | 4 |
| | A151 | Medic Unit | 2.1 | 0.1 | 2 |


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| Station | Unit | Unit Type | Avg. Busy Minutes per Response | Annual Busy Hours | Annual Total Responses |
|---|---|---|---|---|---|
| | A152 | Medic Unit | 19.0 | 0.6 | 2 |
| | **Round Hill Total** | | **28.8** | **25.9** | **54** |
| Star Tannery | A171 | Medic Unit | 62.8 | 8.4 | 8 |
| | B17 | Brush | 82.9 | 9.7 | 7 |
| | W17 | Pumper | 85.1 | 9.9 | 7 |
| | T17 | Tanker | 87.7 | 7.3 | 5 |
| | E17 | Engine | 33.0 | 2.8 | 5 |
| | **Star Tannery Total** | | **71.3** | **38.0** | **32** |
| Stephens City | W11 | Engine | 72.8 | 7.3 | 6 |
| Stephens City | TW11 | Aerial | 49.9 | 1.7 | 2 |
| Stephens City | BT11 | Boat | 619.9 | 10.3 | 1 |
| Stephens City | BT112 | Boat | 603.3 | 10.1 | 1 |
| Stephens City | TRS11 | Tech Rescue | 593.1 | 9.9 | 1 |
| Stephens City | E11 | Engine | 2.0 | 0.0 | 1 |
| Stephens City | CH11 | Chief Officer | 33.2 | 0.6 | 1 |
| Stephens City | A111 | Medic Unit | 71.8 | 1.2 | 1 |
| Stephens City | A112 | Medic Unit | 0.1 | 0.0 | 1 |
| Stephens City | **Stephens City Total** | | **164.0** | **41.0** | **15** |
| **Frederick County Total** | | | **56.0** | **743.5** | **796** |


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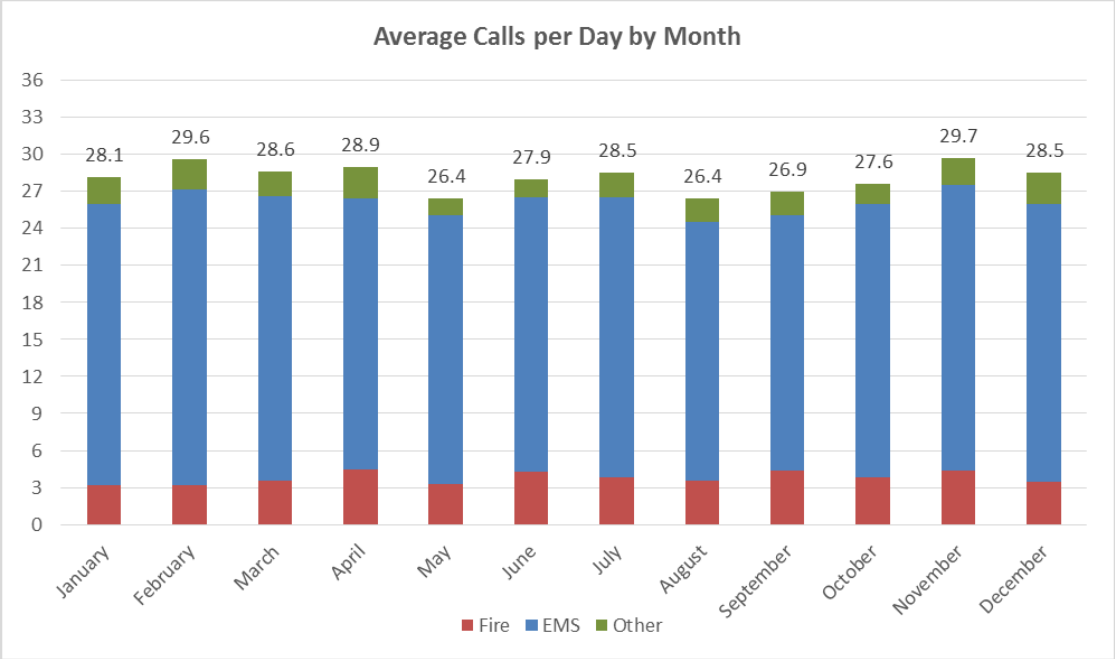
Temporal analyses were conducted to evaluate patterns in community demands. These measures examined the frequency of requests for service by month, day of week, and hour of day. In the following temporal analysis, rescue, hazmat, fire investigation and mutual aid calls were grouped into the other category for presentation purpose.

Overall, average requests per month ranged from a low of 26.4 per day in May to a high of 29.7 per day in November. The top three months with the most demands in the descending order are: November (29.7 per day), February (29.6 per day) and April (28.9 per day).

***Figure 2: Overall: Average Calls per Day by Month***




Similar analyses were conducted for requests by day of week. The data revealed that there is little variability in the demand for services by day of week. Wednesday was the lowest for the week at 26.7 calls per day. Monday has the highest frequency of requests for services at 29.2 calls per day.


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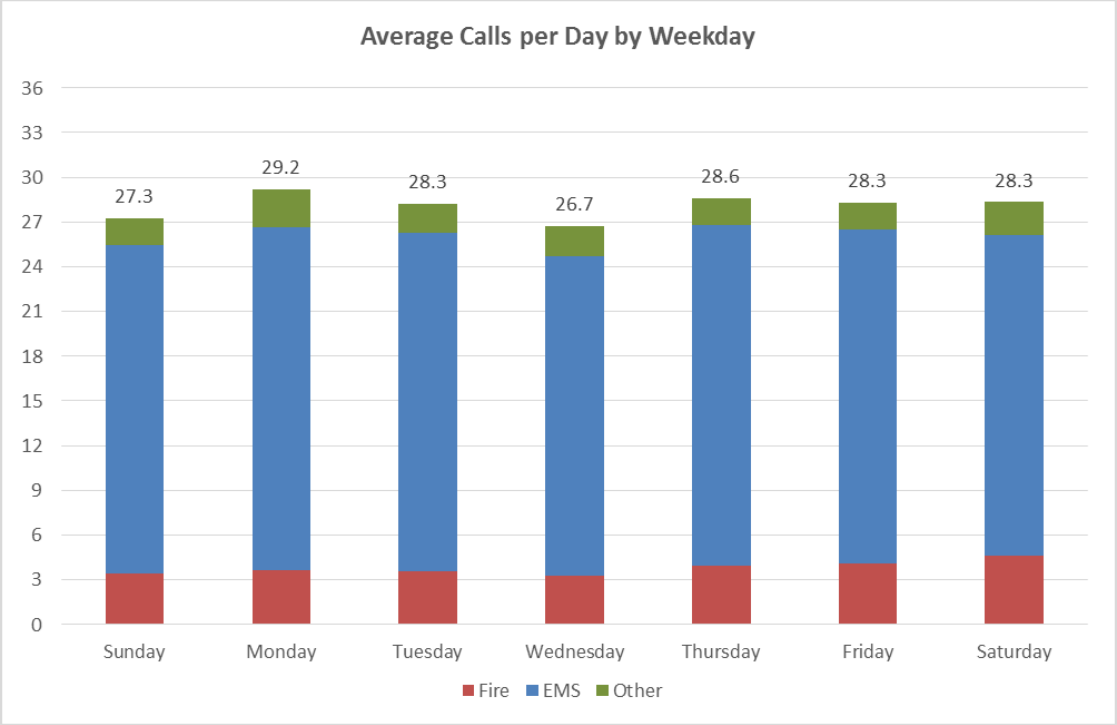
***Figure 3: Overall: Average Calls per Day by Weekday***




Overall demands were evaluated by the hour of the day. Considerable variability exists in the time of day that requests for emergency services are received. The average number of calls per hour is 427 or 1.2 per hour. The data illustrates that the busiest times of the day are between 1000 and 1700. The hour with the peak demand is at 1000.

To provide a more granular understanding of the community's demand for emergency services, this temporal analysis included the average number of calls per hour. In other words, when referring to the figure below, the busiest hour is at 1000 with 621 calls during that hour. The average number of calls per hour is a daily average for those 621 calls if they were equally distributed. Therefore, the busiest hour per day would be at 1000 with an average hourly call volume at 1.70 calls per day. The second busiest hour is at 1700 with 616 calls during the hour, and averaged 1.69 calls per hour.


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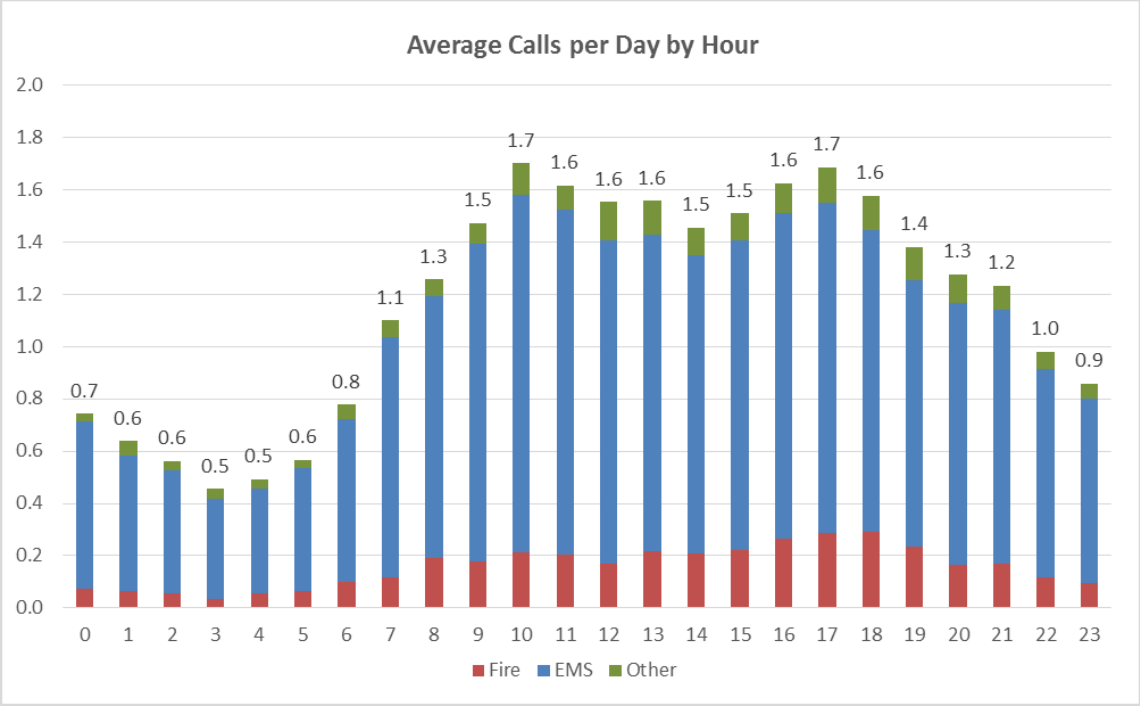
***Figure 4: Overall: Average Calls per Day by Hour***




Overall, all units made 20,609 unit responses, and the total busy hours were 18,103 hours. On average, a Frederick County Fire Rescue unit spent 52.7 minutes from dispatch to clear. Units in the Greenwood station was dispatched most, totaling 4,453 runs a year, averaging 12.2 unit responses, and 11.3 hours a day.

***Table 5: Overall Workload by Station***

| Station | Number of Calls | Annual Total Responses | Annual Busy Hours | Average Responses per Call | Avg. Busy Minutes per Response | Busy Hours per Day | Unit Responses per Day |
|---|---|---|---|---|---|---|---|
| Clear Brook | 1,123 | 1,316 | 1,235 | 1.2 | 56.3 | 3.4 | 3.6 |
| Gainesboro | 1,334 | 1,390 | 1,250 | 1.0 | 54.0 | 3.4 | 3.8 |
| Gore | 400 | 580 | 579 | 1.5 | 59.9 | 1.6 | 1.6 |
| Greenwood | 2,498 | 2,560 | 2,351 | 1.0 | 55.1 | 6.4 | 7.0 |
| Middletown | 1,184 | 1,673 | 1,608 | 1.4 | 57.7 | 4.4 | 4.6 |
| Millwood | 1,893 | 2,172 | 1,579 | 1.1 | 43.6 | 4.3 | 6.0 |
| North Mountain | 465 | 754 | 638 | 1.6 | 50.7 | 1.7 | 2.1 |
| Public Safety Building | 1,512 | 1,649 | 1,104 | 1.1 | 40.2 | 3.0 | 4.5 |
| Reynolds Store | 393 | 552 | 546 | 1.4 | 59.4 | 1.5 | 1.5 |
| Round Hill | 1,822 | 2,273 | 1,806 | 1.2 | 47.7 | 4.9 | 6.2 |
| Star Tannery | 219 | 249 | 334 | 1.1 | 80.5 | 0.9 | 0.7 |
| Stephens City | 2,207 | 2,674 | 2,466 | 1.2 | 55.3 | 6.8 | 7.3 |
| **Total** | **10,250** | **17,842** | **15,495** | **1.7** | **52.1** | **42.5** | **48.9** |

***Table 6: Overall Workload by Unit***

| Station | Unit | Unit Type | Avg. Busy Minutes per Response | Annual Busy Hours | Annual Total Responses |
|---|---|---|---|---|---|
| Clear Brook | A132 | Medic Unit | 65.0 | 527.3 | 487 |
| | A131 | Medic Unit | 66.8 | 387.5 | 348 |
| | E13 | Engine | 33.7 | 123.5 | 220 |
| | W13 | Wagon | 38.5 | 76.5 | 119 |
| | B13 | Brush | 39.7 | 44.4 | 67 |
| | T13 | Tanker | 54.3 | 57.0 | 63 |
| | CH13 | Chief Officer | 89.2 | 13.4 | 9 |
| | MO13 | Mobile | 139.3 | 4.6 | 2 |
| | SV13 | Serve | 46.6 | 0.8 | 1 |
| | **Clear Brook Total** | | **56.3** | **1,234.9** | **1,316** |
| Gainesboro | ALS1 | ALS Chase Unit | 58.1 | 846.1 | 874 |
| | CH16 | Chief Officer | 40.5 | 227.2 | 337 |
| | A162 | Medic Unit | 66.5 | 344.8 | 311 |
| | A161 | Medic Unit | 59.1 | 232.3 | 236 |
| | W16 | Wagon | 37.8 | 90.1 | 143 |
| | E16 | Engine | 44.9 | 66.5 | 89 |
| | T16 | Tanker | 53.8 | 69.0 | 77 |
| | MO16 | Mobile | 71.7 | 82.5 | 69 |
| | AT16 | Attack | 54.2 | 55.1 | 61 |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| Station | Unit | Unit Type | Avg. Busy Minutes per Response | Annual Busy Hours | Annual Total Responses |
|---|---|---|---|---|---|
| | TW16 | Aerial | 59.8 | 37.8 | 38 |
| | ALS16 | ALS Chase Unit | 106.7 | 26.7 | 15 |
| | B16 | Brush | 82.6 | 17.9 | 13 |
| | BT16 | Boat | 2.5 | 0.0 | 1 |
| | **Gainesboro Total** | | **55.5** | **2,096.0** | **2,264** |
| Gore | A142 | Medic Unit | 70.4 | 195.9 | 167 |
| | A141 | Medic Unit | 69.6 | 141.6 | 122 |
| | E14 | Engine | 43.8 | 62.8 | 86 |
| | SV14 | Serve | 35.4 | 50.7 | 86 |
| | AT14 | Attack | 66.5 | 45.4 | 41 |
| | CH14 | Chief Officer | 65.3 | 33.7 | 31 |
| | T14 | Tanker | 61.2 | 27.6 | 27 |
| | B14 | Brush | 84.8 | 17.0 | 12 |
| | W14 | Wagon | 29.1 | 2.9 | 6 |
| | MO14 | Mobile | 40.0 | 1.3 | 2 |
| | **Gore Total** | | **59.9** | **578.9** | **580** |
| Greenwood | ALS2 | ALS Chase Unit | 55.8 | 1,761.9 | 1,893 |
| | A183 | Medic Unit | 65.0 | 1,132.8 | 1,046 |
| | A181 | Medic Unit | 60.3 | 764.2 | 760 |
| | E18 | Engine | 31.6 | 145.2 | 276 |
| | Q18 | Aerial | 26.9 | 103.9 | 232 |
| | CH18 | Chief Officer | 22.5 | 62.5 | 167 |
| | A184 | Medic Unit | 132.3 | 130.1 | 59 |
| | B18 | Brush | 41.2 | 10.3 | 15 |
| | SV18 | Serve | 36.5 | 1.8 | 3 |
| | MO18 | Mobile | 8.3 | 0.3 | 2 |
| | **Greenwood Total** | | **55.4** | **4,112.9** | **4,453** |
| Middletown | A121 | Medic Unit | 66.2 | 453.3 | 411 |
| | A122 | Medic Unit | 68.9 | 434.9 | 379 |
| | ALS12 | ALS Chase Unit | 63.1 | 317.4 | 302 |
| | RE12 | Rescue Engine | 30.2 | 146.6 | 291 |
| | ET12 | Engine | 36.6 | 60.4 | 99 |
| | CH12 | Chief Officer | 58.7 | 78.3 | 80 |
| | AT12 | Attack | 44.0 | 38.9 | 53 |
| | MO12 | Mobile | 47.6 | 41.2 | 52 |
| | ATV12 | ATV | 363.7 | 36.4 | 6 |
| | **Middletown Total** | | **57.7** | **1,607.5** | **1,673** |
| Millwood Station | A211 | Medic Unit | 57.9 | 764.2 | 792 |
| | RE21 | Rescue Engine | 26.5 | 206.5 | 467 |
| | E21 | Engine | 27.0 | 207.4 | 460 |

