EMERGENCY OPERATIONS STUDY

REPORT SUMMARY

International Association of Fire Fighters
1750 New York Avenue, N.W.
Washington, DC 20006

HOUSTON FIRE DEPARTMENT

Houston, Texas

April, 2026

This Report is Dedicated to the Citizens of Houston, Texas who Deserve the Most Efficient and Effective Fire, Rescue, and Emergency Medical Services Available.

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Executive Summary

The International Association of Fire Fighters (IAFF) Headquarters was engaged by IAFF Local 341 to create a data-driven document for the decision makers of Houston and fire department administrators. The document is intended to inform decisions regarding resource management to meet incident demand. Using geographic information systems (GIS) mapping software and examining historical computer-aided dispatch (CAD), patient care report (PCR), and out-of-service (OOS) data, performance and response capabilities were assessed based on the industry standards contained in the National Fire Protection Association (NFPA ®) Standard 1500: Standard on Fire Department Occupational Safety and Health and NFPA 1710: Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments.

This study examines Houston Fire Department's (HFD's) current response capabilities and compares them with a recommended staffing and deployment configuration. Analyses evaluate HFD's ability to meet industry standard objectives and assess the need for additional resources. This study provides recommendations to improve the department's ability to provide effective and efficient emergency responses. The full report is available online.

HFD's response boundary covers the City of Houston. HFD currently operates out of 93 stations, staffing 89 engines, 37 ladders, 41 medics, 5 squads, 57 ambulances, and 5 peak-hours ambulances. HFD also staffs command vehicles and specialized apparatus. The members of HFD provide fire suppression, emergency medical services (EMS) first response and transport, hazardous materials (HazMat) response, search and rescue, watercraft response, and technical rescue coverage to Houston.

HFD operates without adequate resources to provide effective, efficient, and safe emergency operations as required by NFPA 1710. Due to its insufficient number of stations, apparatus, and personnel, HFD fails to meet NFPA standards. Without additional resources, HFD will continue to be unable to provide effective service to the residents of Houston.

Definitions

Study Period: The period from January 1, 2018, through December 17, 2024. The IAFF examined data from this period for this report. Any references to 2024 in this report are limited by the bounds of the study period.

Peak Hours: 8:00 through 20:00 prior to September 20, 2024. 6:30 through 18:30 on and after September 20, 2024.

Off-Peak Hours: Inverse of peak hours.

EMS Unit: HFD staffs 5 types of EMS units: medics provide 24-hour advanced life support (ALS) transport, ambulances provide 24-hour basic life support (BLS) transport, peak-hours ambulances provide 12-hour BLS transport, squads provide 24-hour ALS first response, and airport EMS first response units provide 24-hour first response at the airports.

ETHAN Program: Emergency Tele-Health and Navigation Program. This program, implemented in 2014, "leverages telemedicine technology to connect emergency responders with physicians in real time, ensuring that low-acuity patients receive the most appropriate level of care while optimizing the use of emergency medical resources."[1]

Unit Hour: 1 hour of service by a fully equipped and staffed EMS unit.

Time on Task (TOT): Ratio of total time on task (including treatment and transport when relevant) in hours to the available resources (unit hours). This metric only accounts for direct work (responses to incidents), not indirect work (apparatus maintenance, staff training, equipment retrieval, decontamination, public relations, etc.).

Cover Incident: An incident for which the first-arriving unit is stationed outside the incident's response area, despite a unit of the same type being stationed within that area.

[1] "ETHAN: About Us." ethanhealthlgc.org/about-us/. Accessed 18 Jul. 2025.

Key Findings

- Fire incidents increased from an average of **122** incidents per day in 2018 to **162** incidents per day in 2024 (**34% increase**).
- EMS incidents increased from an average of **810** incidents per day in 2018 to **979** incidents per day in 2024 (**21% increase**).
- In 2018, **31%** of HFD's EMS units exceeded the recommended time on task (TOT) during off-peak hours and **86%** of units exceeded the recommended TOT during peak hours. In 2024, **83%** of HFD's EMS units exceeded the recommended TOT during off-peak hours and **96%** of units exceeded the recommended TOT during peak hours.
- Over the last 200 days of the study period, **56%** of the 41 units in the medic fleet were either busy (responding to a call) or out-of-service (performing indirect work) during the median incident for which a medic was dispatched. Over the same period, **65%** of the 62 peak-hours or 57 24-hour units in the ambulance fleet were either busy or out-of-service during the median incident for which an ambulance was dispatched.
- Over the last 200 days of the study period, there were **211** incidents during which all medic units were unavailable and **63** incidents during which all ambulance units were unavailable.
- Diverting a patient to the ETHAN program rather than transporting the patient yields approximately **50 minutes** of time savings for the responding unit. However, ETHAN program utilization was reduced by more than **52%** over the study period.
- ALS units were required to perform both an ALS intervention and transport for **17%** of EMS incidents when dispatched along with an ambulance.
- In 2023 and 2024, the average engine met the 4-minute travel time standard for **29%** of incidents when it was the first non-command unit on scene, with no engine meeting the standard for more than 56% of incidents.
- When an engine or ambulance was the first non-command unit on scene for incidents within their own response areas, they met the travel time standard for **35%** and **23%** of incidents, respectively. However, when an engine or ambulance was the first non-command unit on scene for cover incidents, they met the travel time standard for **8%** and **3%** of incidents, respectively.
- From 2018 to 2024, cover incidents increased from **14%** to **19%** of incidents with a first-responding engine.
- From 2018 to 2024, cover incidents increased from **11%** to **38%** of incidents with a first-responding ambulance. A large portion of this increase occurred between 2019 and 2020; this increase cannot be attributed to an increase in workload and is likely due to an operational change. From 2020 to 2024, cover incidents increased from **30%** to **38%** of incidents with a first-responding ambulance.

