

U.S. Fire Administration / National Fire Data Center

Structure Fire Response Times

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Findings

- Regardless of region, season, or time of day, structure fire response times are generally less than 5 minutes half the time.
- The nationwide 90th percentile response time to structure fires is less than 11 minutes.
- Structure fires in the Northeast have the lowest response times while those in the West have the highest.
- Average structure fire response times show a relationship between flame spread and longer response times, but only after flames have spread beyond the room of origin.

DEFINITION OF RESPONSE TIME

The definition of “response time” depends on the perspective from which one approaches the data. In the fire service, “total” response time is usually measured from the time a call is received by the emergency communications center to the arrival of the first apparatus at the scene. For the public, the clock for response time begins when the public becomes aware there is an emergency incident occurring and the fire department is notified. In reality, however, the response time clock for fire suppression begins at the moment of fire ignition and continues until the fire is extinguished.

RESPONSE TIME COMPONENTS

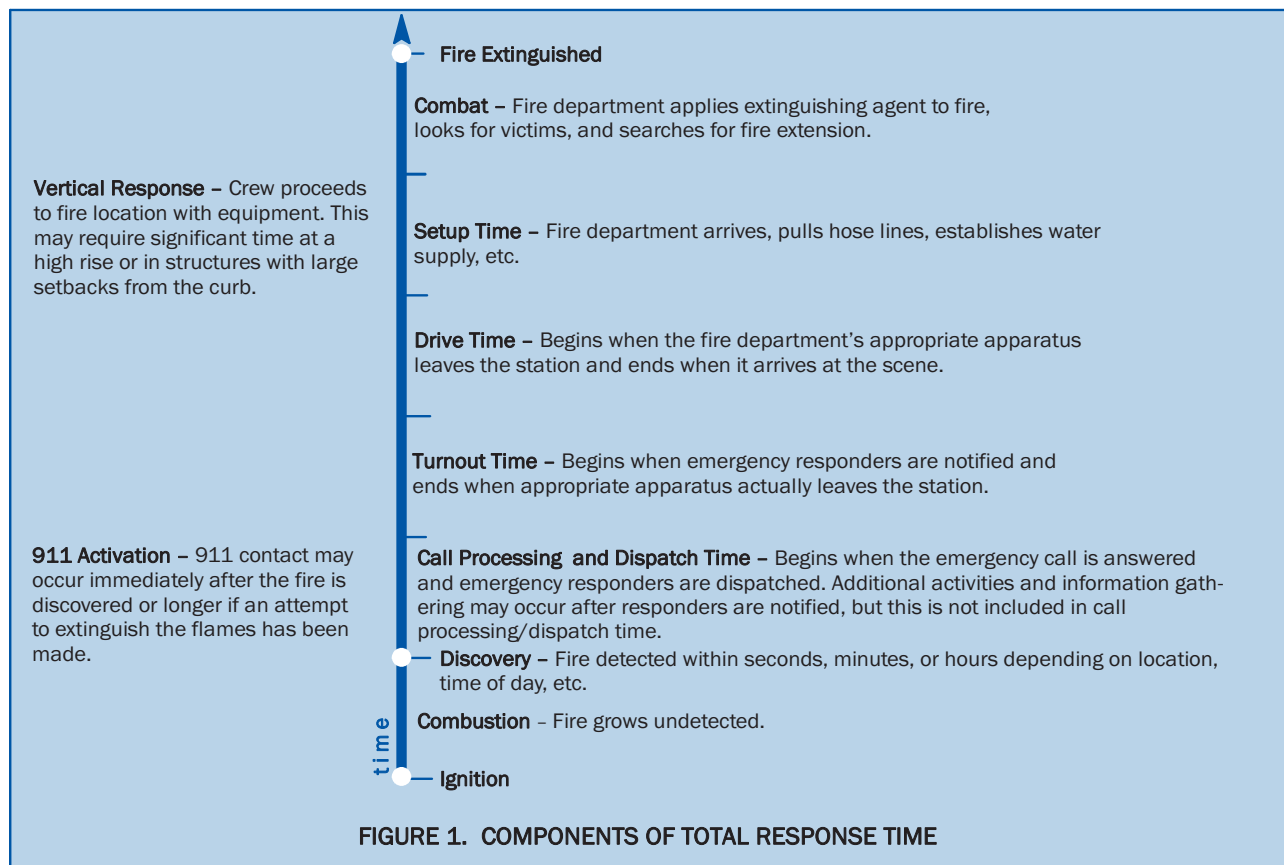
Response time components include ignition, combustion, discovery, 911 activation,¹ call processing and dispatch, turnout time, drive time, setup time, “vertical” response, combat, and extinguishment (Figure 1).