| Station | Unit | Unit Type | Avg. Busy Minutes per Response | Annual Busy Hours | Annual Total Responses |
|---|---|---|---|---|---|
| | A212 | Medic Unit | 56.3 | 314.4 | 335 |
| | A101 | Medic Unit | 48.7 | 62.5 | 77 |
| | SV21 | Serve | 34.7 | 22.6 | 39 |
| | CH21 | Chief Officer | 42.2 | 1.4 | 2 |
| | **Millwood Station Total** | | **43.6** | **1,578.9** | **2,172** |
| North Mountain | A192 | Medic Unit | 62.8 | 174.9 | 167 |
| | A191 | Medic Unit | 69.4 | 173.4 | 150 |
| | CH19 | Chief Officer | 40.5 | 91.7 | 136 |
| | W19 | Pumper | 41.9 | 59.3 | 85 |
| | SV19 | Serve | 26.5 | 37.1 | 84 |
| | AT19 | Attack | 33.4 | 36.7 | 66 |
| | T19 | Tanker | 54.9 | 43.9 | 48 |
| | B19 | Brush | 72.3 | 20.5 | 17 |
| | E19 | Engine | 0.1 | 0.0 | 1 |
| | **North Mountain Total** | | **50.7** | **637.6** | **754** |
| Public Safety Building | BTL10 | Duty Officer Vehicle | 32.0 | 743.2 | 1,394 |
| | FM102 | Fire Marshal | 68.6 | 61.7 | 54 |
| | FM1 | Fire Marshal | 82.4 | 70.0 | 51 |
| | FM2 | Fire Marshal | 152.7 | 119.6 | 47 |
| | CH10 | Chief Officer | 34.1 | 17.6 | 31 |
| | OPS1 | Chief Officer | 26.4 | 11.0 | 25 |
| | FM103 | Fire Marshal | 176.5 | 50.0 | 17 |
| | BTX10 | Duty Officer Vehicle | 27.6 | 4.6 | 10 |
| | TN102 | Support Vehicle | 20.6 | 1.7 | 5 |
| | HZM10 | HazMat Truck | 144.6 | 7.2 | 3 |
| | TN10 | Chief Officer | 84.5 | 4.2 | 3 |
| | E10 | Engine | 21.5 | 1.1 | 3 |
| | EM10 | Support Vehicle | 178.2 | 8.9 | 3 |
| | FM106 | Fire Marshal | 88.8 | 3.0 | 2 |
| | TN101 | Support Vehicle | 8.5 | 0.1 | 1 |
| | **Public Safety Building Total** | | **40.2** | **1,104.0** | **1,649** |
| Reynolds Store | A202 | Medic Unit | 80.1 | 215.1 | 161 |
| | E20 | Engine | 49.8 | 102.2 | 123 |
| | T20 | Tanker | 62.6 | 55.3 | 53 |
| | A201 | Medic Unit | 71.7 | 60.9 | 51 |
| | AT20 | Attack | 50.4 | 38.7 | 46 |
| | MO20 | Mobile | 40.8 | 26.5 | 39 |
| | RE20 | Rescue Engine | 31.3 | 16.2 | 31 |
| | CH20 | Chief Officer | 40.4 | 20.2 | 30 |
| | B201 | Brush | 18.4 | 3.4 | 11 |

| Station | Unit | Unit Type | Avg. Busy Minutes per Response | Annual Busy Hours | Annual Total Responses |
|---|---|---|---|---|---|
| | B202 | Brush | 114.2 | 7.6 | 4 |
| | B203 | Brush | 3.5 | 0.2 | 3 |
| | **Reynolds Store Total** | | **59.4** | **546.2** | **552** |
| Round Hill | A152 | Medic Unit | 60.9 | 988.4 | 974 |
| | RE15 | Rescue Engine | 30.9 | 182.1 | 354 |
| | A151 | Medic Unit | 60.9 | 345.2 | 340 |
| | E15 | Engine | 26.0 | 107.2 | 247 |
| | SV15 | Serve | 29.1 | 84.7 | 175 |
| | CH15 | Chief Officer | 33.4 | 58.4 | 105 |
| | B15 | Brush | 30.9 | 39.6 | 77 |
| | AT15 | Attack | 1.2 | 0.0 | 1 |
| | **Round Hill Total** | | **47.7** | **1,805.6** | **2,273** |
| Star Tannery | A171 | Medic Unit | 94.2 | 260.7 | 166 |
| | B17 | Brush | 52.7 | 24.6 | 28 |
| | W17 | Pumper | 50.8 | 16.9 | 20 |
| | T17 | Tanker | 64.4 | 21.5 | 20 |
| | E17 | Engine | 46.9 | 9.4 | 12 |
| | SV17 | Serve | 16.3 | 0.8 | 3 |
| | **Star Tannery Total** | | **80.5** | **333.9** | **249** |
| Stephens City | A113 | Medic Unit | 61.8 | 974.8 | 947 |
| | A112 | Medic Unit | 65.3 | 592.3 | 544 |
| | A111 | Medic Unit | 64.1 | 401.4 | 376 |
| | CH11 | Chief Officer | 31.5 | 124.8 | 238 |
| | W11 | Engine | 35.8 | 118.7 | 199 |
| | E11 | Engine | 35.2 | 113.2 | 193 |
| | AT11 | Attack | 28.2 | 27.8 | 59 |
| | MO11 | Mobile | 23.8 | 20.2 | 51 |
| | TW11 | Aerial | 39.4 | 29.5 | 45 |
| | TRS11 | Tech Rescue | 259.2 | 21.6 | 5 |
| | BT11 | Boat | 244.9 | 20.4 | 5 |
| | SV11 | Serve | 12.3 | 0.8 | 4 |
| | ALS11 | Mobile | 54.5 | 2.7 | 3 |
| | BT111 | Boat | 387.8 | 6.5 | 1 |
| | HZM11 | Support Trailer | 26.5 | 0.4 | 1 |
| | BT112 | Boat | 603.3 | 10.1 | 1 |
| | UT11 | Utility | 28.8 | 0.5 | 1 |
| | B11 | Brush | 38.3 | 0.6 | 1 |
| | **Stephens City Total** | | **55.3** | **2,466.2** | **2,674** |
| **Frederick County Total** | | | **52.7** | **18,102.8** | **20,609** |


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This analysis utilized the first arriving units of all distinct incidents. CAD data does not differentiate dispatch and turnout times reliably, so dispatch and turnout time are reported together. The mean (average) dispatch and turnout time was 312 seconds. The mean (average) travel time was 354 seconds (five minutes 54 seconds), and response time was 672 seconds (eleven minutes and 12 seconds). The average response time is the same as the sum of the average dispatch time and turnout and travel time.

However, a more conservative and reliable measure of performance is the fractile or percentile. This measure is more robust, or less influenced by outliers, than measures of central tendency such as the mean. Best practice is to measure at the 90th percentile. In other words, 90% of all performance is captured expecting that 10% of the time the department may experience abnormal conditions that would typically be considered an outlier. For example, if the department were to report an average response time of six minutes, then in a normally distributed set of data, half of the responses would be longer than six minutes and half of the responses would be less than six minutes. The 90th percentile communicates that 9 out of 10 times the department performance is predictable and thus more clearly articulated to policy makers and the community.

The performance for dispatch and turnout time at the 90th percentile was 437 seconds (seven minutes and 17 second), travel time was 623 seconds (ten minutes and 23 seconds), and response time was 16.4 minutes. Please note that the summation of 90th percentile dispatch and turnout time, and 90th percentile travel time is not the same as 90th percentile response time.

***Table 7: Average Dispatch, Turnout and Travel Time of First Arriving Units by Program***

| Program | Dispatch and Turnout Time | Travel Time | Response Time | Sample Size[3] |
|---|---|---|---|---|
| EMS | 5.3 | 5.9 | 11.1 | 7,519 |
| Fire | 4.8 | 6.4 | 11.2 | 1,088 |
| Rescue | 5.4 | 6.0 | 11.4 | 15 |
| Hazmat | 5.5 | 5.9 | 11.3 | 274 |
| **Total** | **5.2** | **5.9** | **11.2** | **8,896** |

[3] The sample size is different from the totals reported in Tables 1 and 2 due to missing data elements such as missing time elements. Therefore, 87% of the total incidents are represented and are statistically robust to make inferences about the total population.


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***Figure 5: Average Turnout and Travel Time by Call Category***

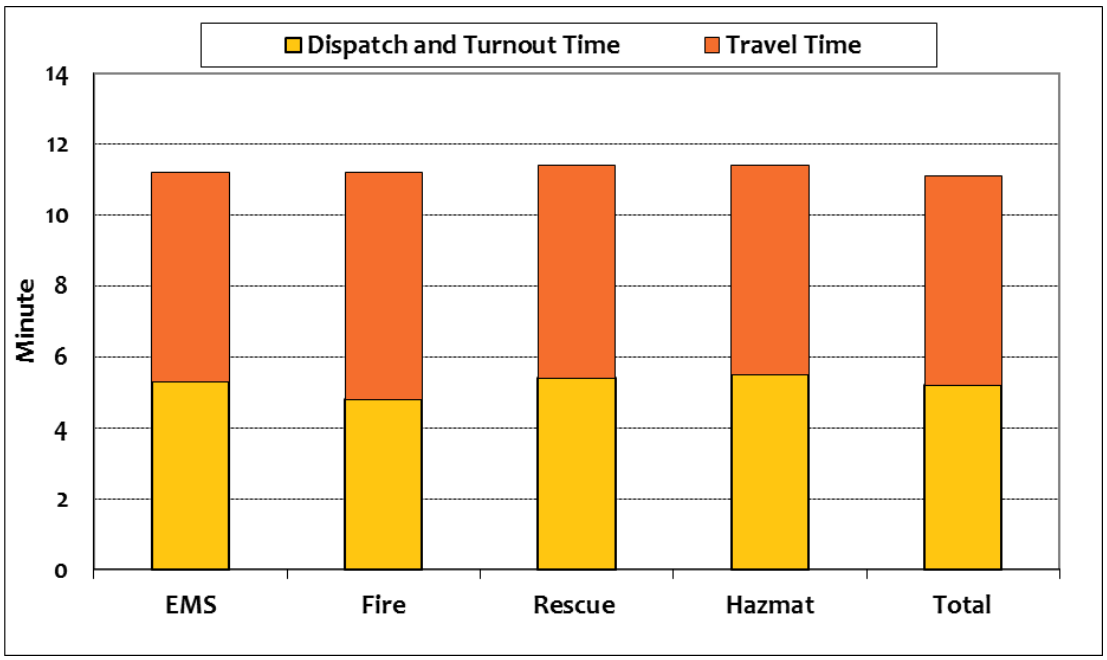

*Table 8: 90th Percentile Turnout and Travel Time of First Arriving Units by Program*

| Program | Dispatch and Turnout Time | Travel Time | Response Time | Sample Size |
|---|---|---|---|---|
| EMS | 7.3 | 10.1 | 16.1 | 7,519 |
| Fire | 7.5 | 11.7 | 17.6 | 1,088 |
| Rescue | 8.6 | 9.6 | 17.6 | 15 |
| Hazmat | 8.0 | 10.7 | 17.1 | 274 |
| **Total** | **7.3** | **10.4** | **16.4** | **8,896** |

The average travel time varied by EMD code from 4.8 minutes for Echo calls to 8.3 minutes for Omega calls. The 90th percentile response times were consistently more than 14 minutes and the aggregate total response time was 16.1 minutes. Echo type of EMS calls has the shortest average and 90th percentile response time.

The distributions of dispatch and turnout time and travel time were also analyzed. A total of 53% of calls had dispatch and turnout time of five minutes or less. A total of 47% of calls had travel time of five minutes or less, and 78% of calls had travel time of eight minutes or less.

*Figure 6: All Calls: Distribution of Dispatch and Turnout Time of First Arriving Unit*

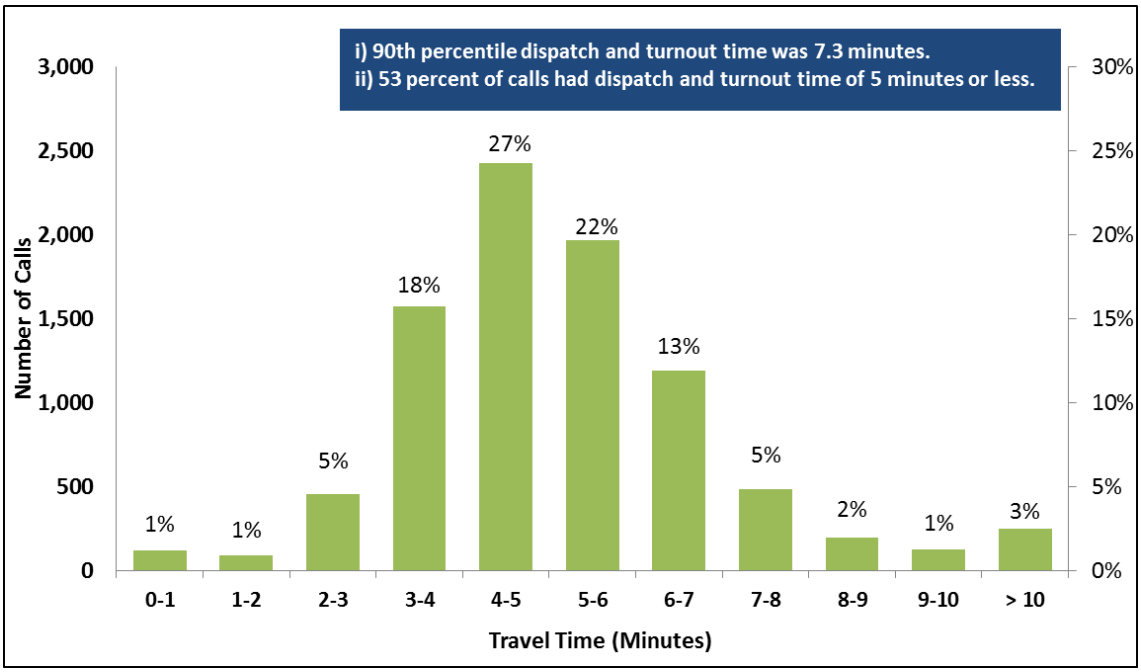



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*Figure 7: All Calls: Distribution of Travel Time of First Arriving Unit*

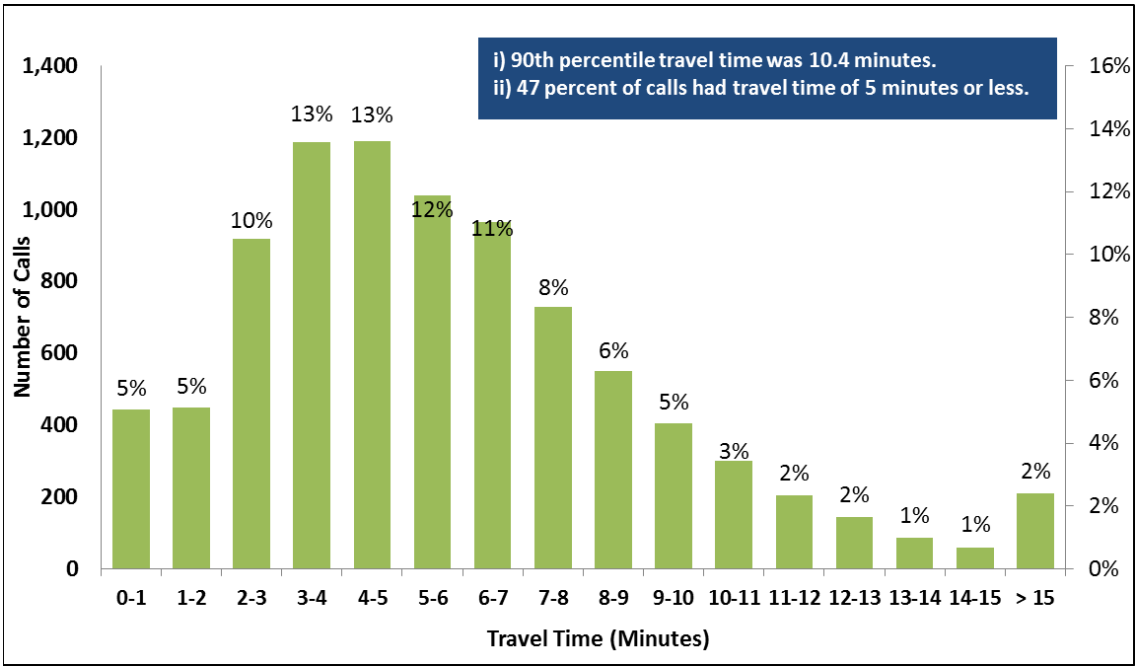


*Table 9: EMS Calls: Average Dispatch, Turnout and Travel Time of First Arriving Units by EMD Code*

| Program | Dispatch and Turnout Time | Travel Time | Response Time | Sample Size |
|---|---|---|---|---|
| Alpha | 5.5 | 6.0 | 11.6 | 1,911 |
| Bravo | 5.5 | 5.7 | 11.2 | 882 |
| Charlie | 5.6 | 6.0 | 11.6 | 1,407 |
| Delta | 5.3 | 5.8 | 11.1 | 1,931 |
| Echo | 4.2 | 4.8 | 9.0 | 109 |
| Omega | 5.5 | 8.3 | 13.8 | 29 |
| Missing | 4.4 | 5.6 | 10.0 | 1,250 |
| **EMS Total** | **5.3** | **5.9** | **11.1** | **7,519** |

*Figure 8: EMS Calls: Average Turnout and Travel Time by EMD Code*

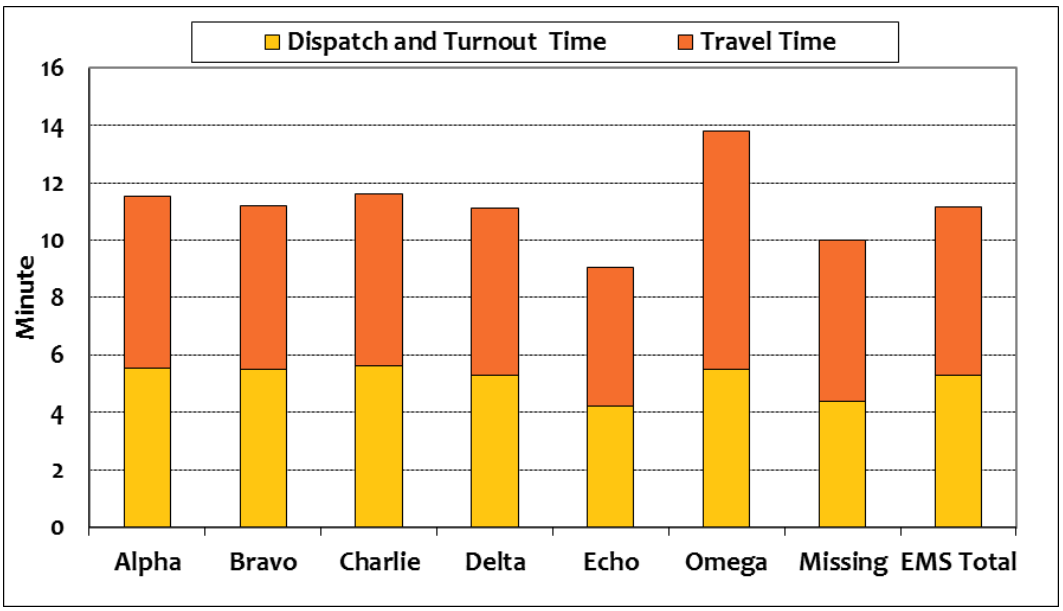


*Table 10: EMS Calls: 90th Percentile Dispatch, Turnout and Travel Time of First Arriving Units by EMD Code*

| Program | Dispatch and Turnout Time | Travel Time | Response Time | Sample Size |
|---|---|---|---|---|
| Alpha | 7.4 | 10.3 | 16.5 | 1,911 |
| Bravo | 7.4 | 9.8 | 15.9 | 882 |
| Charlie | 7.5 | 10.0 | 16.4 | 1,407 |
| Delta | 7.2 | 9.9 | 15.9 | 1,931 |
| Echo | 6.1 | 8.2 | 14.1 | 109 |
| Omega | 7.0 | 12.9 | 18.7 | 29 |
| Missing | 6.8 | 10.6 | 15.6 | 1,250 |
| **EMS Total** | **7.3** | **10.1** | **16.1** | **7,519** |


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## Fire Services

Overall, there are 1,379 total fire incidents, averaging 3.8 per day. Structure, outside and vehicle fires totaled 314. The largest fire category was alarm and public service calls, averaging 1.3 and 1.2 per day.