IAFF Recommendations

- Build 10 new fire stations. Staff a new engine at each station. Each engine should be staffed with a minimum of 4 fire fighters.
- Staff 2 new ladders. Each ladder should be staffed with a minimum of 4 fire fighters.
- Staff 65 new BLS ambulances.
- Staff 0 new ALS medics or squads.
- Examine potential causes of low ETHAN program utilization and implement solutions.
- Dispatch 1 medic, rather than 1 medic and 1 ambulance or 1 squad and 1 ambulance, to all EMS incidents expected to require ALS intervention or transport. HFD should still dispatch 1 BLS unit to these incidents as well. For C1 incidents, HFD should dispatch only the closest BLS unit (either an ambulance or a suppression apparatus). For C3 and D1 incidents, HFD should eliminate ambulance dispatches since the closest suppression apparatus will be dispatched by default.
- Collect quality assurance and quality improvement (QA/QI) patient data for EMS transports. Utilize these data to refine an emergency medical dispatch system with active medical direction.
- Require OOS data records to include the type of task (maintenance, training, operational, or public relations) and a task description. Utilize these data to determine the necessary number of reserve EMS units.

Workload Analysis

Between 2018 and 2024, the Houston Fire Department (HFD) experienced an increase in emergency service demand. Fire incidents rose from an average of 122 per day in 2018 to 162 per day in 2024 (34% increase). EMS incidents climbed from 810 per day to 979 per day over the same period (21% increase). This growth in call volume strained HFD's operational capacity and resource availability.

One key indicator of system stress is time on task (TOT), which measures how long EMS units are actively engaged in incidents. In 2018, 31% of EMS units exceeded the recommended TOT threshold during off-peak hours, and 86% exceeded it during peak hours. By 2024, these figures had escalated to 83% and 96%, respectively.

This widespread overutilization has led to frequent unavailability of EMS units during emergencies. Over the last 200 days of the study period, 56% of the 41 units in the medic fleet were either busy (responding to a call) or out-of-service (performing indirect work) during the median incident for which a medic was dispatched. Over the same period, 65% of the 62 peak-hours or 57 24-hour units in the ambulance fleet were either busy or out-of-service during the median incident for which an ambulance was dispatched. During this same period, HFD recorded 211 incidents during which all medic units were unavailable and 63 incidents during which all ambulance units were unavailable. Remedies focused on both reducing EMS workload and increasing the number of EMS units in service were evaluated in this study.

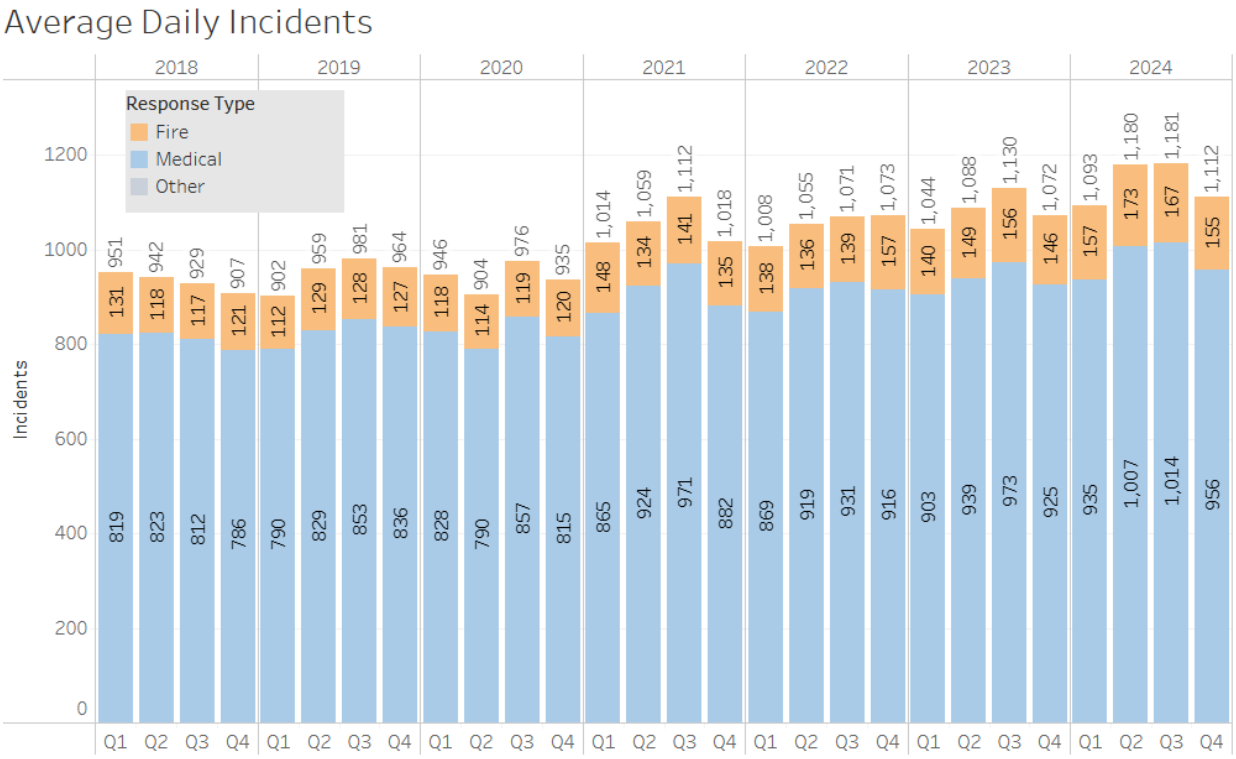
Travel time performance is another major concern for HFD. In 2023 and 2024, the average engine met the 4-minute travel time standard for only 29% of incidents when it was the first non-command unit on scene, with no engine exceeding 56%. EMS units performed even worse, meeting the standard for only 15% of incidents on average, with no unit exceeding 42%.