Fire ignition occurs when oxygen, fuel, and heat combine to produce flame. Combustion is a self-sustaining chemical reaction yielding energy or products that cause further reactions of the same kind.² Depending on the available fuel load and other conditions, a fire may grow undetected for some time prior to being detected. Discovery or detection occurs when someone becomes aware of the fire and takes steps to mitigate the situation (e.g., calls the fire department, uses a fire extinguisher). Depending on whether or not one tries to extinguish the fire, 911 activation may occur several minutes after the fire is detected. In the case of an incendiary or suspicious fire (or other criminal firesetting act), this activation might be postponed deliberately.

Once 911 has been activated, *call processing and dispatch* is the time it takes for the 911 operator to ascertain the location and type of incident and alert the appropriate emergency service providers to the emergency.

Turnout time is measured from the time the alarm is received by firefighting personnel to the time the appropriate apparatus begins its actual driving response to the scene. Turnout time comprises getting to the station (in most volunteer organizations), donning protective gear, and other preparatory activities.

Drive time is the time it takes to drive from the fire station (or location that received the alarm) to curbside of the address of the incident.



Setup time begins once a fire engine or other apparatus arrives on the scene and ends after personnel established a water supply, set up necessary equipment, etc. Additional time may be required if the structure is set far back from the curb or in a high-rise where a vertical response is required.

Once equipment and personnel are on the scene and setup is completed, combat time is the period of time required to completely extinguish the fire.

METHODOLOGY

National Fire Incident Reporting System (NFIRS) 5.0 data for 2001 and 2002 were used. If no arrival time was included or if response time appeared to exceed 24 hours, the incident was excluded. Only 0.14% of incidents recorded a response time of more than 24 hours; as such, these were considered as outliers and omitted from the analysis. Incidents classified as automatic or mutual aid were also excluded to avoid double counting. With the exception of flame spread, trends included all structure fires (incident type codes 110 through 123). Only fires with flame spread (incident type codes 110 through 112 and 120 through 123) were included in the analysis of response times related to flame spread.

Data for this study were queried in whole minutes. This means that response times of exactly 4 minutes and those up to 4 minutes and 59 seconds are all included in the 4-minute category. As such, slight differences between 3 minutes, 4 minutes, or 5 minutes are not as substantial as when data are examined more closely (i.e., including the seconds). References to the x-minute range mean everything from x minutes to x minutes and 59 seconds while “less than x minutes” means everything from zero to 1 second below x minutes.

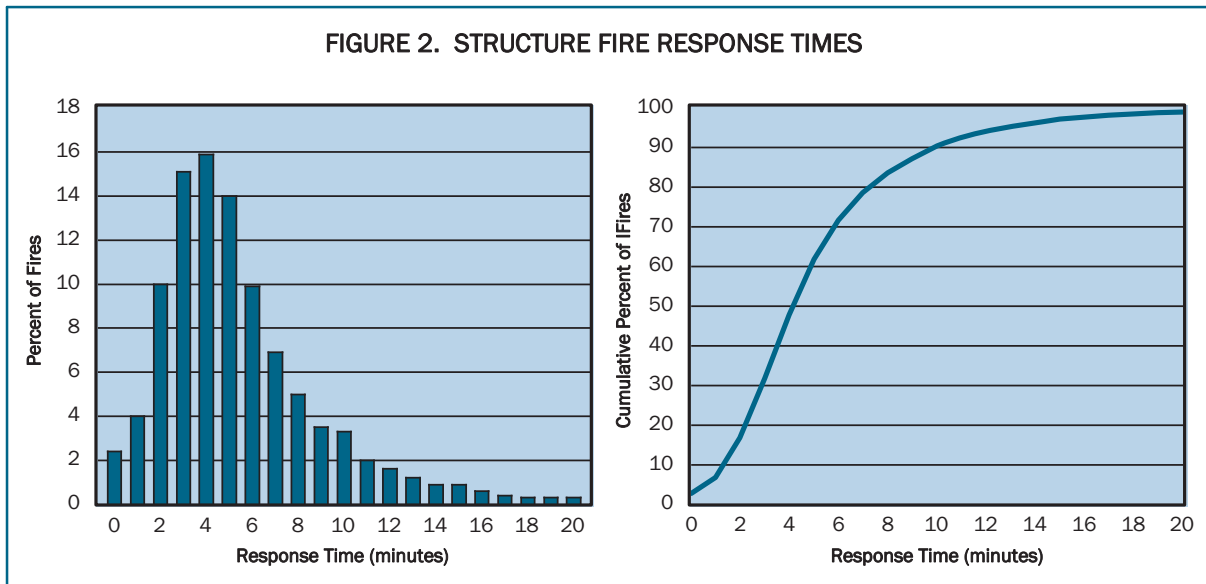
Because the vast majority of response times are 20 minutes or less (98.7%), the charts and graphs in this paper do not reflect response times more than 20 minutes.