***Table 11: Number of Fire Incidents Dispatched by Category***

| Call Category | Number of Calls | Calls per Day |
|---|---|---|
| Structure fire | 113 | 0.3 |
| Outside fire | 117 | 0.3 |
| Vehicle fire | 84 | 0.2 |
| Alarm | 476 | 1.3 |
| Public service | 424 | 1.2 |
| Move up | 47 | 0.1 |
| Fire other | 118 | 0.3 |
| **Fire Total** | **1,379** | **3.8** |

Temporal analyses were conducted to evaluate patterns in community demands for fire related services. These measures examined the frequency of requests for service in 2016 by month, day of week, and hour of day. Results found that there was variability by month. The three months with most fire calls in order were: April (4.5 per day), November (4.4 per day) and September (4.3 per day). The three months with least fire calls in order were: January and February (3.2 per day) and May (3.3 per day). Results are presented below.

***Table 12: Total Fire Related Calls per Month***

| Month | Number of Calls | Calls per Day | Call Percentage |
|---|---|---|---|
| January | 99 | 3.2 | 7.2 |
| February | 90 | 3.2 | 6.5 |
| March | 109 | 3.5 | 7.9 |
| April | 134 | 4.5 | 9.7 |
| May | 103 | 3.3 | 7.5 |
| June | 129 | 4.3 | 9.4 |
| July | 120 | 3.9 | 8.7 |
| August | 109 | 3.5 | 7.9 |
| September | 130 | 4.3 | 9.4 |
| October | 118 | 3.8 | 8.6 |
| November | 132 | 4.4 | 9.6 |
| December | 106 | 3.4 | 7.7 |
| **Total** | **1,379** | **3.78** | **100.0** |


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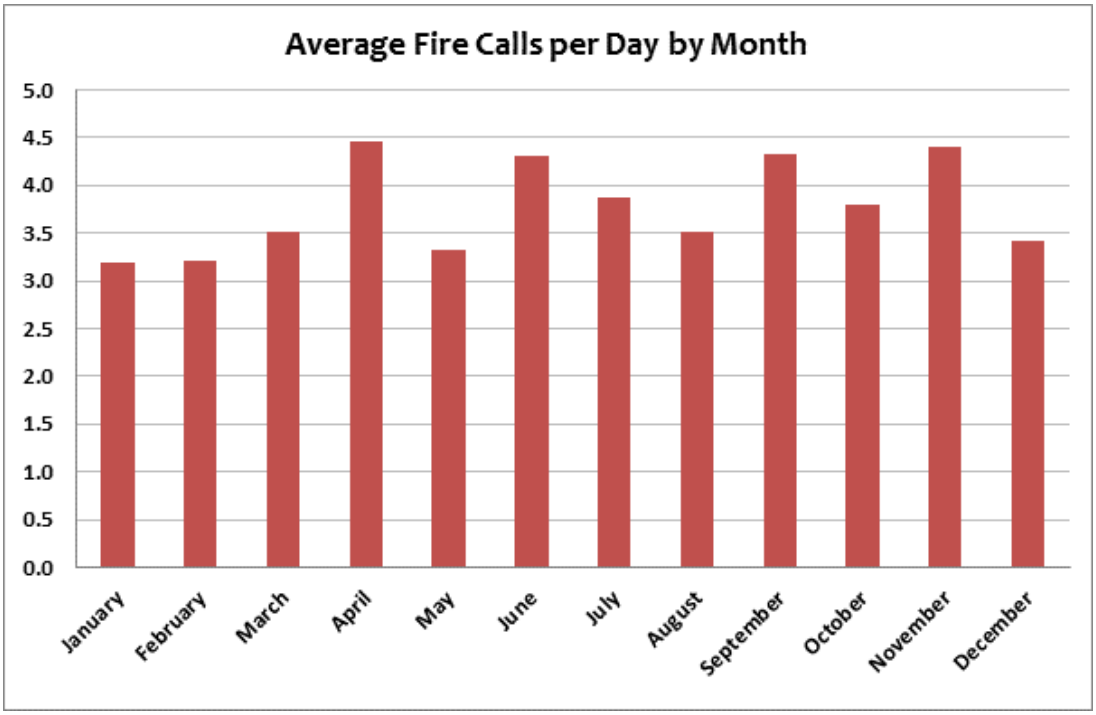
*Figure 9: Average Fire Related Calls per Month*

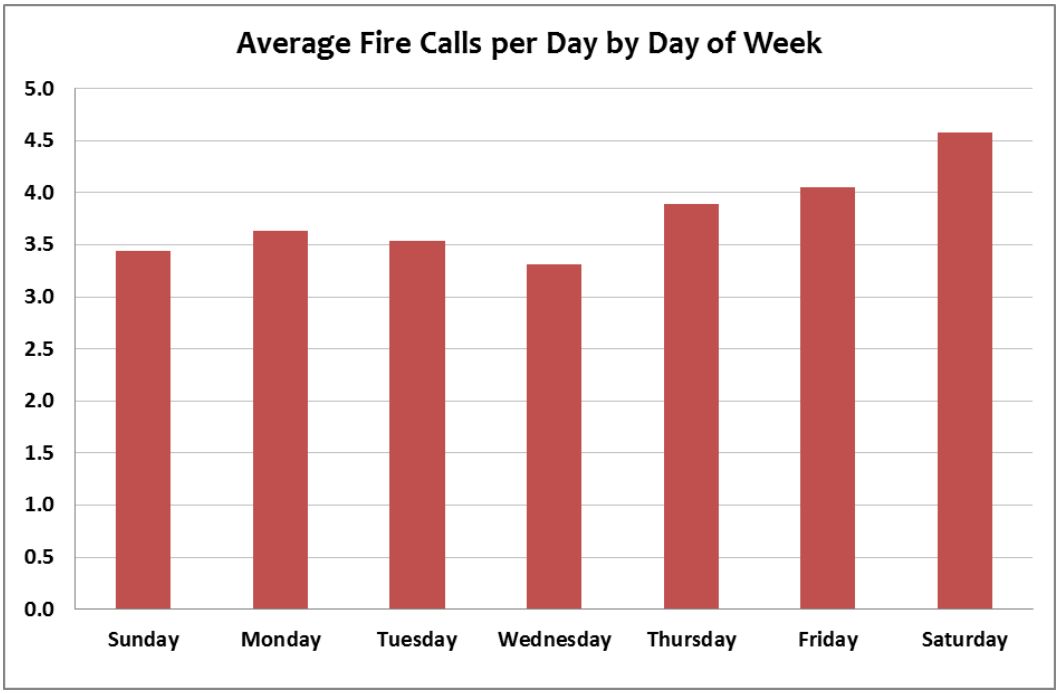



Similar analyses were conducted for fire related calls per day of week. The data revealed that there is some variability in the demand for services by day of week. Wednesday was the lowest for the week, averaging 3.3 per day or 12.5 percent of the fire related calls for the week. Saturday has the highest frequency of requests for fire related services averaging 4.6 calls per day and 17.3%. Results for this analysis are presented below.

*Table 13: Total Fire Related Calls by Day of Week*

| Day of Week | Number of Calls | Calls per Day | Call Percentage |
|---|---|---|---|
| Sunday | 179 | 3.4 | 13.0 |
| Monday | 189 | 3.6 | 13.7 |
| Tuesday | 184 | 3.5 | 13.3 |
| Wednesday | 172 | 3.3 | 12.5 |
| Thursday | 206 | 3.9 | 14.9 |
| Friday | 211 | 4.1 | 15.3 |
| Saturday | 238 | 4.6 | 17.3 |
| **Total** | **1,379** | **3.78** | **100.0** |

*Figure 10: Average Fire Related Calls by Day of Week*



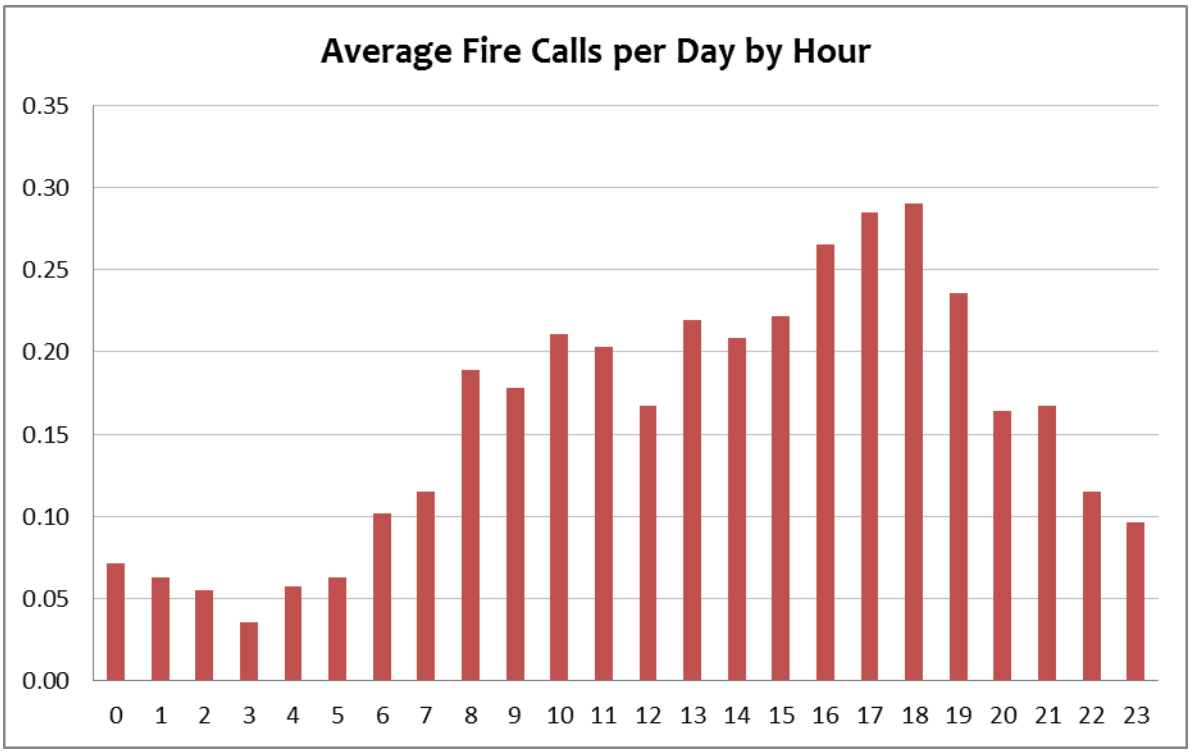

Fire related calls were evaluated by hour of the day. Considerable variability exists in the time of day that requests for fire related services are received. The hours that include 0100 to 0500 have the lowest demands. The middle of the day has the greatest frequency of calls, specifically from 1600 to 1800. The average number of calls per hour in a year is 57. Finally, in an effort to provide a more granular understanding of the community's demand for fire related services, this temporal analysis included the average number of calls per hour. In other words, when referring to the Table below, the busiest hour is at 1800 with 106 calls during that hour in 2016. The average number of calls per hour is a daily average for those 106 calls if they were equally distributed. Therefore, the busiest hour per day would be at 1800 with an average hourly call volume of 0.29 calls per hour.

*Table 14: Total and Average Fire Related Calls by Hour of Day*

| Hour of Day | Number of Calls | Calls per Day | Call Percentage |
|---|---|---|---|
| 0 | 26 | 0.07 | 1.9 |
| 1 | 23 | 0.06 | 1.7 |
| 2 | 20 | 0.05 | 1.5 |
| 3 | 13 | 0.04 | 0.9 |
| 4 | 21 | 0.06 | 1.5 |
| 5 | 23 | 0.06 | 1.7 |
| 6 | 37 | 0.10 | 2.7 |
| 7 | 42 | 0.12 | 3.0 |
| 8 | 69 | 0.19 | 5.0 |
| 9 | 65 | 0.18 | 4.7 |

| Hour of Day | Number of Calls | Calls per Day | Call Percentage |
|---|---|---|---|
| 10 | 77 | 0.21 | 5.6 |
| 11 | 74 | 0.20 | 5.4 |
| 12 | 61 | 0.17 | 4.4 |
| 13 | 80 | 0.22 | 5.8 |
| 14 | 76 | 0.21 | 5.5 |
| 15 | 81 | 0.22 | 5.9 |
| 16 | 97 | 0.27 | 7.0 |
| 17 | 104 | 0.28 | 7.5 |
| 18 | 106 | 0.29 | 7.7 |
| 19 | 86 | 0.24 | 6.2 |
| 20 | 60 | 0.16 | 4.4 |
| 21 | 61 | 0.17 | 4.4 |
| 22 | 42 | 0.12 | 3.0 |
| 23 | 35 | 0.10 | 2.5 |
| **Total** | **1,379** | **3.78** | **100.0** |

***Figure 11: Average Fire Related Calls per Day by Hour of Day***




Frederick Fire and Rescue units made a total of 3,488 responses to fire related calls. The total time on task was 2,703 hours, and the average time on task was 46.5 minutes.

***Table 15: Workload by Station for Fire Calls***

| Station | Avg. Busy Minutes per Response | Annual Busy Hours | Annual Total Responses | Busy Hours per Day | Unit Responses per Day |
|---|---|---|---|---|---|
| Clear Brook | 43.6 | 204 | 281 | 0.6 | 0.8 |
| Gainesboro | 63.6 | 427 | 403 | 1.2 | 1.1 |
| Gore | 55.9 | 116 | 124 | 0.3 | 0.3 |
| Greenwood | 41.5 | 357 | 516 | 1.0 | 1.4 |
| Middletown | 68.3 | 297 | 261 | 0.8 | 0.7 |
| Millwood Station | 28.1 | 183 | 391 | 0.5 | 1.1 |
| North Mountain | 42.0 | 132 | 189 | 0.4 | 0.5 |
| Public Safety Building | 48.6 | 367 | 453 | 1.0 | 1.2 |
| Reynolds Store | 48.3 | 77 | 96 | 0.2 | 0.3 |
| Round Hill | 31.1 | 185 | 358 | 0.5 | 1.0 |
| Star Tannery | 50.7 | 34 | 40 | 0.1 | 0.1 |
| Stephens City | 51.7 | 324 | 376 | 0.9 | 1.0 |
| **Total** | **46.5** | **2,703** | **3,488** | **7.4** | **9.6** |

We analyzed number of responding units by call type. Overall, 42% of fire calls were responded by one unit; 23% were responded to by two units; 15% were responded to by three units, and 19% were responded to by four or more units. However, for structure fire calls, five or more units responded to 85% of calls. Ten or more units responded to a total of 24% of the structure fires.

***Table 16: Number of Responding Units by Fire Call Type***

| Call Category | Number of Frederick Units | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 or more | |
| Structure fire | 2 | 3 | 6 | 7 | 16 | 13 | 66 | 113 |
| Outside fire | 19 | 21 | 29 | 14 | 11 | 10 | 13 | 117 |
| Vehicle fire | 15 | 22 | 15 | 21 | 7 | 2 | 2 | 84 |
| Alarm | 161 | 142 | 109 | 54 | 8 | 2 | 0 | 476 |
| Public service | 288 | 88 | 34 | 4 | 5 | 3 | 2 | 424 |
| Move-up | 33 | 12 | 2 | 0 | 0 | 0 | 0 | 47 |
| Fire other | 67 | 30 | 14 | 3 | 3 | 1 | 0 | 118 |
| **Total** | **585** | **318** | **209** | **103** | **50** | **31** | **83** | **1,379** |
| **Percentage** | **42.4%** | **23.1%** | **15.2%** | **7.5%** | **3.6%** | **2.2%** | **6.0%** | **100.0%** |


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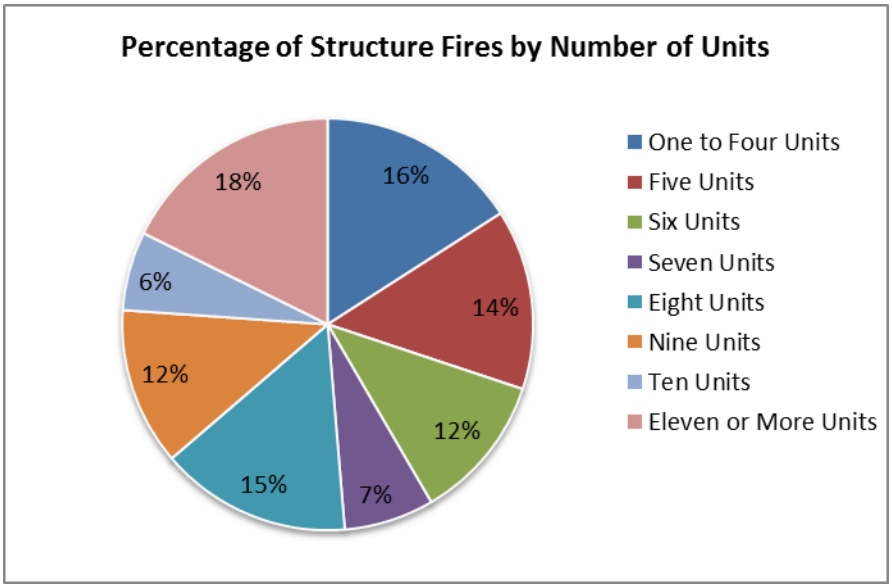
**Figure 12: Percentage of Structure Fire Calls by Number of Responding Units**




## Emergency Medical Services

Frederick Fire Rescue provides patient transport services. Requests for EMS are categorized as granular call categories using the CAD call description. On average, there were 22.3 EMS requests, and Cardiac and Stroke requests totaled 1,138 or 3.1 per day.