When engines and ambulances responded within their own response areas, they met the travel time standard for only 35% and 23% of incidents, respectively. This indicates that HFD's station density is insufficient to support timely responses, even under ideal deployment conditions. Cover incidents further exacerbate the issue. For these incidents, engines met the standard only 8% of the time, and ambulances just 3%.

The frequency of cover incidents has increased over the study period. Response areas which house busier units tend to require cover incidents at a higher rate than response areas with less busy units. Accordingly, the increase in HFD's workload will have downstream effects on its travel times. From 2018 to 2024, the percentage of engine cover incidents rose from 14% to 19%. Ambulance cover incidents increased even more dramatically, from 11% to 38%. A significant portion of this increase occurred between 2019 and 2020 and cannot be attributed to increased workload alone, suggesting that an operational change contributed to the shift. From 2020 to 2024, ambulance cover incidents continued to rise, from 30% to 38%.

Call Volume

Over the course of the study period, HFD responded to an increasing number of both fire and EMS incidents.[2] The rate of fire incidents increased from an average of 122 incidents per day in 2018 to 162 incidents per day in 2024 (34% increase). The rate of EMS incidents increased from an average of 810 incidents per day in 2018 to 979 incidents per day in 2024 (21% increase). Over the same period, the rate of unit responses to fire and EMS incidents increased by 20% and 16%, respectively. This indicates that HFD responded with fewer apparatus per incident in 2024 than it did in 2018.