Several caveats need to be kept in mind with respect to response times. First, they are subject to a variety of measurement errors when units report their arrival on scene prematurely or belatedly. Second, response times are frequently not comparable across fire-rescue systems because of the differing manners in which they are calculated. Also, it is difficult, if not impossible, to measure some components of response time.

Response times here are measured from alarm time to arrival on scene, but there is uncertainty in the data. NFIRS 5.0 defines alarm time as “when the alarm was received by the fire department.” This definition is vague and subjective. Some departments may read this definition to mean when the notification comes into the 911 communications center (911 activation) while others may read it as when the notification comes into the station (dispatch time). Thus, depending on the interpretation by the department, response times reported to NFIRS may or may not include call processing and dispatch time, which could typically take between 30 and 120 seconds.

GENERAL TRENDS

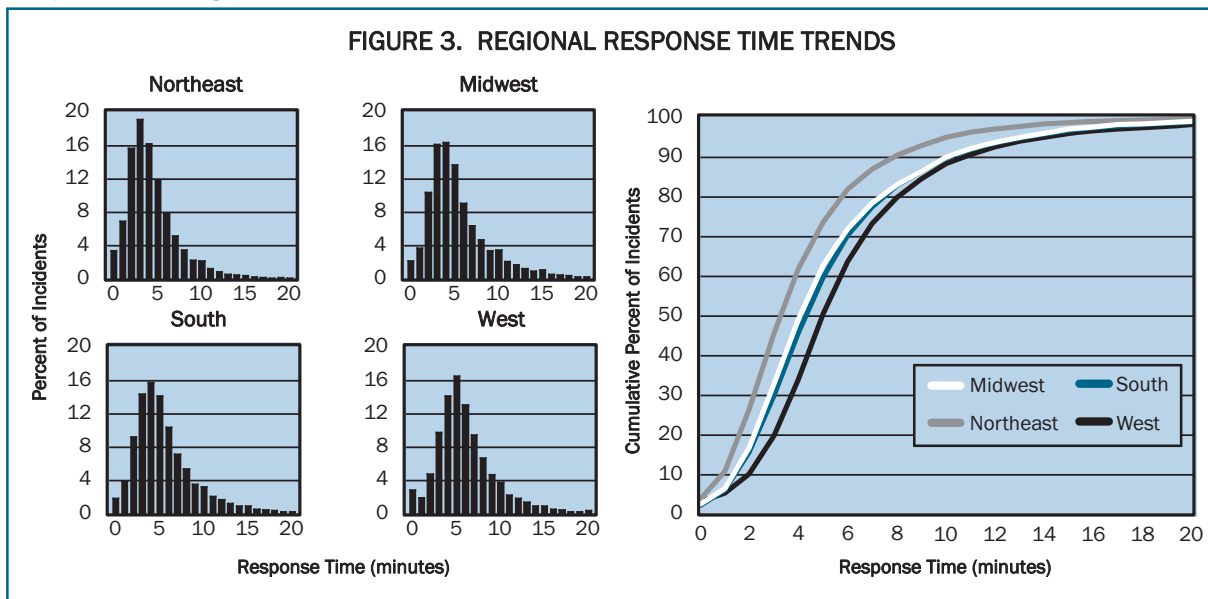
As shown in Figure 2, the highest percentage (16%) of structure fires had a response time in the 4-minute range. The percent of structure fires with response times of 3 and 5 minutes were not far behind at 15% and 14%, respectively. Overall, 61% of structure fires in 2001 and 2002 had a response time of less than 6 minutes.