***Table 17: Number of EMS Incidents Dispatched by Category***

| Call Category | Number of Calls | Calls per Day |
|---|---|---|
| Cardiac and stroke | 1,138 | 3.1 |
| Seizure and unconsciousness | 731 | 2.0 |
| Breathing difficulty | 729 | 2.0 |
| Overdose and psychiatric | 152 | 0.4 |
| MVC | 582 | 1.6 |
| Fall and injury | 1,741 | 4.8 |
| Illness and other | 3,060 | 8.4 |
| **EMS Total** | **8,133** | **22.3** |

Temporal analyses were completed to describe the community's demands for emergency medical services. These analyses were completed by month of year, day of week, and hour of day. February had the most EMS demand, averaging 23.9 per day. September had the lowest EMS demand, averaging 20.7 per day.


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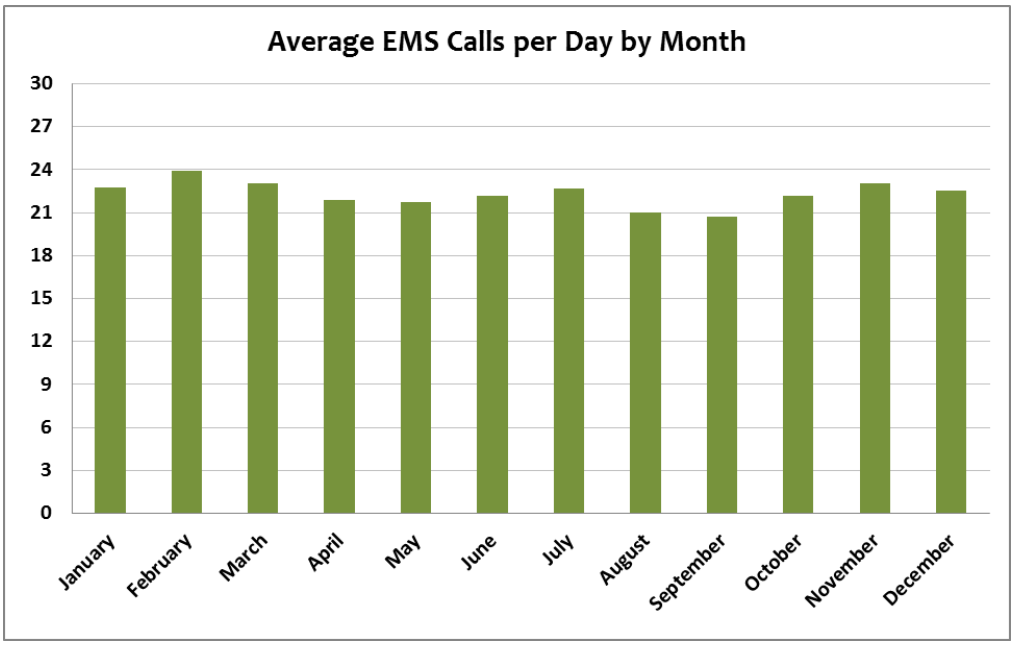
*Table 18: Annual Total and Average per Day of EMS Calls by Month of Year*

| Month | Number of Calls | Calls per Day | Call Percentage |
|---|---|---|---|
| January | 705 | 22.7 | 8.7 |
| February | 670 | 23.9 | 8.2 |
| March | 714 | 23.0 | 8.8 |
| April | 657 | 21.9 | 8.1 |
| May | 673 | 21.7 | 8.3 |
| June | 665 | 22.2 | 8.2 |
| July | 702 | 22.6 | 8.6 |
| August | 650 | 21.0 | 8.0 |
| September | 621 | 20.7 | 7.6 |
| October | 686 | 22.1 | 8.4 |
| November | 692 | 23.1 | 8.5 |
| December | 698 | 22.5 | 8.6 |
| **Total** | **8,133** | **22.3** | **100.0** |

*Figure 13: Average EMS Calls per Day by Month of Year*

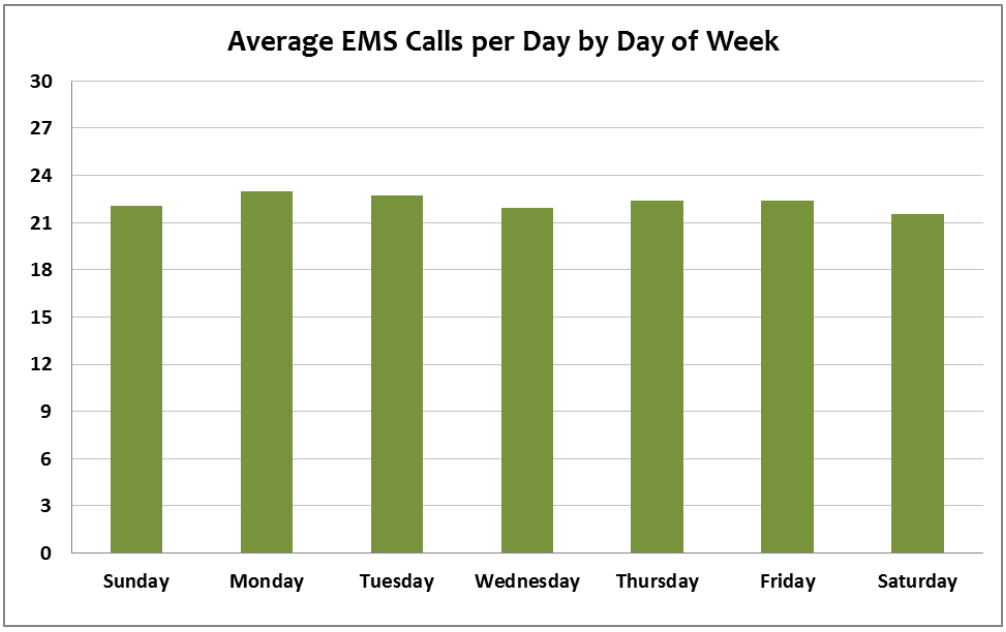



Similar analyses were conducted examining the frequency of requests for service by the day of the week. Once again, there is variability in the demand for services by the day of the week. Monday receives the most requests for service and Saturday the least. Results are provided below.

*Table 19: Annual Total and Average per Day of EMS Calls by Day of Week*

| Day of Week | Number of Calls | Calls per Day | Call Percentage |
|---|---|---|---|
| Sunday | 1,146 | 22.0 | 14.1 |
| Monday | 1,195 | 23.0 | 14.7 |
| Tuesday | 1,182 | 22.7 | 14.5 |
| Wednesday | 1,139 | 21.9 | 14.0 |
| Thursday | 1,186 | 22.4 | 14.6 |
| Friday | 1,166 | 22.4 | 14.3 |
| Saturday | 1,119 | 21.5 | 13.8 |
| **Total** | **8,133** | **22.3** | **100.0** |

*Figure 14: Average EMS Calls per Day by Day of Week*




Finally, the analyses for EMS services are completed by identifying the EMS calls by hour of day and the average hourly rate of EMS calls per hour. The demand curve for requests for EMS service follows an expected pattern experienced in similar communities across the nation. The higher frequency of service calls begins from 0900 to 1800 and each hour had more than 400 calls. The demand peaked at 1000 with 500 calls in a year. Results are provided below.

*Table 20: Annual Total and Average per Day of EMS Calls by Hour of Day*

| Hour of Day | Number of Calls | Calls per Day | Call Percentage |
|---|---|---|---|
| 0 | 234 | 0.64 | 2.9 |
| 1 | 190 | 0.52 | 2.3 |
| 2 | 172 | 0.47 | 2.1 |
| 3 | 139 | 0.38 | 1.7 |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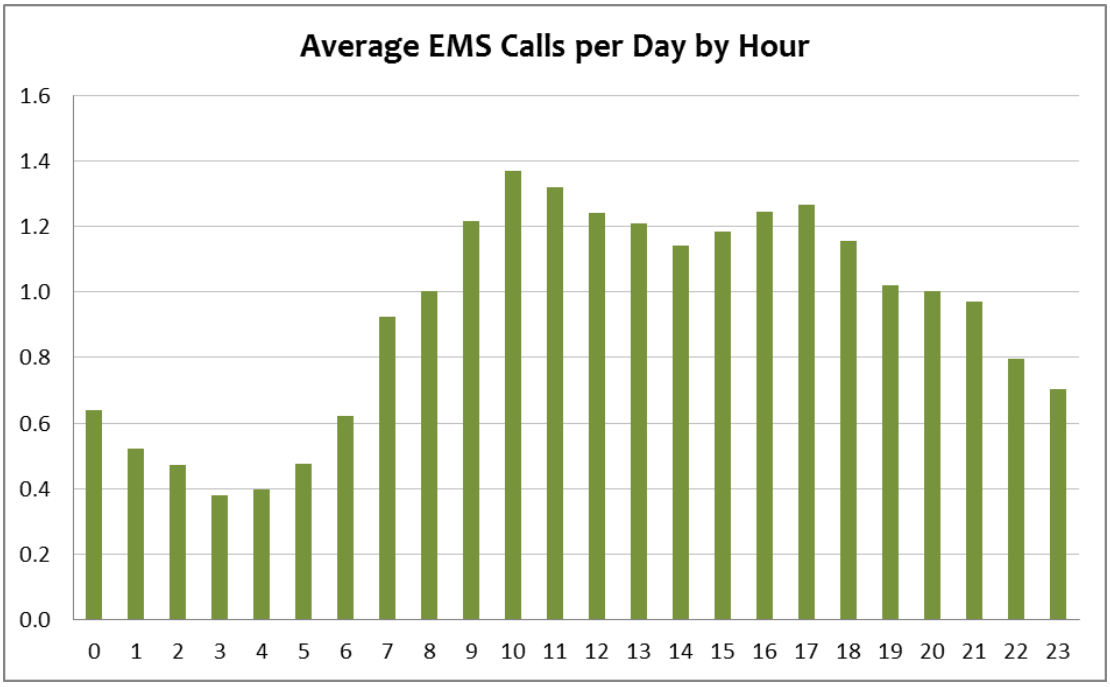
| Hour of Day | Number of Calls | Calls per Day | Call Percentage |
|---|---|---|---|
| 4 | 145 | 0.40 | 1.8 |
| 5 | 173 | 0.47 | 2.1 |
| 6 | 227 | 0.62 | 2.8 |
| 7 | 337 | 0.92 | 4.1 |
| 8 | 366 | 1.00 | 4.5 |
| 9 | 444 | 1.22 | 5.5 |
| 10 | 500 | 1.37 | 6.1 |
| 11 | 482 | 1.32 | 5.9 |
| 12 | 453 | 1.24 | 5.6 |
| 13 | 442 | 1.21 | 5.4 |
| 14 | 417 | 1.14 | 5.1 |
| 15 | 432 | 1.18 | 5.3 |
| 16 | 455 | 1.25 | 5.6 |
| 17 | 462 | 1.27 | 5.7 |
| 18 | 422 | 1.16 | 5.2 |
| 19 | 372 | 1.02 | 4.6 |
| 20 | 366 | 1.00 | 4.5 |
| 21 | 355 | 0.97 | 4.4 |
| 22 | 291 | 0.80 | 3.6 |
| 23 | 257 | 0.70 | 3.2 |
| **Total** | **8,133** | **22.28** | **100.0** |

***Figure 15: Average EMS Calls per Day by Hour of Day***



A total of 53 percent of the EMS incidents had multiple responding units. On average, 1.9 units were dispatched per EMS call. Motor Vehicle Collision (MVC) is the category that had 95% of the incidents with two or more units responding.

Frederick Fire Rescue units made a total of 15,408 responses to EMS calls. The total time on task was 13,971 hours, and the average time on task was 54.4 minutes. Greenwood, Stephens City, and Round Hill were the top three stations in terms of total unit responses.

***Table 21: Workload by Station for EMS Incidents***

| Station | Avg. Busy Minutes per Response | Annual Busy Hours | Annual Total Responses | Busy Hours per Day | Unit Responses per Day |
|---|---|---|---|---|---|
| Clear Brook | 62.0 | 939 | 909 | 2.6 | 2.5 |
| Gainesboro | 46.0 | 657 | 858 | 1.8 | 2.4 |
| Gore | 59.8 | 391 | 392 | 1.1 | 1.1 |
| Greenwood | 58.0 | 1,952 | 2,021 | 5.3 | 5.5 |
| Middletown | 60.5 | 1,213 | 1,203 | 3.3 | 3.3 |
| Millwood Station | 48.3 | 1,306 | 1,622 | 3.6 | 4.4 |
| North Mountain | 54.4 | 462 | 509 | 1.3 | 1.4 |
| Public Safety Building | 27.5 | 441 | 962 | 1.2 | 2.6 |
| Reynolds Store | 65.4 | 312 | 286 | 0.9 | 0.8 |
| Round Hill | 52.5 | 1,561 | 1,784 | 4.3 | 4.9 |
| Star Tannery | 91.7 | 249 | 163 | 0.7 | 0.4 |
| Stephens City | 56.1 | 2,029 | 2,171 | 5.6 | 5.9 |
| **Total** | **53.6** | **11,511** | **12,880** | **31.5** | **35.3** |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### *Transport*

We analyzed outcomes for the requests for EMS services. The number of EMS transports totaled 5,996, averaging 16.4 transports per day. Approximately 74% of EMS calls resulted in a patient transport. Duration of a call is defined as the difference between the earliest dispatch time and the last unit clear time. On average, the duration of a non-transport EMS call was 27.1 minutes. The duration of a transport EMS call was averaged 86.5 minutes, which was one hour or three times longer than a non-transport EMS call.

***Table 22: EMS Transports by Call Category***

| | Non-Transport | | Transport | | |
|---|---|---|---|---|---|
| Call Category | Duration | Number of Calls | Duration | Number of Calls | Transport Rate |
| Cardiac and stroke | 31.7 | 177 | 91.3 | 961 | 84.4% |
| Seizure and unconsciousness | 26.9 | 152 | 91.7 | 579 | 79.2% |
| Breathing difficulty | 22.9 | 75 | 90.7 | 654 | 89.7% |
| Overdose and psychiatric | 24.2 | 46 | 87.7 | 106 | 69.7% |
| MVC | 43.7 | 280 | 98.7 | 302 | 51.9% |
| Fall and injury | 17.9 | 582 | 82.7 | 1,159 | 66.6% |
| Illness and other | 27.4 | 825 | 82.1 | 2,235 | 73.0% |
| **Total** | **27.1** | **2,137** | **86.5** | **5,996** | **73.7%** |

We analyzed variation of total EMS requests and transport requests by the hour of the day and the average hourly rate of requests. The variation of total EMS requests and EMS transport reports followed a similar pattern. The busiest period for EMS and EMS transport requests was between 0900 and 1800. From 0900 to 1300, on average one EMS transport occurred per hour per day. Requests by hour of the day are represented below.

***Figure 16: Average EMS Calls and EMS Transports per Day by Hour of Day***

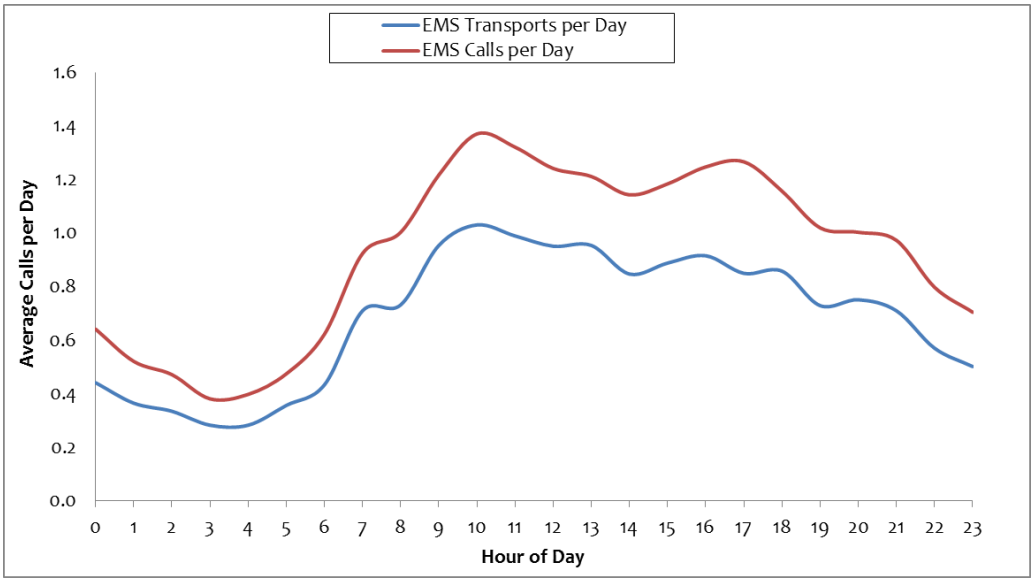



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***Table 23: Total EMS Calls and EMS Transports and Average per Day by Hour of Day***

| Hour | Number of EMS Transports | Number of EMS Calls | EMS Transports per Day | EMS Calls per Day | Transport Rate |
|---|---|---|---|---|---|
| 0 | 161 | 234 | 0.4 | 0.6 | 68.8 |
| 1 | 133 | 190 | 0.4 | 0.5 | 70.0 |
| 2 | 122 | 172 | 0.3 | 0.5 | 70.9 |
| 3 | 103 | 139 | 0.3 | 0.4 | 74.1 |
| 4 | 103 | 145 | 0.3 | 0.4 | 71.0 |
| 5 | 130 | 173 | 0.4 | 0.5 | 75.1 |
| 6 | 158 | 227 | 0.4 | 0.6 | 69.6 |
| 7 | 259 | 337 | 0.7 | 0.9 | 76.9 |
| 8 | 267 | 366 | 0.7 | 1.0 | 73.0 |
| 9 | 348 | 444 | 1.0 | 1.2 | 78.4 |
| 10 | 376 | 500 | 1.0 | 1.4 | 75.2 |
| 11 | 361 | 482 | 1.0 | 1.3 | 74.9 |
| 12 | 347 | 453 | 1.0 | 1.2 | 76.6 |
| 13 | 348 | 442 | 1.0 | 1.2 | 78.7 |
| 14 | 309 | 417 | 0.8 | 1.1 | 74.1 |
| 15 | 324 | 432 | 0.9 | 1.2 | 75.0 |
| 16 | 334 | 455 | 0.9 | 1.2 | 73.4 |
| 17 | 310 | 462 | 0.8 | 1.3 | 67.1 |
| 18 | 313 | 422 | 0.9 | 1.2 | 74.2 |
| 19 | 266 | 372 | 0.7 | 1.0 | 71.5 |
| 20 | 274 | 366 | 0.8 | 1.0 | 74.9 |
| 21 | 259 | 355 | 0.7 | 1.0 | 73.0 |
| 22 | 208 | 291 | 0.6 | 0.8 | 71.5 |
| 23 | 183 | 257 | 0.5 | 0.7 | 71.2 |

# REVIEW OF SYSTEM PERFORMANCE

The first step in determining the current state of the system's deployment model is to establish baseline measures of performance. This analysis is crucial to the ability to discuss alternatives to the status quo and in identifying opportunities for improvement. This portion of the analysis will focus efforts on elements of response time and the cascade of events that lead to timely response with the appropriate apparatus and personnel to mitigate the event. Response time goals should be looked at in terms of total reflex time, or total response time, which includes the dispatch or call processing time, turnout time, and travel time, respectively.