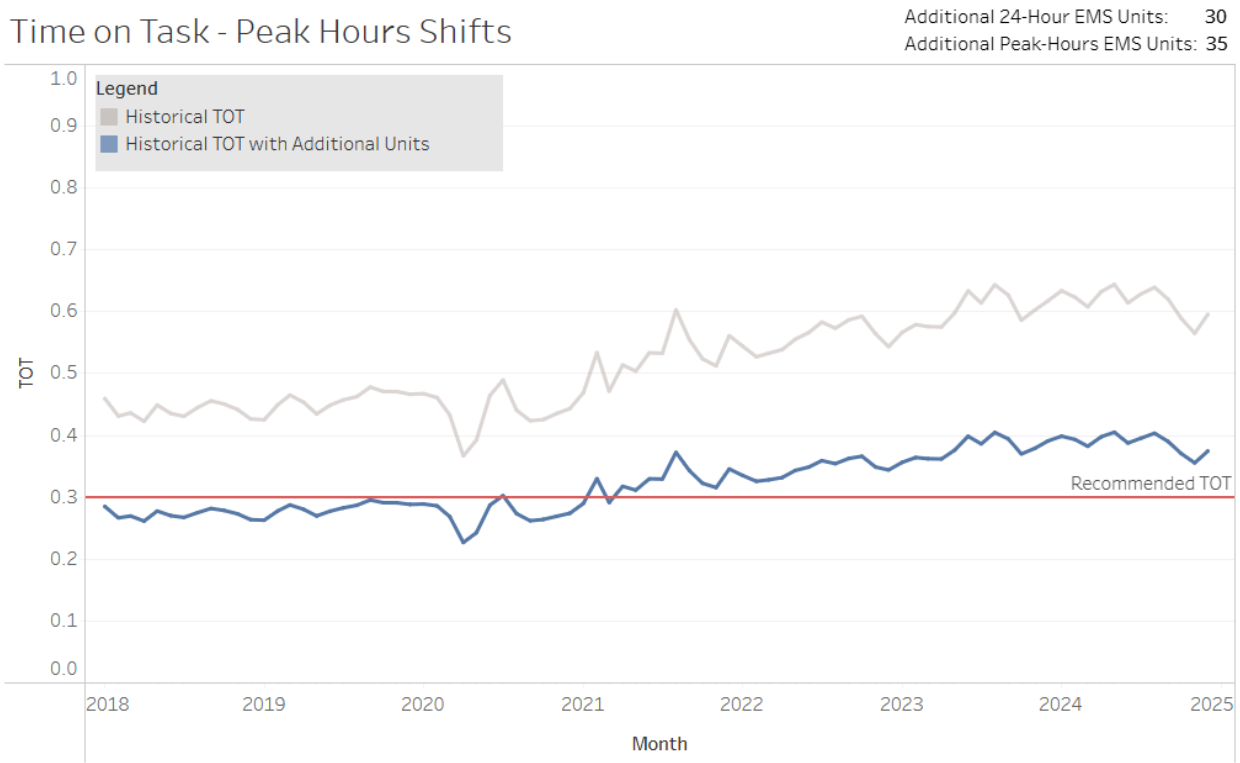
Time on Task

Time on task (TOT) is a metric for estimating the number of frontline EMS units needed to manage demand and provide patient transportation. TOT is the ratio of total time on task (including treatment and transport when relevant) in hours to the available resources (unit hours). For departments like HFD, which utilize personnel from EMS units on the initial fire response or as members of an effective response force, it is recommended to keep the TOT at or below 0.3 to balance system utilization and readiness. Higher TOT increases the likelihood that EMS units will be unavailable or delayed in response to an emergency.

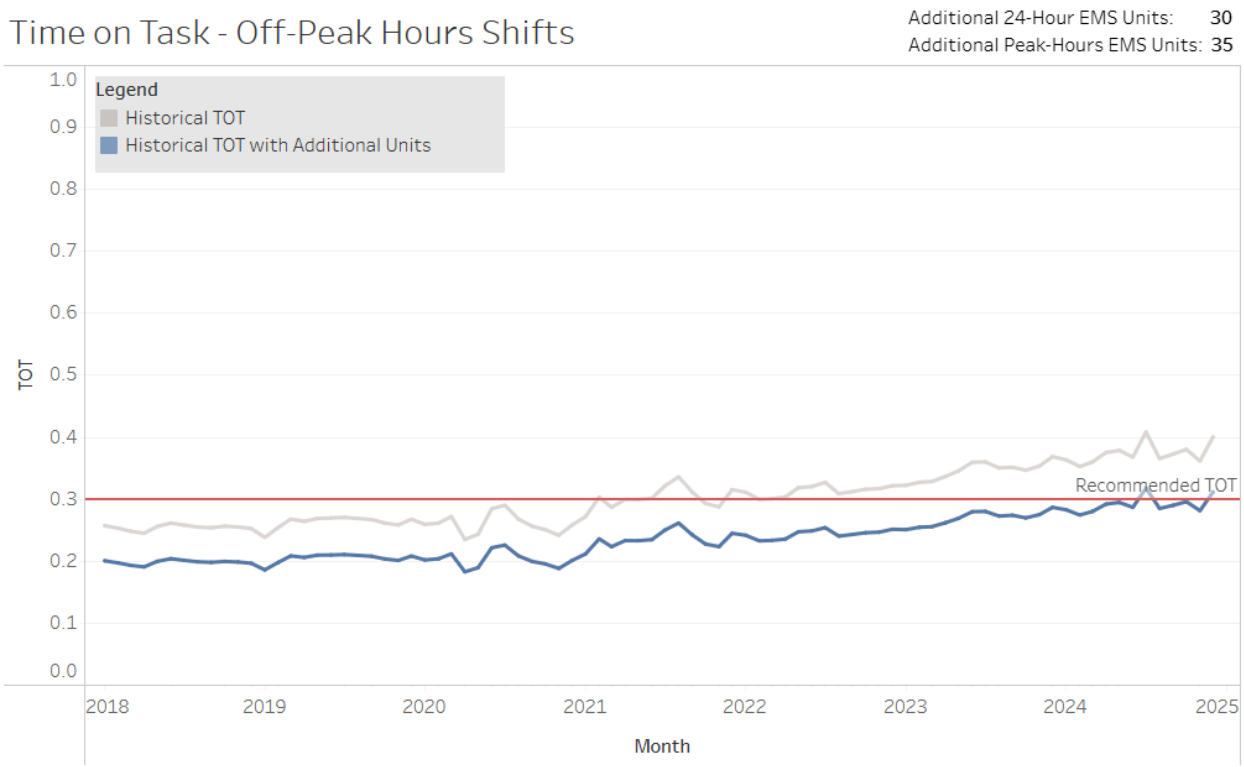
[2] Call volume decreased nationwide in 2020 due to the COVID-19 pandemic.

HFD will need to staff additional EMS units to achieve the recommended system-wide TOT of 0.3 or below. In 2016, FACETS Consulting published a study which recommended that HFD staff an additional 70 peak-hours EMS units.[3] An additional 70 peak-hours ambulances would have reduced HFD's system-wide TOT to approximately 0.25 during both peak and off-peak shifts based on HFD's workload in 2018. However, only 5 additional peak-hours ambulances have been staffed since this report was released and HFD's call volume has increased between 2018 and 2024.