REGIONAL TRENDS

Regional variation in response time was observed (Figure 3). As the regions move from the Northeast to the West, the percent of structure fires with a response time of less than 5 minutes decreases. The regional differences may be due to population densities. Usually as population densities increase, fire stations are situated so that they cover less and less geographic area, which may contribute to reduced response times. However, more investigation is needed as there is also variability within the regions.³

The peak in response time (minute range with the highest percentage) also moves from lower (3-minute range) to higher (5-minute range) as we move from the Northeast to the West.



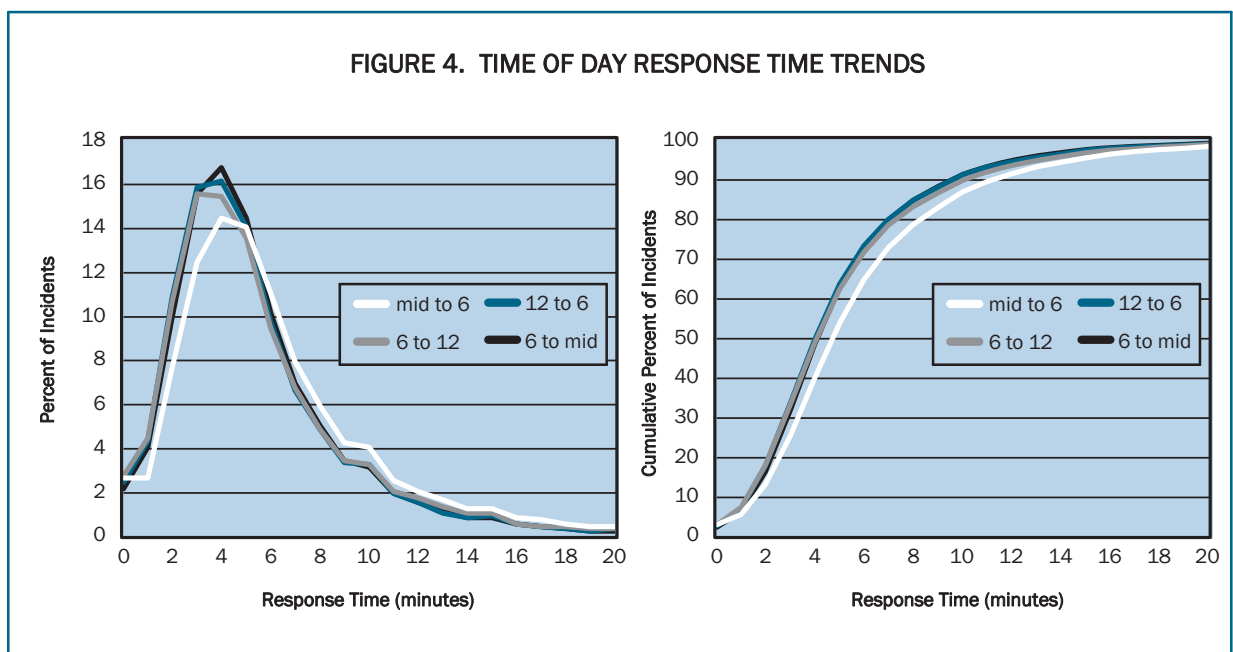
SEASONAL TRENDS⁴

Although the number of fires fluctuates depending on the season, response times to structure fires in 2001 and 2002 were similar throughout the year and are virtually indistinguishable from the national trends shown in Figure 2. Each season, response times peak with 15% to 16% having a response time in the 4-minute range. Throughout the year, about half of fires have response times of less than 5 minutes. Winter has the lowest percentage of calls with a response time of less than 5 minutes (46%). Spring and summer have the highest percentage of calls with a response time of less than 5 minutes (48% each).