## Cascade of Events

The cascade of events is the sum of the individual elements of time beginning with a state of normalcy and continuing until normalcy is once again returned through the mitigation of the event. The elements of time that are important to the ultimate outcome of a structure fire or critical medical emergency begin with the initiation of the event. For example, the first on-set of chest pain begins the biological and scientific time clock for heart damage irrespective of when 911 is notified. Similarly, a fire may begin and burn undetected for a period of time before the fire department is notified. The emergency response system does not have control over the time interval for recognition or the choice to request assistance.

Therefore, Frederick Fire and Rescue utilizes quantifiable "hard" data points to measure and manage system performance. These elements include alarm processing (with updated CAD), turnout time, travel time, and the time spent on-scene. An example of the cascade of events and the elements of performance utilized is provided as Figure 17 below.[4]

### *Detection*

Is the element of time between the time an event occurs and someone detects it and the emergency response system has been notified. This is typically accomplished by calling the 911 Primary Safety Answering Point (PSAP).

### *Call Processing*

This is the element of time measured between when 911 answers the 911 call, processes the information, and subsequently dispatches emergency responders.

[4] Olathe Fire Department. (2012). Adapted from Community Risk and Emergency Services Analysis: Standard of Cover. Olathe, Kansas: Author.

### *Turnout Time*

This is the element of time that is measured between the time the fire department is dispatched or alerted of the emergency incident and the time when the fire apparatus or ambulance is enroute to the call.

It is understood that for Frederick County, the Call Processing (Dispatch) time and Turnout times are combined, as they are not currently differentiated in the data captured by the CAD.

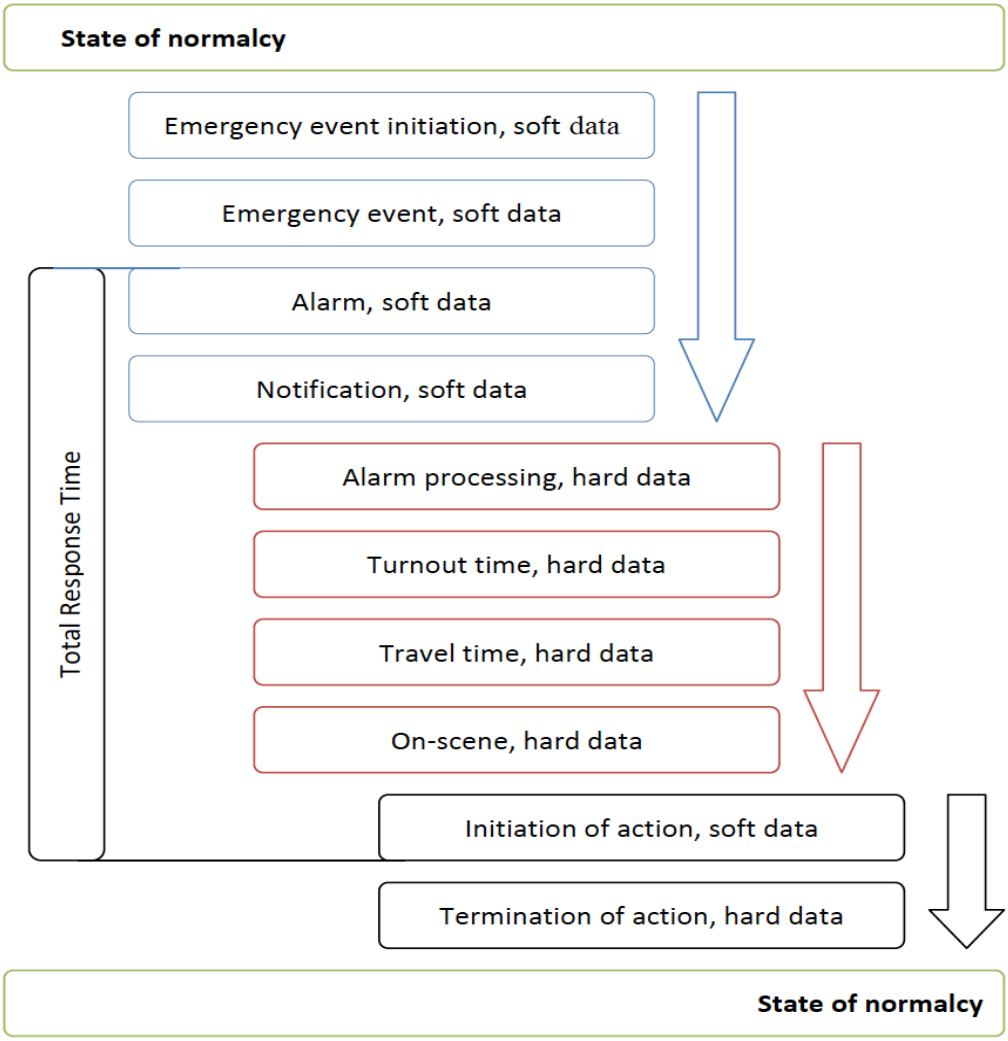
### *Travel Time*

The travel time is the element of time between when the unit went enroute, or began to travel to the incident, and their arrival on-scene.

### *Total Response Time*

The total response time, or total reflex time, is the total time required to arrive on-scene beginning with 911 answering the phone request for service and the time that the units arrive on-scene.

*Figure 17: Cascade of Events*




## *Comparison of Workloads and Response Time by Demand Zone*

Another method of assessing the effectiveness of the distribution model is to analyze the demand for services across the distribution model. Workload is assessed at the first due station demand zone level and at the individual unit level.

Of requests in the jurisdiction of Frederick County Fire Rescue, analyses illustrate that Station Demand Zones Greenwood accounted for 21.7% of the total demand, station demand Stephens City accounted for 18.0%, and station Round Hill Community accounted for 12.2% of the total. The workload of the top three station demand zones accounted for 52% of the department total.

***Table 24: Number of Calls and Responses by First Due Station[5]***

| First Due Station | Number of Calls | Number of Unit Responses | Responses per Day | Percent of Department Workload |
|---|---|---|---|---|
| 10 - Frederick County | 100 | 160 | 0.4 | 0.8 |
| 11 - Stephens City | 2,216 | 3,714 | 10.2 | 18.0 |
| 12 - Middletown | 744 | 1,279 | 3.5 | 6.2 |
| 13 - Clear Brook | 981 | 2,053 | 5.6 | 10.0 |
| 14 - Gore | 290 | 740 | 2.0 | 3.6 |
| 15 - Round Hill Community | 1,402 | 2,522 | 6.9 | 12.2 |
| 16 - Gainesboro | 422 | 1,149 | 3.1 | 5.6 |
| 17 - Star Tannery | 178 | 362 | 1.0 | 1.8 |
| 18 - Greenwood | 1,990 | 4,470 | 12.2 | 21.7 |
| 19 - North Mountain | 356 | 979 | 2.7 | 4.8 |
| 20 - Reynolds Store | 316 | 762 | 2.1 | 3.7 |
| 21 - Millwood Station | 979 | 1,893 | 5.2 | 9.2 |
| Berkeley County | 28 | 35 | 0.1 | 0.2 |
| Clarke County | 27 | 58 | 0.2 | 0.3 |
| Hampshire County | 42 | 88 | 0.2 | 0.4 |
| Hardy County | 8 | 11 | 0.0 | 0.1 |
| Jefferson County | 5 | 10 | 0.0 | 0.0 |
| Morgan County | 42 | 101 | 0.3 | 0.5 |
| Out of County | 3 | 4 | 0.0 | 0.0 |
| Warren County | 4 | 8 | 0.0 | 0.0 |
| Winchester | 117 | 211 | 0.6 | 1.0 |
| **Total** | **10,250** | **20,609** | **56.5** | **100.0** |

[5] The CAD data provided did not have a method to determine calls involving Shenandoah County.


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*Figure 18: Number of Incidents by Station Demand Zone*

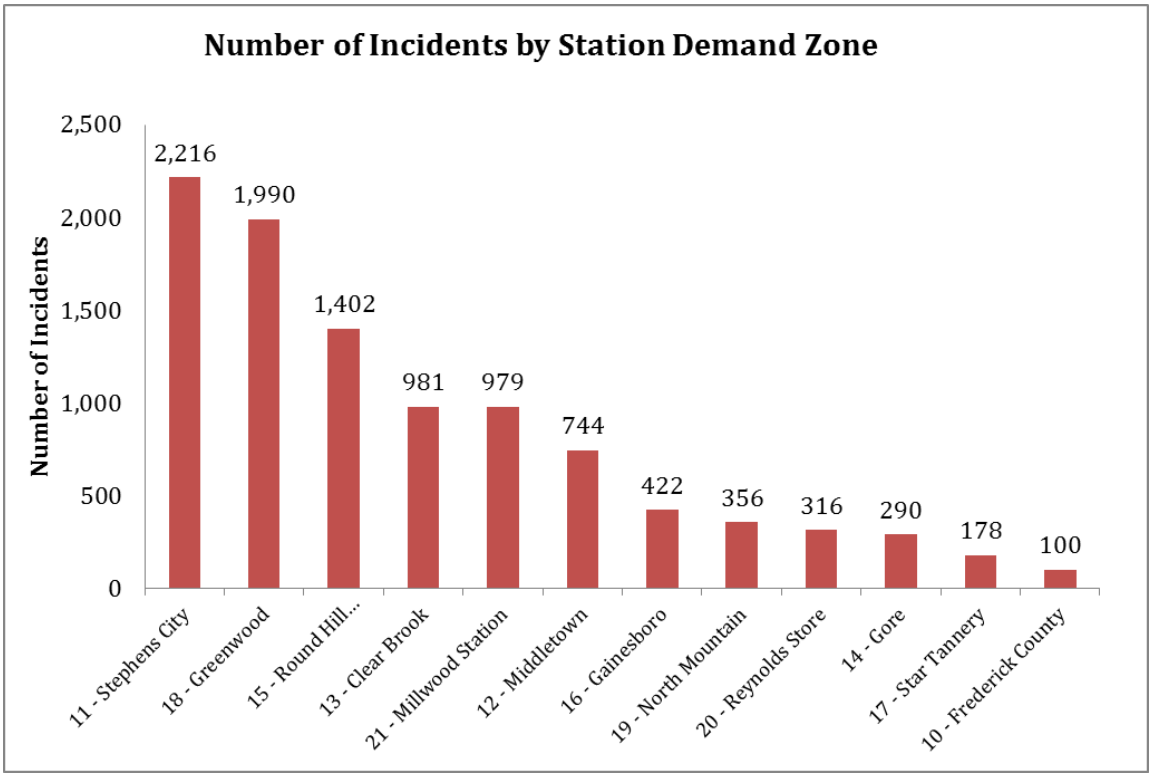
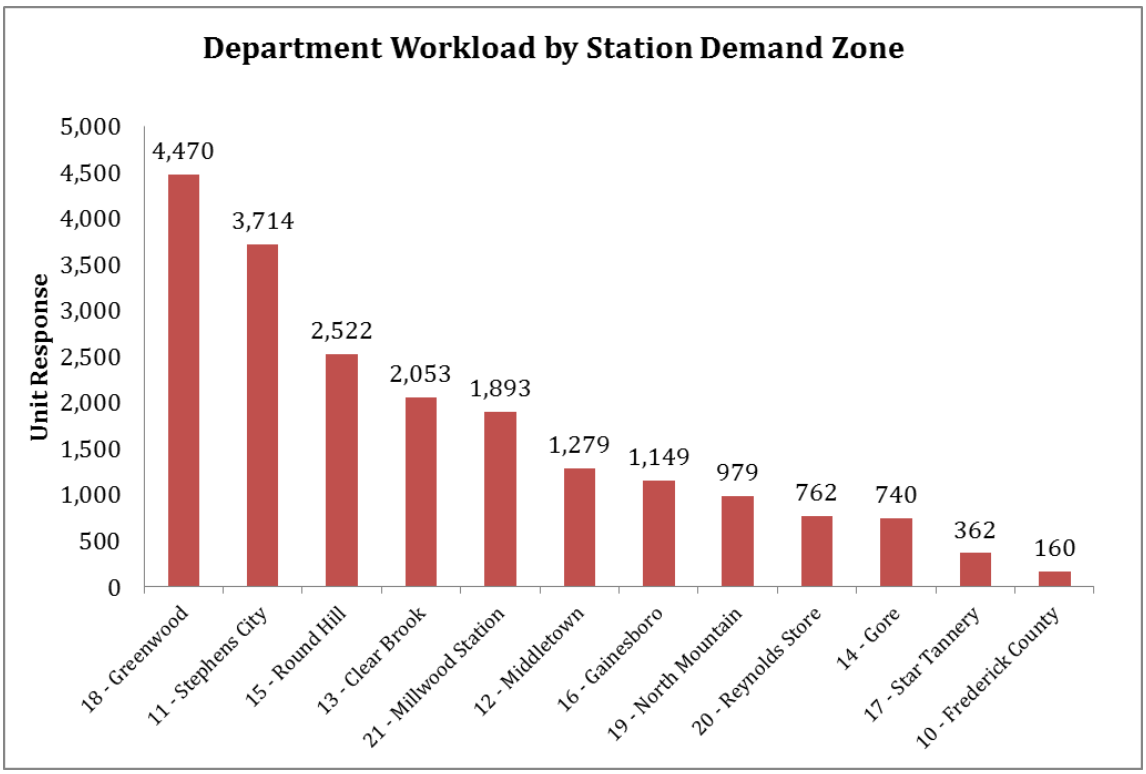



*Figure 19: Workload by Station Demand Zone*





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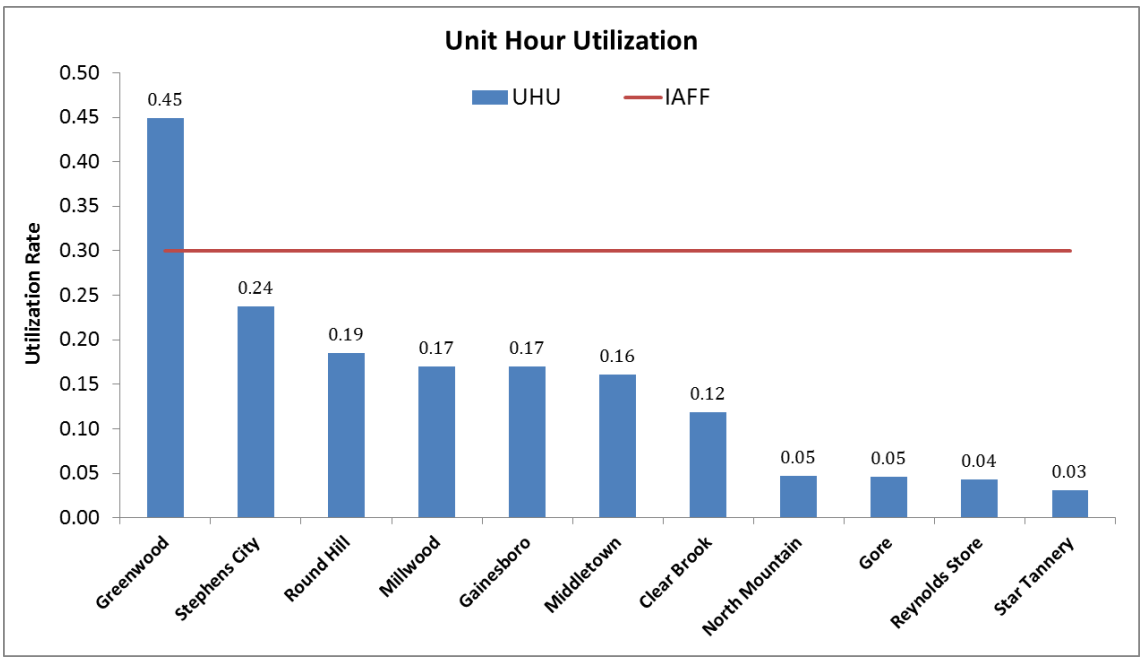
Another measure, time on task, is necessary to evaluate best practices in efficient system delivery and consider the impact workload has on personnel. Unit Hour Utilization (UHU) determinants were developed by mathematical model. This model includes both the proportion of calls handled in each major service area (Fire, EMS, Rescue, and Hazmat) and total unit time on task for these service categories in 2016. The resulting UHU's represent the percentage of the work period (24 hours) that is utilized responding to requests for service. Historically, the International Association of Fire Fighters (IAFF) has recommended that 24-hour units utilize 0.30, or 30% workload as an upper threshold.[6] In other words this recommendation would have personnel spend no more than eight (8) hours per day on emergency incidents. These thresholds take into consideration the necessity to accomplish non-emergency activities such as training, health and wellness, public education, and fire inspections. The 4th edition of the IAFF EMS Guidebook no longer specifically identifies an upper threshold. However, *FITCH* recommends that an upper unit utilization threshold of approximately .30, or 30%, would be considered best practice. In other words, units and personnel should not exceed 30%, or eight (8) hours, of their workday responding to calls. These recommendations are also validated in the literature. For example, in their review of the City of Rolling Meadows, the Illinois Fire Chiefs Association utilized a UHU threshold of .30 as an indication to add additional resources.[7] Similarly, in a standards of cover study facilitated by the Center for Public Safety Excellence, the Castle Rock Fire and Rescue Department utilizes a UHU of .30 as the upper limit in their standards of cover due to the necessity to accomplish other non-emergency activities.[8]

These thresholds take into consideration the necessity to accomplish non-emergency activities such as training, health and wellness, public education, and fire inspections.