HFD should commit to staffing the remaining 65 EMS units that FACETS recommended. HFD should staff 30 of these units as 24-hour units to address to increase in EMS workload during off-peak hours; HFD should staff the other 35 units as peak-hours units. Based on HFD's workload in 2024, these changes would result in an increase in system-wide TOT during off-peak hours and a decrease in system-wide TOT during peak hours relative to 2018. Overall, the recommended additional 65 units would return the TOT for HFD's EMS units to roughly the 2018 level.



[3] Bryson, William, et al. *Response Time and Staffing Analysis Model for the Houston Fire Department*. Page 80. FACETS Consulting, Aug. 2016.

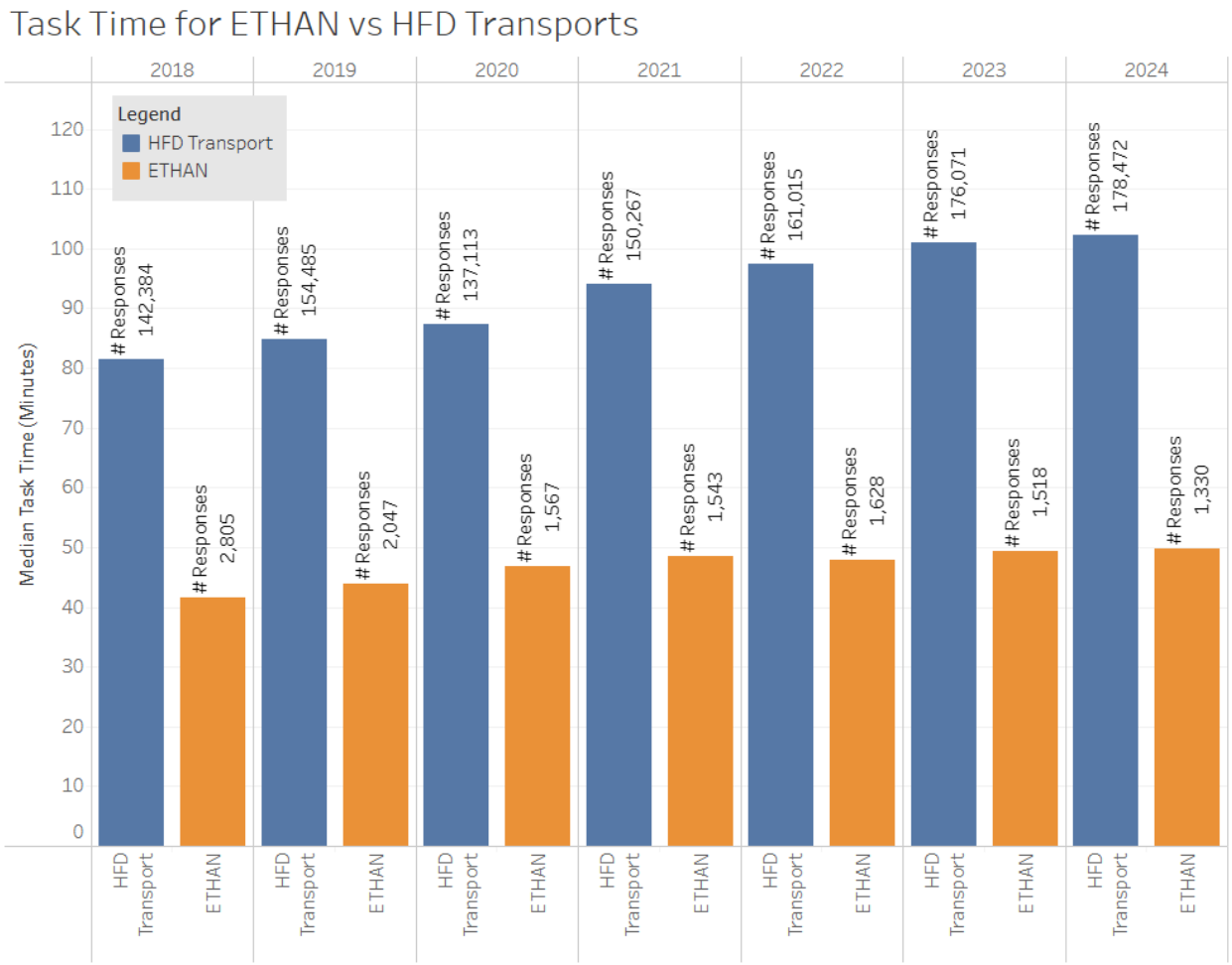


ETHAN Program

The ETHAN program yields substantial time savings for HFD's EMS units by reducing the frequency of patient transport. PCR data were analyzed to determine the extent of the time savings. In 2024, the median task time, defined as minutes from dispatch to available, for responses to EMS incidents requiring HFD patient transport was 102 minutes. The median task time for these responses has risen steadily since 2018, when it was only 82 minutes. In 2024, the median task time for responses to EMS incidents for which patients were diverted to the ETHAN program was 50 minutes. The median task time for these responses has also risen steadily since 2018, when it was only 42 minutes. Accordingly, HFD can expect to save approximately 50 minutes on each response for which a patient is diverted from an HFD transport to the ETHAN program.