TIME OF DAY TRENDS

Regardless of time of day, response times to structure fires peaked at the 4-minute range (Figure 4); however, more fires have a 4-minute range response time between 6 p.m. and midnight (17%) than any other time of day. Between midnight and 6 a.m., only 14% of fires had a response time in the 4-minute range. These results were expected because firefighters—both career and volunteer—tend to be asleep between midnight and 6 a.m. In addition, it is more difficult to see at night and just after awakening, which results in driving more slowly.

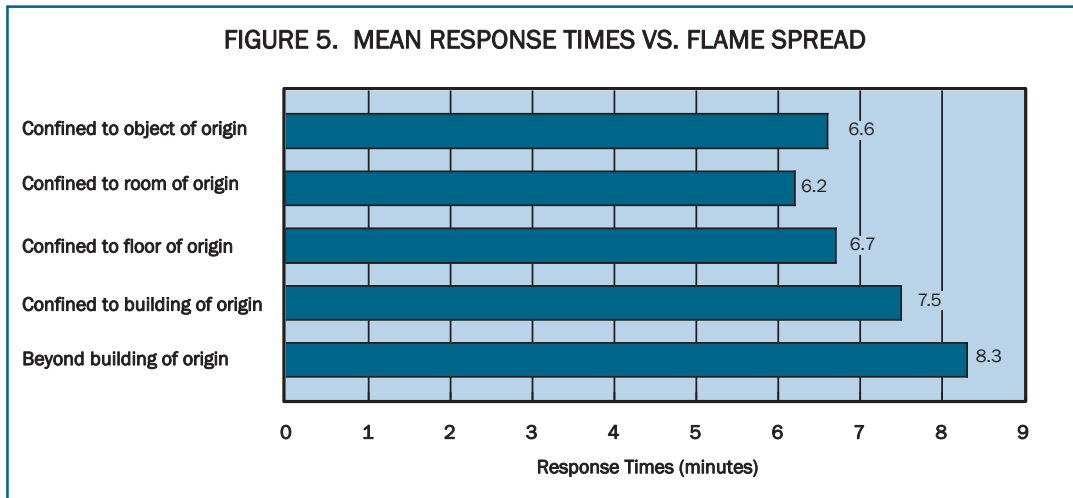
Fires have a better chance of having a response time of less than 5 minutes between noon and 6 p.m. (49%). Only 40% had a response time of less than 5 minutes between midnight and 6 a.m.



FLAME SPREAD AND RESPONSE TIME

The fire service is primarily concerned with how response time impacts flame spread. About half of structure fires confined to the room of origin (51%) and confined to the floor of origin (51%) had a response time of less than 5 minutes. More than half of fires confined to the building of origin (54%) and nearly half of fires beyond the building of origin (49%) had a response time of less than 6 minutes.

Figure 5 shows that the mean response time was lowest for fires confined to the room of origin (less than 7 minutes) while fires that spread beyond the building of origin have the highest mean response time (less than 9 minutes).



CONCLUSION

Despite the differences in time of day, season, or location in the country, there is not a great difference in response times to structure fires as analyzed here. A more detailed analysis may uncover larger differences.

In most of the analyses done here, response times were less than 5 minutes nearly 50% of the time and less than 8 minutes about 75% of the time. Nationally, average response times were generally less than 8 minutes. The overall 90th percentile, a level often cited in the industry, was less than 11 minutes. How much current response times have been impacted by industry standards and fire department goals is not clear.

To request additional information or comment on this report, visit
<http://www.usfa.dhs.gov/applications/feedback>

Notes:

1. Approximately 96% of the geographic United States is covered by some type of 911. *National Emergency Number Association.*
2. *Essentials of Fire Fighting, Fourth Edition, 2001.*
3. The regions of the United States are defined by the U.S. Census Bureau as the *Northeast* (Connecticut, Massachusetts, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont); *South* (Alabama, Arkansas, District of Columbia, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia); *Midwest* (Iowa, Illinois, Indiana, Kansas, Michigan, Minnesota, Missouri, North Dakota, Nebraska, Ohio, South Dakota, Wisconsin); *West* (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, New Mexico, Nevada, Oregon, Utah, Washington, Wyoming).
4. For purposes of this analysis, the seasons are defined as winter: January–March; spring: April–June; summer: July–September; fall: October–December.