We grouped cross-staffed units together and conduct UHU analysis at station level. Greenwood Station has the highest workload at 0.44, followed by Stephens City station at 0.24, Greenwood at 0.22, and Round Hill at 0.19. North Mountain, Gore, Reynolds Store, and Star Tannery stations all had UHU less than or equal to 5%.

[6] International Association of Firefighters. (1995). Emergency *Medical Services: A Guidebook for Fire-Based Systems.* Washington, DC: Author. (p. 11)
[7] Illinois Fire Chiefs Association. (2012). An *Assessment of Deployment and Station Location: Rolling Meadows Fire Department.* Rolling Meadows, Illinois: Author. (pp. 54-55)
[8] Castle Rock Fire and Rescue Department. (2011). Community *Risk Analysis and Standards of Cover.* Castle Rock, Colorado: Author. (p. 58)

***Figure 20: Station Level Unit Hour Utilization***




*Note: Greenwood station assumed one unit was staffed by full-time firefighters 24/7.*

***Table 25: Station Level Unit Hour Utilization***

| Station | Unit | Busy Hours | UHU | IAFF | IAFC |
|---|---|---|---|---|---|
| Greenwood | A181/A183/A814/E18/ALS2 | 3,934 | 0.45 | 0.30 | 0.30 |
| Stephens City | A111/A112/A113/E11 | 2,082 | 0.24 | 0.30 | 0.30 |
| Round Hill | A151/A152/RE15/E15 | 1,623 | 0.19 | 0.30 | 0.30 |
| Millwood | A211/A212/RE21/E21 | 1,493 | 0.17 | 0.30 | 0.30 |
| Gainesboro | A161/A162/E16/ALS1 | 1,490 | 0.17 | 0.30 | 0.30 |
| Middletown | A121/A122/ALS12/RE12/ET12 | 1,413 | 0.16 | 0.30 | 0.30 |
| Clear Brook | A131/A132/E13 | 1,038 | 0.12 | 0.30 | 0.30 |
| North Mountain | A191/A192/W19 | 408 | 0.05 | 0.30 | 0.30 |
| Gore | A141/A142/E14 | 400 | 0.05 | 0.30 | 0.30 |
| Reynolds Store | A201/A202/E20 | 378 | 0.04 | 0.30 | 0.30 |
| Star Tannery | A171/E17 | 270 | 0.03 | 0.30 | 0.30 |

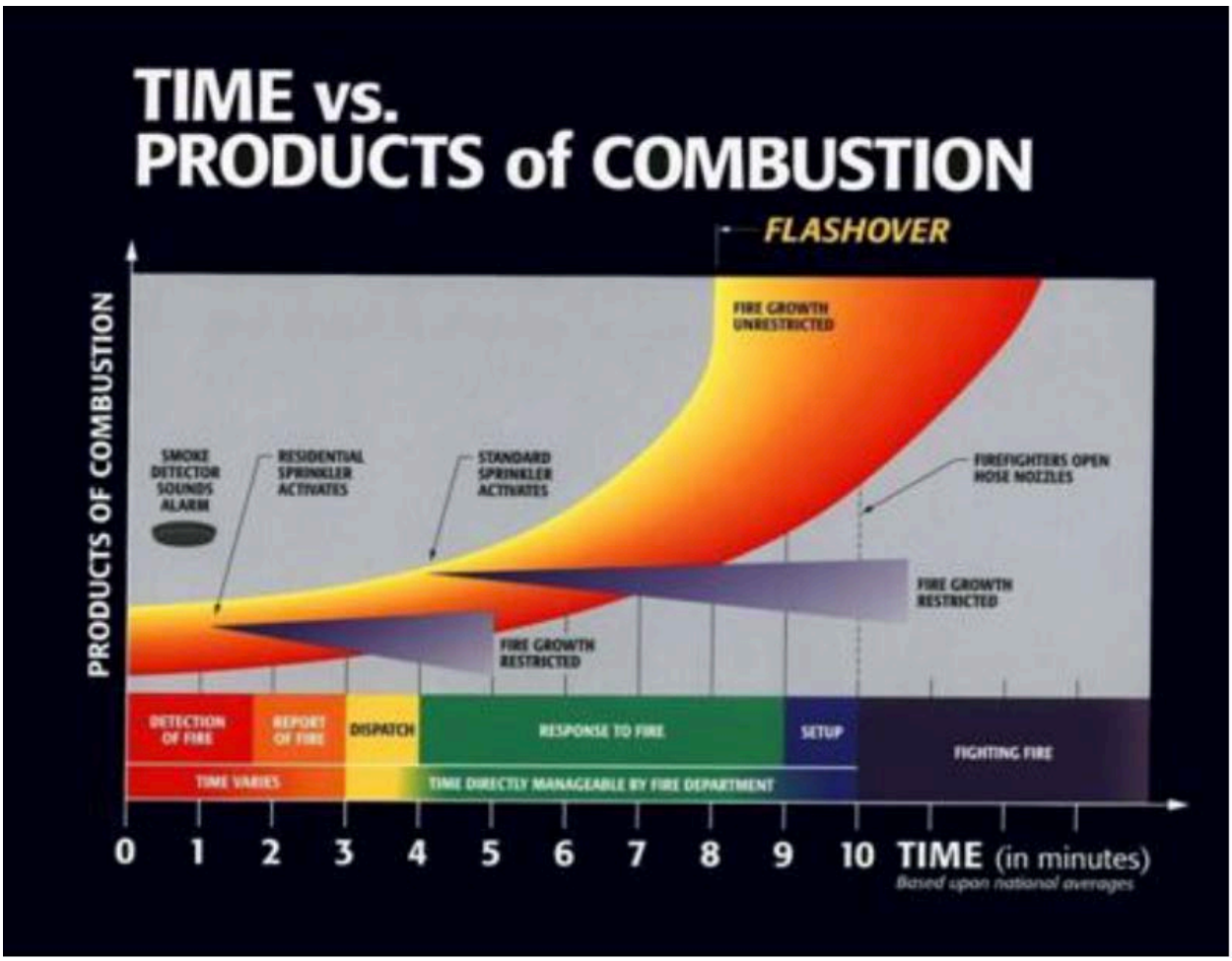
# RESPONSE TIME CONTINUUM

## Fire

The number one priority with structural fire incidents is to save lives followed by the minimization of property damage. A direct relationship exists between the timeliness of the response and the survivability of unprotected occupants and property damage. The most identifiable point of fire behavior is Flashover.

Flashover is the point in fire growth where the contents of an entire area, including the smoke, reach their ignition temperature, resulting in a rapid-fire growth rendering the area un-survivable by civilians and untenable for firefighters. Best practices would result in the fire department arriving and attacking the fire prior to the point of flashover. A representation of the traditional time temperature curve and the cascade of events are provided as Figure 19 below.[9]

***Figure 21: Example of Traditional Time Temperature Curve***




[9] Example of Traditional Time Temperature Curve. Retrieved at http://www.usfa.fema.gov/downloads/pdf/coffee-break/time-vs-products-of-combustion.pdf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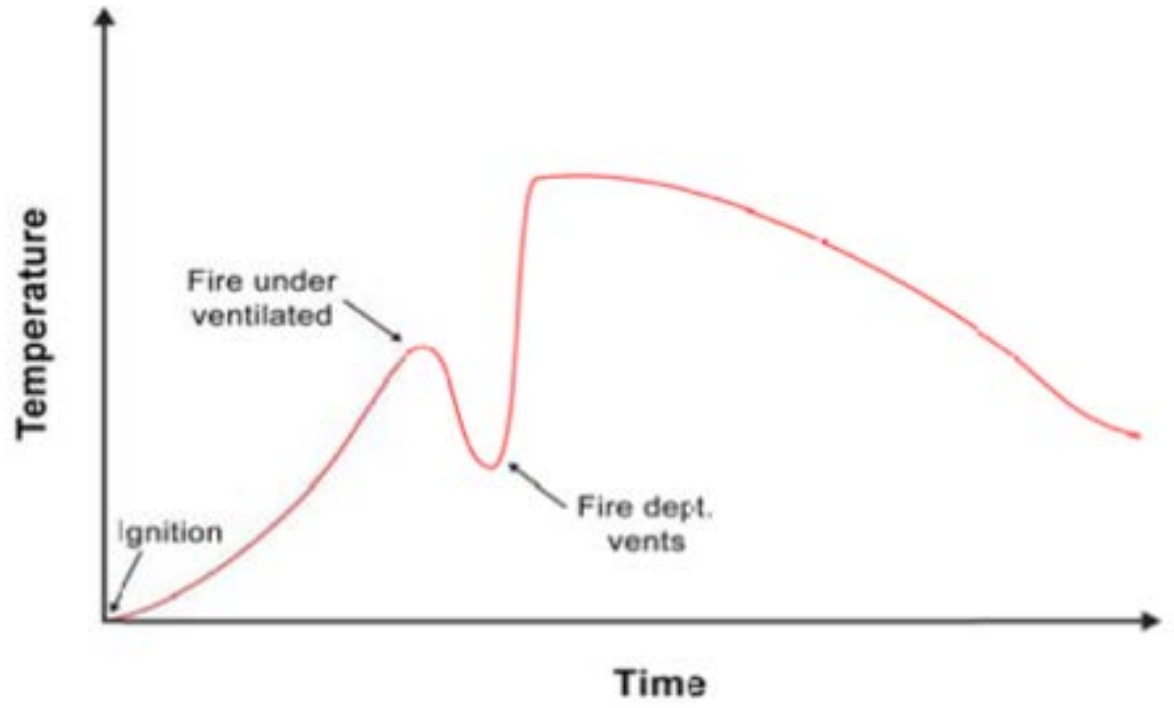
Recent studies by Underwriter's Laboratories (UL) have found that in compartment fires such as structure fires, flashover occurs within 4 minutes in modern fire environment. In addition, the UL research has identified an updated time temperature curve due to fires being ventilation controlled rather than fuel controlled as represented in the traditional time temperature curve. While this ventilation controlled environment continues to provide a high risk to unprotected occupants to smoke and high heat, it does provide some advantage to property conservation efforts as water may be applied to the fire prior to ventilation and the subsequent flashover. An example of UL's ventilation controlled time temperature curve is provided as Figure 20 below.[10]

***Figure 22: Ventilation Controlled Time Temperature Curve***




## EMS

The effective response to Emergency Medical Service (EMS) incidents also has a direct correlation to the ability to respond within a specified period of time. However, unlike structure fires, responding to EMS incidents introduces considerable variability in the level of clinical acuity. From this perspective, the association of response time and clinical outcome varies depending on the severity of the injury or the illness. Research has demonstrated that the overwhelming majority of requests for EMS services are not time sensitive between 5 minutes and 11 minutes for emergency and 13

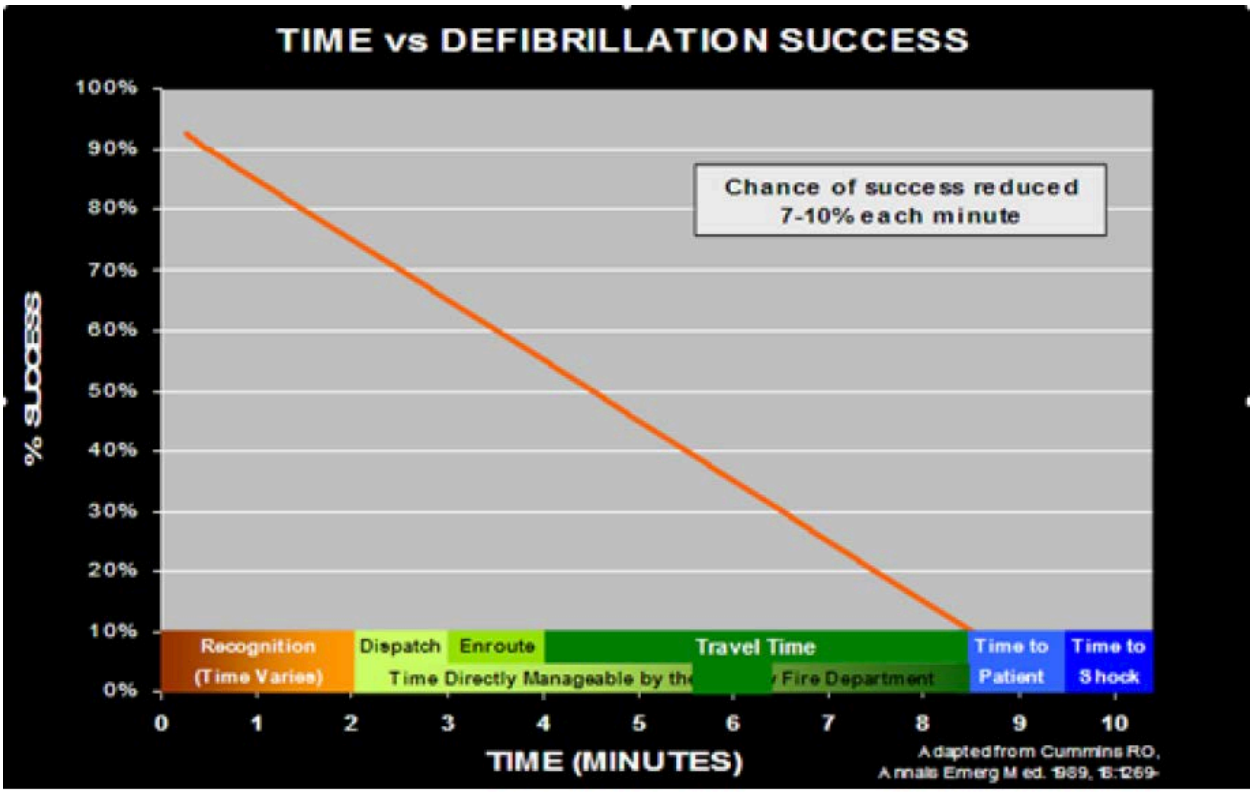
[10] UL/NIST Ventilation Controlled Time Temperature Curve. Retrieved from http://www.nist.gov/fire/fire_behavior.cfm

minutes for non-emergency responses.[11] The 12-minute upper threshold is only the upper limit of the available research and is not a clinically significant time measure, as patients were not found to have a significantly different clinical outcome when the 12-minute threshold was exceeded.[12]

Out of hospital sudden cardiac arrest is the most identifiable and measured incident type for EMS. In an effort to demonstrate the relationship between response time and clinical outcome, a representation of the cascade of events and the time to defibrillation (shock) is presented as Figure 21 below. The American Heart Association (AHA) has determined that brain damage will begin to occur between four and six minutes and become irreversible after 10 minutes without intervention.

Modern sudden cardiac arrest protocols recognize that high quality Cardio-Pulmonary Resuscitation (CPR) at the Basic Life Support (BLS) level is a quality intervention until defibrillation can be delivered in shockable rhythms. Figure 23[13] below is representative of a sudden cardiac arrest that is presenting in a shockable heart rhythm such as Ventricular Fibrillation or Ventricular Tachycardia.

***Figure 23: Cascade of Events for Sudden Cardiac Arrest with Shockable Rhythm***




[11] Blackwell, T.H., & Kaufman, J.S. (April 2002). Response time effectiveness: Comparison of response time and survival in an urban emergency medical services system. *Academic Emergency Medicine,* 9(4): 289-295.
[12] Blackwell, T.H., et al. (Oct-Dec 2009). Lack of association between prehospital response times and patient outcomes. *Prehospital Emergency Care,* 13(4): 444-450.
[13] Olathe Fire Department. (2012). Adapted from Community Risk and Emergency Services Analysis: Standard of Cover. Olathe, Kansas: Author.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# DESCRIPTION OF FIRST ARRIVING UNIT PERFORMANCE

Analyses of the response characteristics of the first arriving units were conducted. Overall the system had a mean dispatch and turnout time of 312 seconds, and 437 seconds at the 90th percentile. The travel time for all first arriving unit responses were calculated irrespective of their assigned station FDZ. In other words, this analysis describes the first arriving unit to the scene. The mean travel time was 354 seconds, or five minutes and 54 seconds. Performance at the 90th percentile was 623 seconds, or ten minutes and 23 seconds.

The "total response time" is defined as from call entry through unit arriving on scene. The mean response time is 672 seconds, or eleven minutes and 12 seconds. Performance at the 90th percentile is 981 seconds, or 16 minutes and 21 seconds. Results of first arriving unit performance are provided below.

***Table 26: Description of First Arriving Unit Emergency Response Performance***

| Measure | Average | 90th Percentile |
|---|---|---|
| Dispatch and Turnout Time | 5.2 | 7.3 |
| Travel Time | 5.9 | 10.4 |
| Response Time | 11.2 | 16.4 |

The 90th percentile dispatch and turnout time for EMS and fire calls were 7.3 and 7.5 minutes respectively. For EMS calls, a total of 51% of calls had dispatch and turnout time of five minutes or less. For fire calls, a total of 65% of the calls had dispatch and turnout time of five minutes or less.

The 90th percentile travel time for EMS and fire calls were 10.1 and 11.7 minutes respectively. For EMS calls, a total of 47% of the calls had travel time of five minutes or less. For fire calls, a total of 46% of calls had travel time of five minutes or less.