Despite the ETHAN program's potential to reduce the workload for HFD's EMS units, the program suffers from low utilization. For incidents with an EMS transport unit (medic or ambulance) dispatched, only 1.9% of patient transports (2,805 total patients) were diverted to the ETHAN program in 2018. By 2024, only 0.7% of patient transports (1,330 total patients) were diverted to the ETHAN program. This report does not identify the sources of the ETHAN program's low and decreasing utilization. HFD should examine potential causes of low ETHAN program utilization (insufficient training, physician availability, technical challenges, etc.) and implement solutions. By maximizing the potential of the ETHAN program, HFD can provide

better service to Houston's citizens, minimize the burden on emergency departments, and reduce workload for its EMS units.



Dispatch Improvements

HFD should improve its dispatch protocols to reduce its EMS workload and minimize unnecessary burden on its ALS units (medics and squads). This section compares workload outcomes for HFD's three ALS dispatch options: dispatching 1 medic, dispatching 1 medic and 1 ambulance, and dispatching 1 squad and 1 ambulance. EMS incidents in 2023 and 2024 which utilized one of the three ALS dispatch options were analyzed to identify possible improvements to HFD's dispatch strategy. In 2023 and 2024, there were 111,727 incidents for which 1 medic was dispatched, 94,913 incidents for which 1 medic and 1 ambulance were dispatched, and 33,925 incidents for which 1 squad and 1 ambulance were dispatched. Fire suppression apparatus (engine, ladder, quint, or rescue) responded to approximately 55% of EMS incidents which received one of the three types of ALS dispatch. There was marginal variation in fire suppression apparatus response rate due to dispatch type; the response rate ranged from 54% to 57% across the three types of ALS dispatch.

The patient time, defined as the time from when a unit arrives at an incident until it returns to service, was analyzed for each ALS dispatch option and transport outcome. HFD has 4 transport outcomes when it utilizes ALS dispatch; there can be no transport, BLS transport (ambulance only), ALS transport (medic only), or ALS transport with an ambulance (squad or medic with an ambulance).[4]

The table below compares the frequency and average patient time for each ALS dispatch option and transport outcome.

ALS Dispatch Option	Transport Outcome	Percentage of Incidents	Medic Average Patient Time (minutes)	Squad Average Patient Time (minutes)	Ambulance Average Patient Time (minutes)
1 Medic	ALS	58%	100		
1 Medic	None	42%	41		
1 Medic and 1 Ambulance	ALS	20%	106		33
1 Medic and 1 Ambulance	ALS with Ambulance	13%	104		95
1 Medic and 1 Ambulance	BLS	31%	35		91
1 Medic and 1 Ambulance	None	36%	43		34
1 Squad and 1 Ambulance	ALS with Ambulance	32%		104	91
1 Squad and 1 Ambulance	BLS	30%		36	89
1 Squad and 1 Ambulance	None	37%		41	32

Overall, HFD can expect the following patient times for each dispatch option:

- 1 Medic: 76 minutes for the medic
- 1 Medic and 1 Ambulance: 61 minutes for the medic and 60 minutes for the ambulance (121 minutes total)
- 1 Squad and 1 Ambulance: 60 minutes for the squad and 68 minutes for the ambulance (128 minutes total)

By dispatching 1 medic to all incidents expected to require ALS intervention or transport, HFD could reduce its total workload. HFD should expect this strategy to increase patient time for ALS

[4] Squad units cannot transport patients. When a squad is dispatched with an ambulance, both units must go to the emergency department for ALS transports. However, 0.1% of incidents with 1 squad and 1 ambulance dispatched (47 total incidents) resulted in a squad only transport.

units by approximately 15 minutes per incident compared to the other ALS dispatch options. This increase is due to the need to perform BLS transports with a medic rather than an ambulance. However, HFD should expect this strategy to reduce its ambulance patient time by 60 minutes relative to dispatching 1 medic and 1 ambulance and 68 minutes relative to dispatching 1 squad and 1 ambulance. The reduction in ambulance patient time does not account for the workload reductions generated by eliminating ambulance turnout and travel time.

HFD should still plan to dispatch a BLS unit to all incidents expected to require ALS intervention or transport. The NFPA standards require an 8-minute travel time for the first-arriving ALS unit at an EMS incident given that a BLS unit was on scene within 4 minutes of travel. Moreover, it is often helpful to have more than 2 HFD personnel on scene for EMS incidents. However, HFD is currently dispatching an ALS unit, a BLS ambulance, and a suppression apparatus to a large share of incidents expected to require ALS intervention or transport. HFD's 2021 EMS response levels state the following:

- C1 – ALS Response: Medic. Ambulance added if closer than selected Medic. Engine or Ladder added anytime it is closer than selected EMS unit(s).[5]
- C3 – ALS Response: Medic. Ambulance added if closer than selected Medic plus Engine or Ladder.
- D1 – ALS Response: Medic. Ambulance added if closer than selected Medic plus Engine or Ladder plus EMS Supervisor.

HFD should eliminate ambulance dispatches to C3 and D1 incidents, since the closest suppression apparatus will be dispatched by default. HFD should dispatch only the closest BLS unit (either an ambulance or a suppression apparatus) to C1 incidents.