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***Figure 24: EMS Calls: Distribution of Dispatch and Turnout Time of First Arriving Unit***

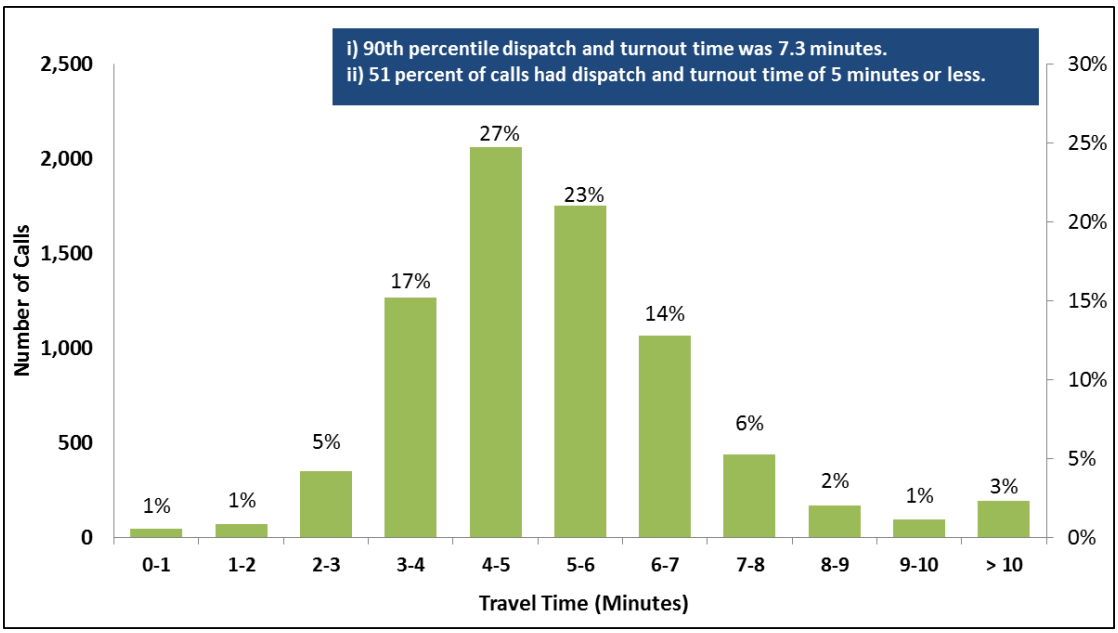


***Figure 25: EMS Calls: Distribution of Travel Time of First Arriving Unit***

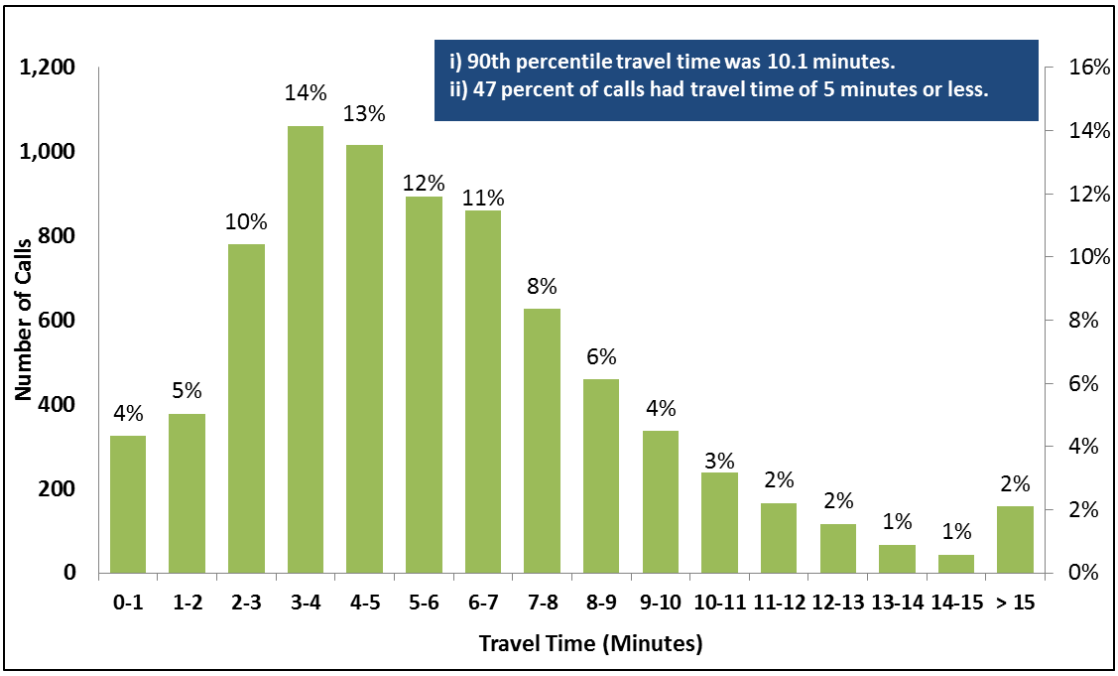



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***Figure 26: Fire Calls: Distribution of Dispatch and Turnout Time of First Arriving Unit***

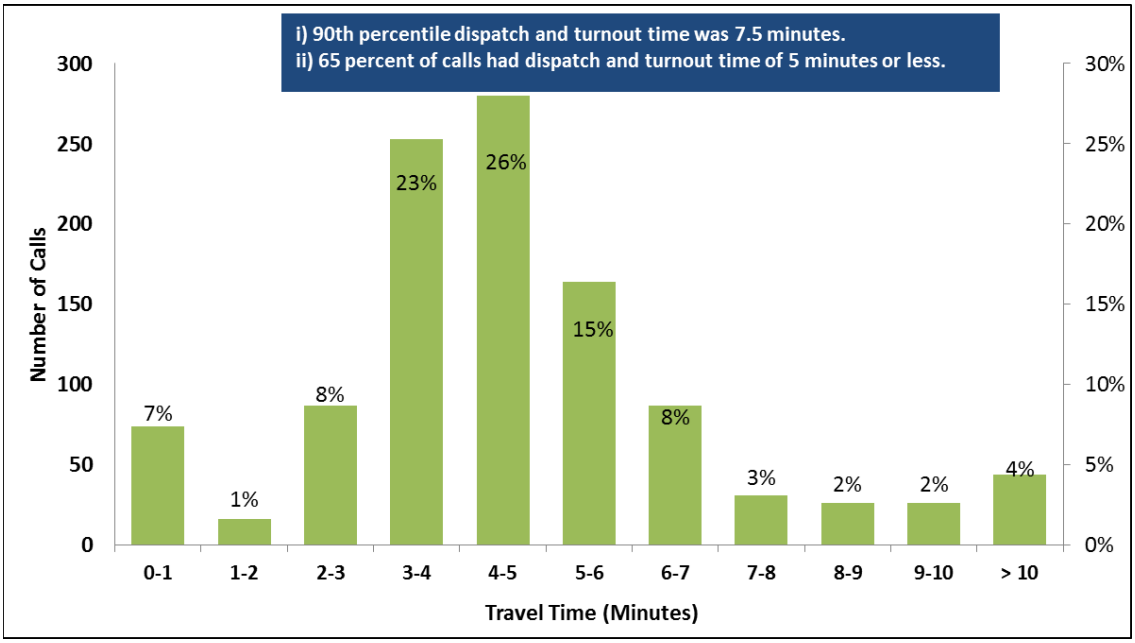
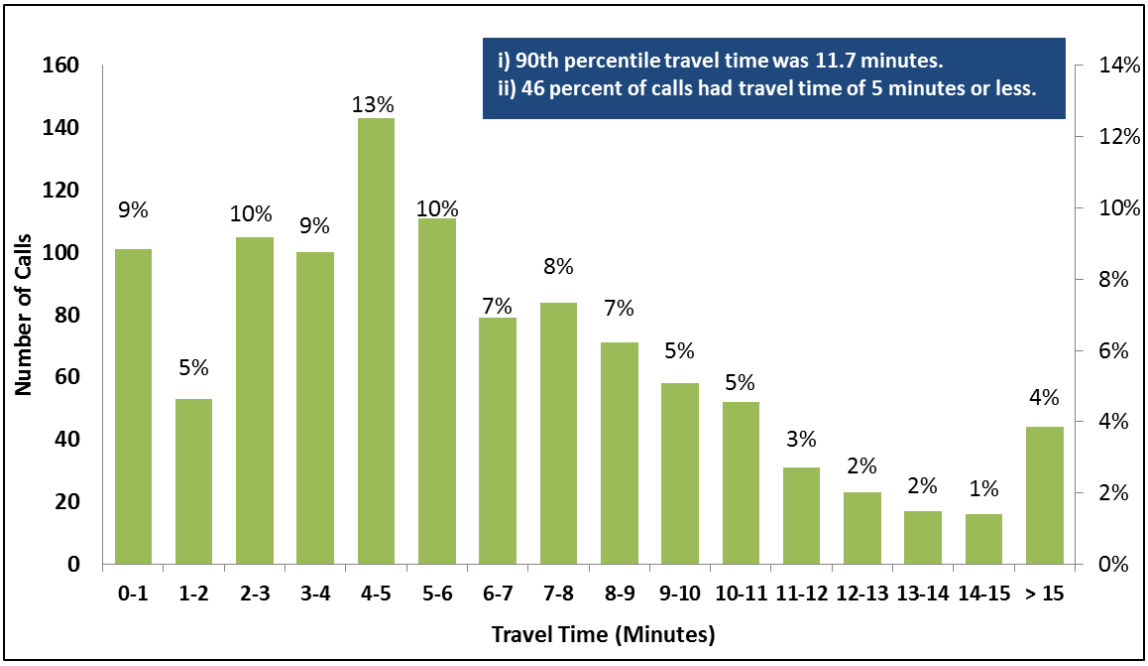



***Figure 27: Fire Calls: Distribution of Travel Time of First Arriving Unit***





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In the following analysis, we focused on units staffed by career firefighters. Greenwood units had the fastest average and 90th percentile response time, followed by Millwood Station and Round Hill.

***Table 27: Average Dispatch, Turnout and Travel Time of First Arriving Units by Station***

| Station | Unit | Dispatch and Turnout Time | Travel Time | Response Time | Sample Size |
|---|---|---|---|---|---|
| Clear Brook | A131/A132/E13 | 5.1 | 6.2 | 11.3 | 697 |
| Gainesboro | A162/A161/E16 | 5.2 | 6.9 | 12.1 | 256 |
| Gore | A141/A142/E14 | 5.3 | 6.2 | 11.5 | 207 |
| Greenwood | A184/A183/A181/E18 | 5.1 | 5.1 | 10.2 | 1,431 |
| Middletown | A121/A122/RE12/ET12 | 5.2 | 6.9 | 12.0 | 541 |
| Millwood Station | A211/A212/RE21/E21 | 5.2 | 5.8 | 10.9 | 945 |
| North Mountain | A192/A191/W19 | 6.5 | 6.4 | 13.0 | 220 |
| Reynolds Store | A202/A201/E20 | 5.3 | 6.1 | 11.5 | 177 |
| Round Hill | A151/A152/RE15/E15 | 5.1 | 5.9 | 11.0 | 1,109 |
| Star Tannery | A171/E17 | 4.9 | 9.6 | 14.6 | 127 |
| Stephens City | A111/A112/A113/E11 | 5.1 | 5.9 | 11.0 | 1,641 |
| **Total** | | **5.2** | **6.0** | **11.1** | **7,325** |

***Table 28: 90th Percentile Dispatch, Turnout and Travel Time of First Arriving Units by Station***

| Station | Unit | Dispatch and Turnout Time | Travel Time | Response Time | Sample Size |
|---|---|---|---|---|---|
| Clear Brook | A131/A132/E13 | 7.2 | 10.5 | 16.4 | 697 |
| Gainesboro | A162/A161/E16 | 7.4 | 11.4 | 17.8 | 256 |
| Gore | A141/A142/E14 | 7.9 | 13.2 | 19.3 | 207 |
| Greenwood | A184/A183/A181/E18 | 7.0 | 8.3 | 14.1 | 1,431 |
| Middletown | A121/A122/RE12/ET12 | 7.3 | 11.9 | 18.1 | 541 |
| Millwood Station | A211/A212/RE21/E21 | 6.9 | 10.0 | 15.9 | 945 |
| North Mountain | A192/A191/W19 | 9.9 | 11.2 | 18.4 | 220 |
| Reynolds Store | A202/A201/E20 | 7.8 | 12.2 | 17.6 | 177 |
| Round Hill | A151/A152/RE15/E15 | 6.9 | 9.8 | 15.4 | 1,109 |
| Star Tannery | A171/E17 | 7.1 | 15.5 | 20.5 | 127 |
| Stephens City | A111/A112/A113/E11 | 7.0 | 9.5 | 15.4 | 1,641 |
| **Total** | | **7.1** | **10.3** | **16.1** | **7,325** |

ALS1 and ALS2 responded to countywide incidents, and they only arrived first on scene 28% of the time. Of all their responses, ALS1's average response time was 15.6 minutes, and the 90th percentile response time was 22.1 minutes. ALS2's average response time was 12.1 minutes, and the 90th percentile response time was 16.9 minutes. When they arrived first on scene, ALS1 90$^{th}$ percentile response time was 17.9 minutes, and ALS2 90$^{th}$ percentile response time was 13.2 minutes.


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*Table 29: ALS1/AL2: Average Dispatch, Turnout and Travel Time by Arrival Sequence*

| Station | Unit | Arrival Sequence | Dispatch and Turnout Time | Travel Time | Response Time | Sample Size |
|---|---|---|---|---|---|---|
| Gainesboro | ALS1 | 1 | 5.1 | 7.6 | 12.8 | 132 |
| | | 2 | 5.9 | 10.4 | 16.3 | 281 |
| | | 3 or later | 5.3 | 11.7 | 17.0 | 129 |
| | | **Total** | **5.6** | **10.0** | **15.6** | **542** |
| Greenwood | ALS2 | 1 | 5.0 | 4.5 | 9.5 | 143 |
| | | 2 | 5.5 | 7.2 | 12.7 | 219 |
| | | 3 or later | 8.5 | 8.3 | 16.9 | 51 |
| | | **Total** | **5.7** | **6.4** | **12.1** | **413** |

*Table 30: ALS1/AL2: 90th Percentile Dispatch, Turnout and Travel Time by Arrival Sequence*

| Station | Unit | Arrival Sequence | Dispatch and Turnout Time | Travel Time | Response Time | Sample Size |
|---|---|---|---|---|---|---|
| Gainesboro | ALS1 | 1 | 7.0 | 11.9 | 17.9 | 132 |
| | | 2 | 7.7 | 15.6 | 22.8 | 281 |
| | | 3 or later | 7.6 | 17.3 | 23.1 | 129 |
| | | **Total** | **7.6** | **15.6** | **22.1** | **542** |
| Greenwood | ALS2 | 1 | 7.0 | 8.1 | 13.2 | 143 |
| | | 2 | 7.5 | 11.4 | 18.0 | 219 |
| | | 3 or later | 13.4 | 11.1 | 22.7 | 51 |
| | | **Total** | **7.8** | **10.4** | **16.9** | **413** |

## First Arriving Unit Response Time by Station Demand Zone

Further analyses were conducted to measure the performance of the first arriving unit in each demand zone. Response times are reported below at both the mean and 90th percentile respectively. Station demand zone Millwood Station had the best response time performance, and the average response time was 10.0 minutes, and the 90th percentile response time was 14.1 minutes. The second fastest station demand zone is Greenwood.

***Table 31: Mean First Arrival Performance by First Due Station***

| Jurisdiction | Dispatch and Turnout Time | Travel Time | Response Time | Sample Size |
|---|---|---|---|---|
| 21 - Millwood Station | 5.1 | 4.9 | 10.0 | 840 |
| 18 - Greenwood | 5.2 | 5.2 | 10.3 | 1,862 |
| 10 - Frederick County | 5.0 | 5.6 | 10.6 | 89 |
| 12 - Middletown | 5.0 | 6.0 | 11.0 | 519 |
| 15 - Round Hill | 5.2 | 5.8 | 11.0 | 1,291 |
| 11 - Stephens City | 5.2 | 6.2 | 11.4 | 2,095 |
| 13 - Clear Brook | 5.1 | 6.3 | 11.5 | 867 |
| 14 - Gore | 5.4 | 6.8 | 12.1 | 248 |
| 16 - Gainesboro | 5.2 | 6.9 | 12.2 | 382 |
| 20 - Reynolds Store | 5.6 | 6.7 | 12.3 | 221 |
| 19 - North Mountain | 6.2 | 6.6 | 12.8 | 331 |
| 17 - Star Tannery | 5.6 | 9.9 | 15.5 | 151 |
| **Total** | **5.2** | **5.9** | **11.2** | **8,896** |

***Figure 28: Average Dispatch and Turnout and Travel Time by Station Demand Zone***

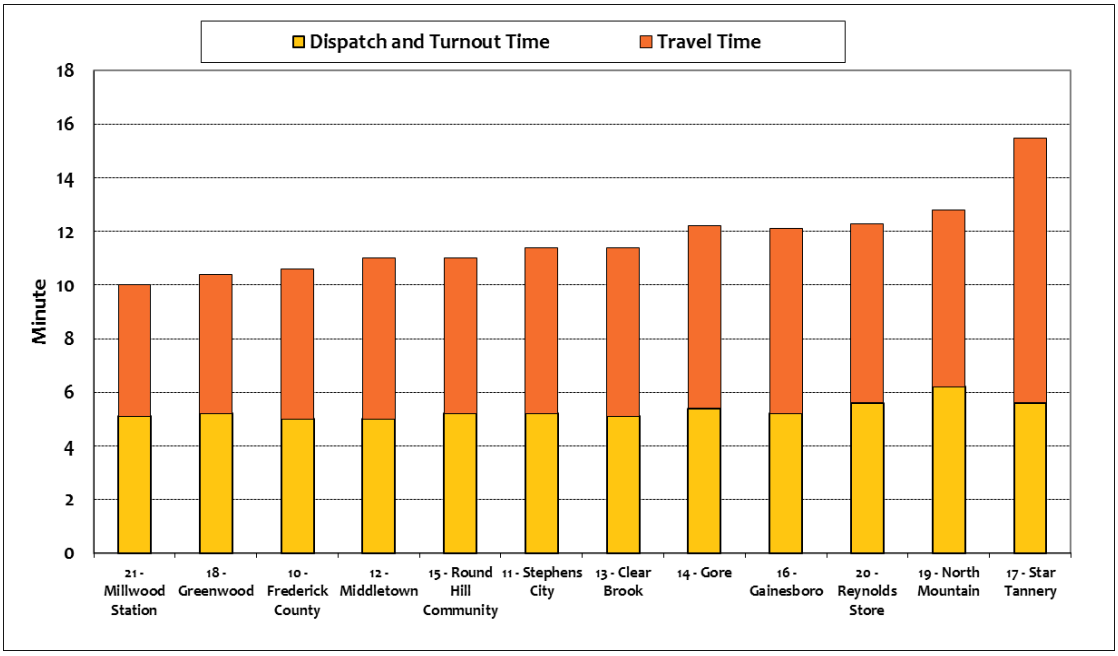
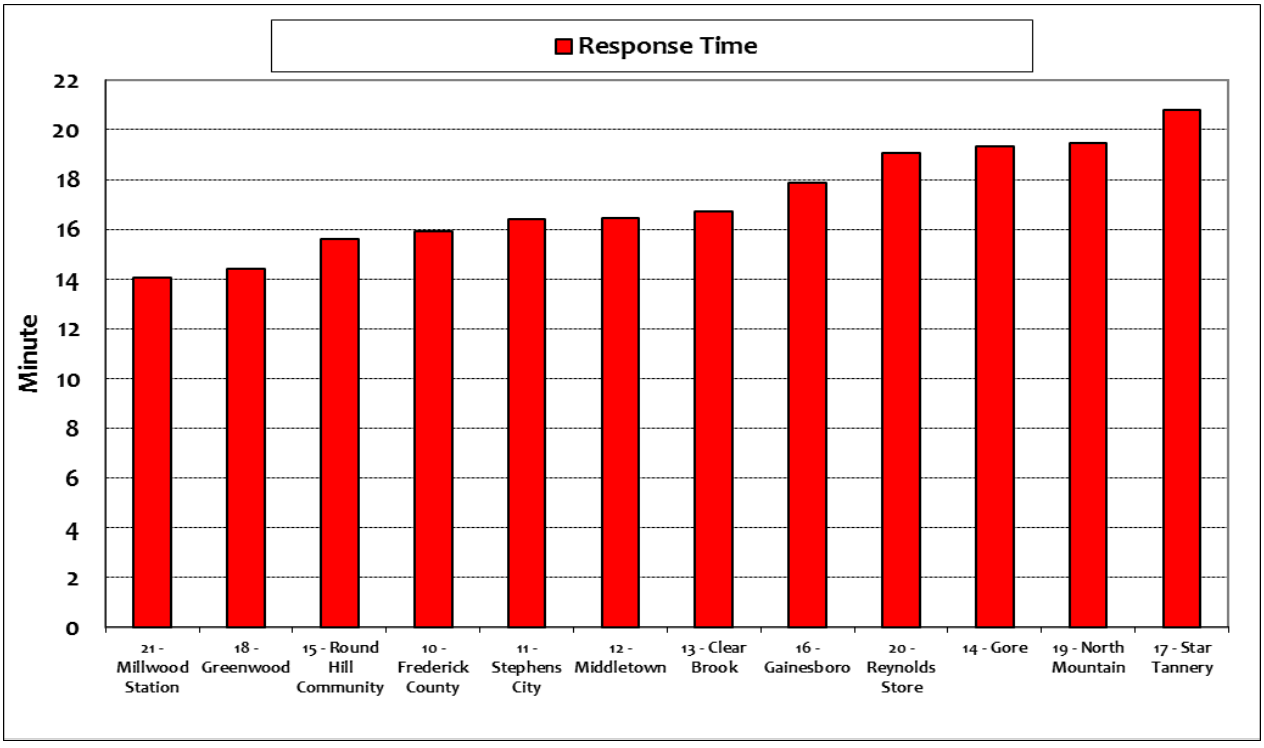


***Table 32: 90th Percentile First Arrival Performance by Station FDZ***

| First Due Station | Dispatch and Turnout Time | Travel Time | Response Time | Sample Size |
|---|---|---|---|---|
| 21 - Millwood Station | 7.1 | 8.5 | 14.1 | 840 |
| 18 - Greenwood | 7.1 | 8.5 | 14.4 | 1,862 |
| 15 - Round Hill | 7.0 | 9.7 | 15.6 | 1,291 |
| 10 - Frederick County | 7.0 | 10.5 | 15.9 | 89 |
| 11 - Stephens City | 7.2 | 10.5 | 16.4 | 2,095 |
| 12 - Middletown | 7.1 | 11.0 | 16.4 | 519 |
| 13 - Clear Brook | 7.2 | 10.7 | 16.7 | 867 |
| 16 - Gainesboro | 7.4 | 11.5 | 17.9 | 382 |
| 20 - Reynolds Store | 8.1 | 12.7 | 19.1 | 221 |
| 14 - Gore | 8.6 | 13.2 | 19.4 | 248 |
| 19 - North Mountain | 9.8 | 12.6 | 19.5 | 331 |
| 17 - Star Tannery | 7.9 | 15.7 | 20.8 | 151 |
| **Total** | **7.3** | **10.4** | **16.4** | **8,896** |

***Figure 29: 90th Percentile Response time by Station FDZ***




The data were further analyzed to compare the individual station FDZ performances. Regarding dispatch and turnout time, performances for calls in Round Hill, Millwood Station, and Middletown were the fastest. With respect to travel time performance, performances for calls in station Greenwood, Millwood Station, and Round Hill were the fastest Calls in Reynolds Store, Gore and Star Tannery had the longest 90th percentile travel time.

***Figure 30: 90th Percentile Dispatch and Turnout Time by Station FDZ***

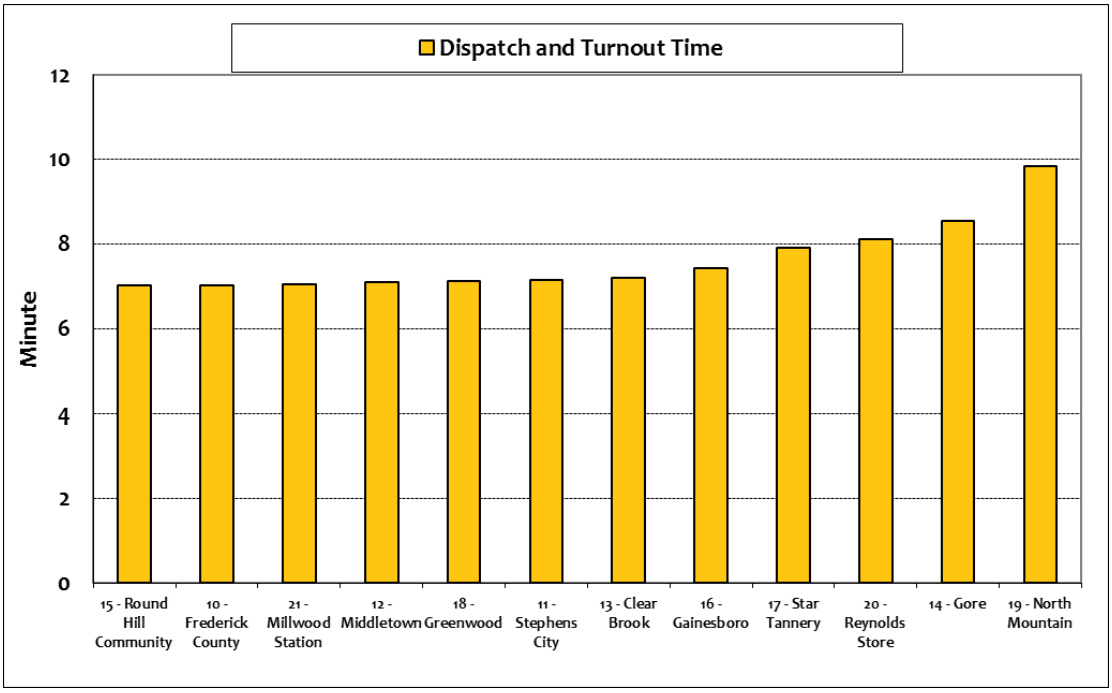
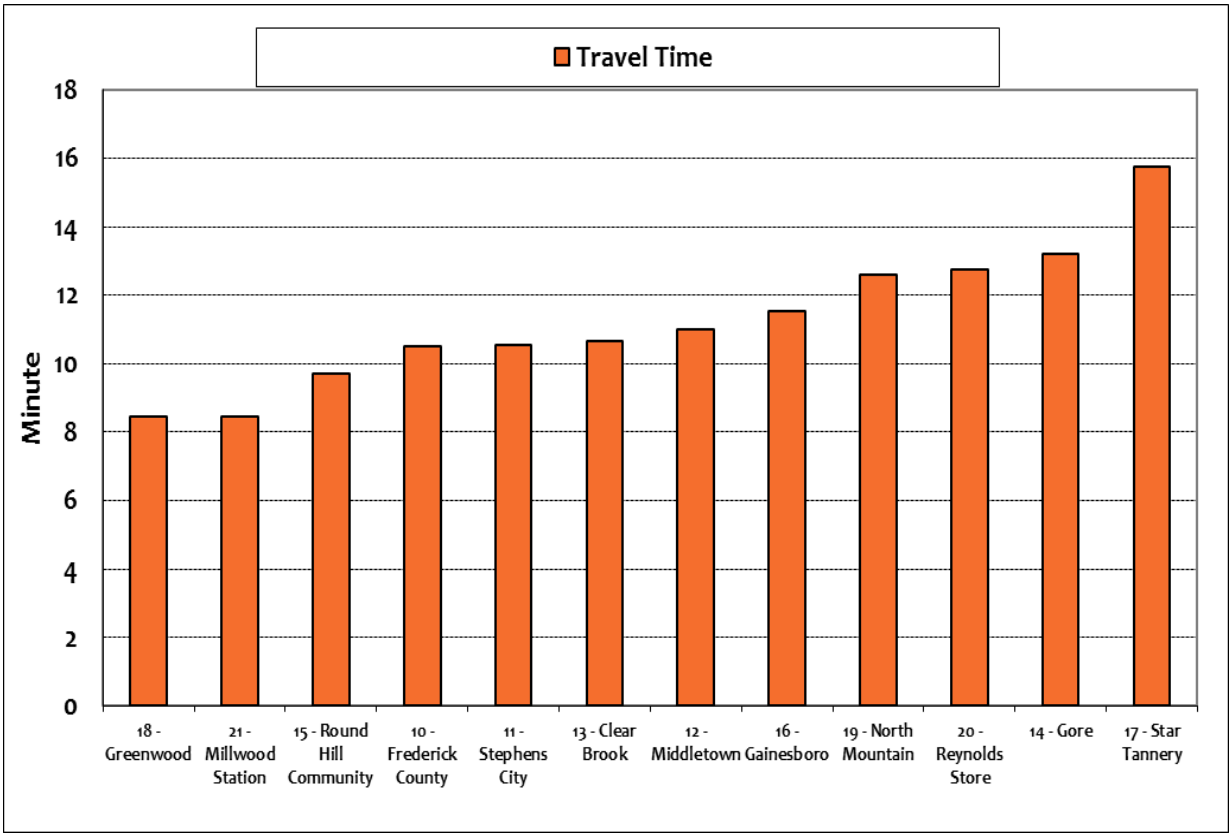



***Figure 31: 90th Percentile Travel Time Performance by Station FDZ***



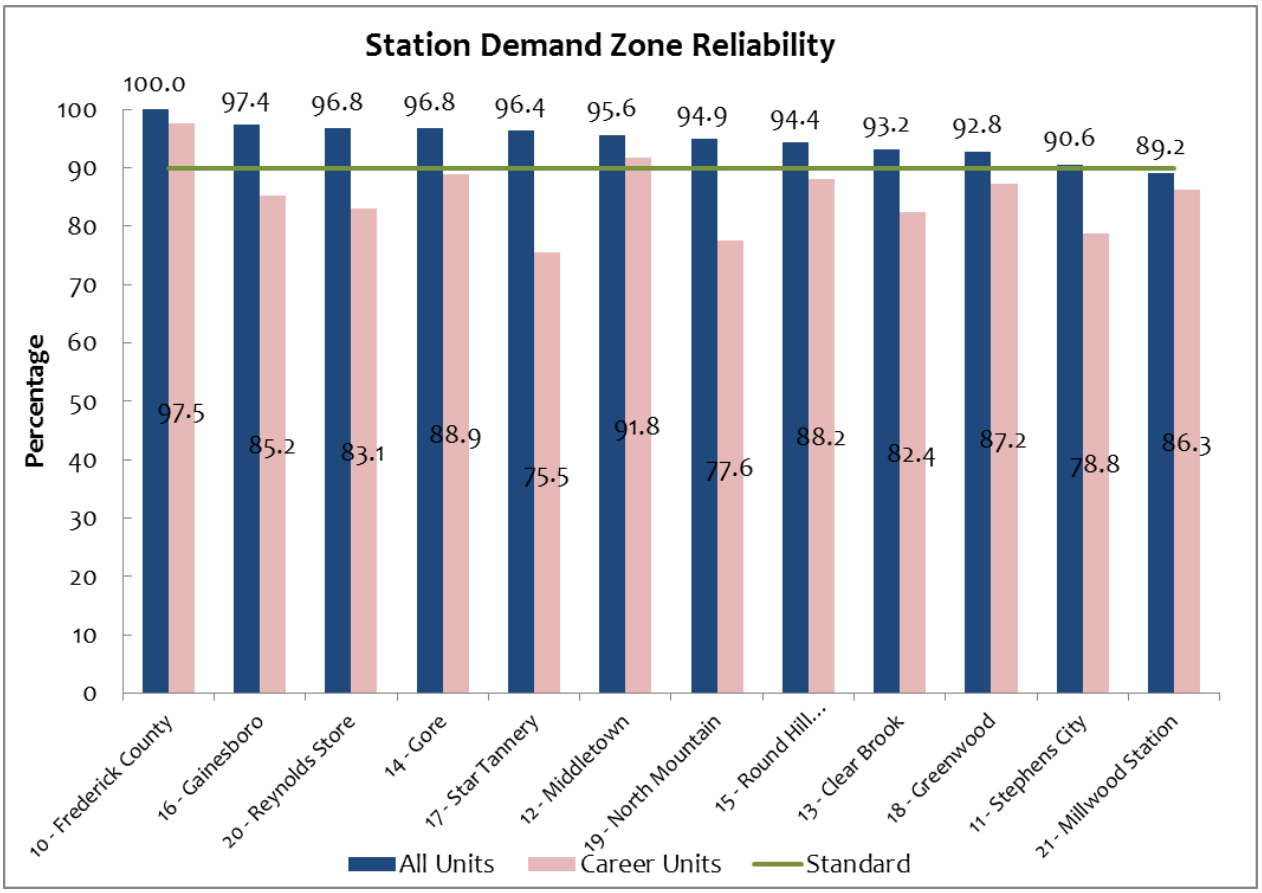
# Reliability Factors

## *Percentage of First Due Compliance*

The reliability of the distribution model is a factor of how often the response model is available and able to respond to the call within the assigned demand zone. If at least one unit from the first due station is able to respond to a call, we consider the station is able to response to the call within the assigned demand zone. Utilizing the Fire Station Demand Zones (FDZ), analyses reveal that all stations except Millwood Station had reliability of 90% or above.

We also only analyzed reliability of career units and only Frederick County, and Middletown had reliability of 90% or above. Star Tannery had the lowest career unit reliability at 75.5.

***Figure 32: Percentage Reliability by Station FDZ***





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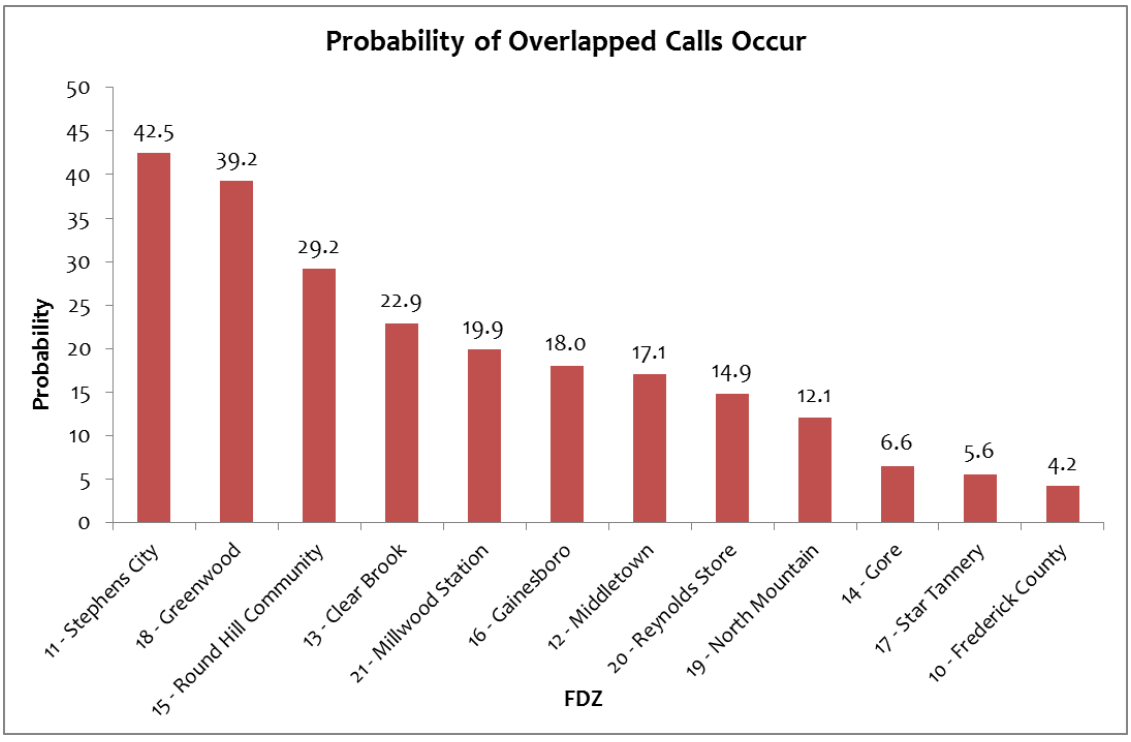
## Overlapped or Simultaneous Call Analysis

Overlapped calls are defined as the rate at which another call was received for the same first due station while there were one or more ongoing calls in the same first due station. For example, if there is one call in station Stephens City's zone, before the call was cleared another request in Stephens City's zone occurred and those two calls would be captured as overlapped calls. Some studies also refer as simultaneous calls. Understanding the probability of overlapped or simultaneous calls occurs will help to determine the number of units to staff for each station. In general, the larger the call volume a first due station has, it is more likely to have overlapped or simultaneous calls. The distribution of the demand throughout the day will impact the chance of having overlapped or simultaneous calls. The duration of a call will also have major influences, since the longer time it takes to clear a request, the more likely to have an overlapped request.

Station Stephens City had the highest probability of having overlapped calls at 42.5% since it has the highest demand at 2,216 requests in 2016, and the average duration was 65.3 minutes. Station Greenwood had the second highest probability of overlapped calls at 39.2%. Greenwood station has the second highest demand at 1,990 requests in 2016 and the average duration was 65.9 minutes.

***Figure 33: Probability of Overlapped Calls Occur by Station FDZ***





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