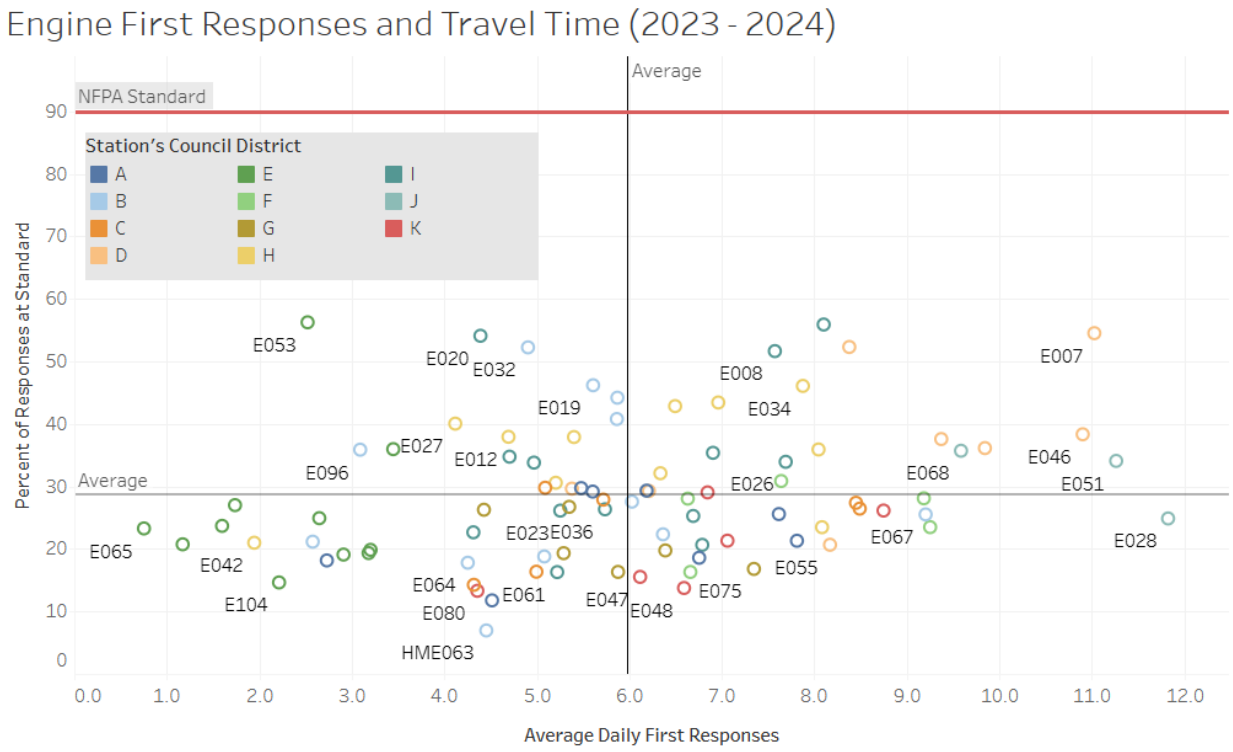
HFD can offset the increase in workload for medic units generated by the shift in ALS dispatch strategy by dispatching ALS units to fewer incidents. For incidents with 1 ALS unit and 1 ambulance dispatched, the ALS unit was required to perform an ALS intervention or transport for 35% of incidents. Furthermore, HFD performed an ALS intervention on only 47% of ALS transports (the ALS unit was required to perform both ALS intervention and transport for 17% of incidents). Some buffer is important when determining whether to dispatch an ALS unit; it is better to dispatch an ALS unit when it is not necessary than to not dispatch an ALS unit when it is necessary. However, given HFD's low availability of EMS units due to high workload, too much buffer causes ALS units to be unavailable when they are needed. HFD could reduce this buffer by implementing an emergency medical dispatch system with active medical direction. This system should be supported by the collection of QA/QI patient data, which should indicate if ALS intervention or transport was necessary for each patient.

[5] These response levels do not include squad responses, since HFD did not staff squad units in 2021.

Travel Time

NFPA 1710 states that the first unit shall be on scene within 4 minutes (240 seconds) of travel to 90% of incidents. This standard applies to engine companies responding to fire suppression incidents and units with automatic external defibrillators or higher-level capabilities responding to EMS incidents.[6] During the study period, HFD was unable to meet the travel time standard. In 2023 and 2024, the average engine responded to 6 incidents per day as the first non-command unit on scene.[7] The average engine met the travel time standard for 29% of its first responses, with no engine unit meeting the standard for more than 56% of its first responses.

Among HFD's engines in 2023 and 2024, there was no association between a unit's average daily first responses and the percentage of first responses that met the travel time standard. Usually, these variables are positively associated. Units stationed in busier areas are typically expected to cover smaller response areas. Accordingly, the proportion of incidents to which those units can travel within 4 minutes tends to be larger. Since there is no association between these variables for HFD's engines, HFD should aim to concentrate new stations and apparatus in its busiest areas.[8]

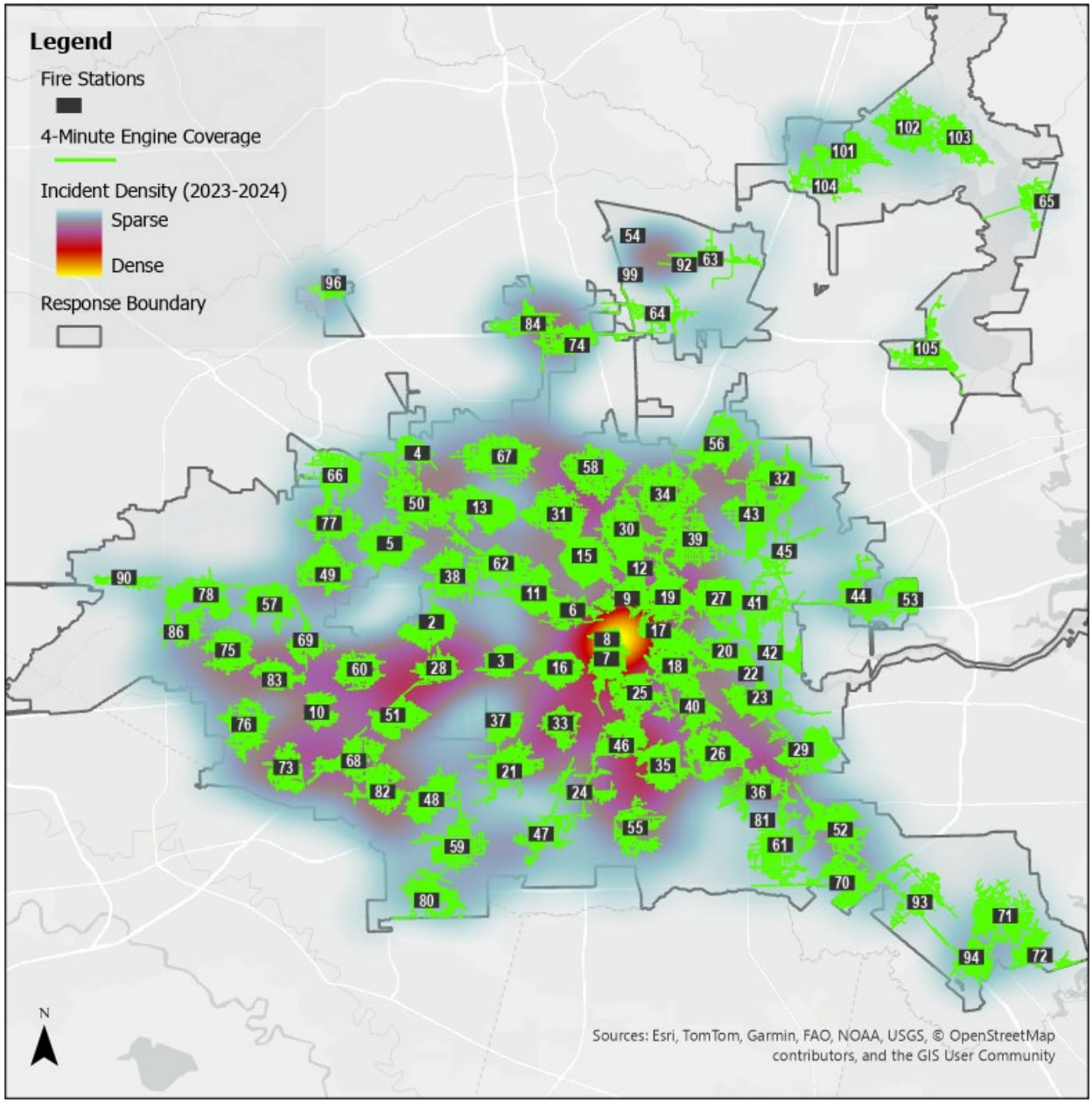


[6] NFPA 1710 §4.1.2.1.3 & §4.1.2.1.7

[7] Travel time analyses only include 2023 and 2024 CAD data to reflect HFD's current staffing and most recent workload.

[8] An explanation of the recommendations for new stations, engines, and ladders is included in the full report.

Use the following map to explore the incident density in 2023 and 2024 relative to the road network expected to be within 4 minutes of travel from an HFD station which houses an engine. The gaps in coverage between HFD's stations are key causes of HFD's poor travel time performance.



Conclusion

HFD is operating under strain driven by rising call volume, insufficient resources, and deployment gaps. Rising TOT, frequent unit unavailability, poor travel-time performance, and a growing reliance on cover incidents all indicate a system that is no longer able to reliably match resources to demand. These challenges compromise response effectiveness, operational efficiency, and firefighter safety, while also limiting the level of service delivered to Houston's residents.

HFD does not currently meet the travel time objectives outlined in NFPA 1710. HFD must build additional stations and staff additional apparatus to address growing gaps in its service. New fire stations, engines, and ladders are necessary to increase the number of incidents which HFD can reach within the relevant travel time standards. Furthermore, growth in call volume and TOT has outpaced growth in HFD's resources from 2018 to 2024. HFD must staff additional EMS units, refine its dispatch protocols, and improve data collection to avoid overburdening its personnel and ensure adequate service for Houston's residents. Implemented together, these measures would improve response times, reduce operational strain, and enhance the safety and effectiveness of emergency services citywide. Without meaningful action, growing demand will continue to outpace capacity, placing both firefighters and the public at increasing risk.

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