Attached is the Auditor’s Office Audit Services Division’s performance audit report examining the City and County of Denver’s emergency medical response system. The audit period was for January 1, 2003 through December 31, 2007. The purpose of the audit was to examine and assess the City’s emergency medical response system and structure to identify possible inefficiencies or weaknesses. This system is operated in conjunction with the Denver Health and Hospital Authority. The audit focused primarily on response times and related processes as a key performance indicator. Though we acknowledge there are other ways to measure performance, response times as performance indicators are a part of the agreement with Denver Health in its role in the emergency medical response system, and are the most meaningful and comprehensible to citizens.

Audit work identified systemic structural weaknesses and limited oversight practices that hinder the City’s ability to effectively monitor and assess the emergency medical response system in a comprehensive, strategic and deliberate manner to optimize the overall system. These limitations result in limited levels of transparency and accountability within the system and emergency medical responses that are longer than the timeframes recommended by Emergency Medical Services (EMS) industry standards.

I am pleased to note that in the City’s response to our audit, the City is moving forward to address issues and recommendations identified by our audit. The City’s commitment to improving the emergency medical response system is admirable and I applaud you for that commitment.

It is distressing however, that emergency medical response times continue to increase year over year, and that Denver Health has not been in compliance with response time measurements as specified in the Operating Agreement during the period audited. Furthermore, they have failed to recognize and adopt accepted standards in their performance goals even though they were adopted by the City in the Building and Fire Code in 2004.

When it comes to public safety and matters of life and death, the public demands and should expect that those entrusted with responding to a medical emergency do so in a timely manner, consistent with industry standards and best practices. Audit analysis and evidence fully support
recommendations presented in this report, and has identified significant opportunities for collaborative process improvements that can improve patient outcomes through improved emergency medical response. While Denver Health is widely recognized for their quality services and staff, they may risk diminishing public confidence if audit recommendations are dismissed.

If you have any questions, please call Kip Memmott, Director of Audit Services, at 720-913-5029.

Sincerely,

Dennis Gallagher
City Auditor

cc: Honorable Members of City Council
Members of Audit Committee
Ms. Kelly Brough, Chief of Staff
Mr. Claude Pumilia, Chief Financial Officer
Mr. Chris Henderson, Chief Operating Officer
Mr. David Fine, City Attorney
Ms. Lauri Dannemiller, City Council Executive Staff Director
Ms. Beth Machann, Controller
Dr. Patricia Gabow, CEO, Denver Health and Hospital Authority
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmittal Letter</td>
<td>1</td>
</tr>
<tr>
<td>Table of Contents</td>
<td>3</td>
</tr>
<tr>
<td>Auditor’s Report</td>
<td>4</td>
</tr>
<tr>
<td>Executive Summary</td>
<td>6</td>
</tr>
<tr>
<td>Background, Scope, Objective, and Methodology</td>
<td>10</td>
</tr>
<tr>
<td>Findings and Recommendations</td>
<td>21</td>
</tr>
<tr>
<td>Appendix A: Table of Approaches to Service Delivery</td>
<td>40</td>
</tr>
<tr>
<td>Appendix B: Timeline of Events</td>
<td>41</td>
</tr>
<tr>
<td>Appendix C: NFPA Audit Alert</td>
<td>42</td>
</tr>
<tr>
<td>Exhibit A – Agency Response</td>
<td>44</td>
</tr>
</tbody>
</table>
AUDITOR’S REPORT

We have completed an audit of the City and County of Denver’s Emergency Medical Response System for the period January 1, 2003 through December 31, 2007. The purpose of the audit was to examine and assess the City’s emergency medical response system and structure to identify possible inefficiencies and opportunities for improvement. Audit work focused primarily on response times and related processes and agreements with third parties as key performance indicators. This performance audit is authorized pursuant to the City and County of Denver Charter, Article V, Part 2, Section 1, General Powers and Duties of Auditor, and was conducted in accordance with generally accepted government auditing standards.

The audit revealed significant limitations in the City’s Emergency Medical Response System. The weaknesses identified, which are disclosed in detail within the accompanying report, hinder the City’s ability to effectively monitor and assess the emergency medical response system in a comprehensive manner to optimize the overall system. Further, they result in limited levels of transparency and accountability within the system and emergency medical responses that are longer than the timeframes recommended by Emergency Medical Services (EMS) industry standards.

Additionally, the City’s reliance on response time as the key emergency medical response performance measure further limits its ability to assess total system effectiveness, since response times have generally not been directly correlated to patient outcomes or measures of clinical effectiveness. Best practices research conducted as part of audit work indicates that effective EMS systems should be monitored using multiple performance criteria. As demonstrated by issues discussed throughout the attached report, the City has opportunities to make improvements in these areas.

We extend our appreciation to the Mayor’s office, agencies and personnel who assisted and cooperated with us during the audit.

Audit Services Division

Kip Memmott, CGAP, CICA
Director of Audit Services

Staff: Ken Kemple, CISA, Deputy Director

To promote open, accountable, efficient and effective government by performing impartial reviews and other audit services that provide objective and useful information to improve decision making by management and the people.

We will monitor and report on recommendations and progress towards their implementation.
Nancy Howe, CICA, Audit Supervisor
Paul Emordi, Senior Auditor
Mary Mutchler, CICA, Senior Auditor
Anita Thompson, CICA, Lead Auditor
Steve Coury, CISA, Audit Supervisor
Aaron Pratt, Senior Auditor
Significant Limitations Identified with City’s Emergency Medical Response System

Audit work determined that the City is not monitoring and assessing the emergency medical response system in a comprehensive, strategic and deliberate manner resulting in limited levels of transparency and accountability within the system and emergency medical responses that are longer than the timeframes recommended by Emergency Medical Services (EMS) industry standards. While these industry standards vary and are not mandated by federal or state law they serve as excellent guidelines and criteria for establishing and monitoring emergency medical response systems. In June 2004, the City formally adopted emergency medical response standards promulgated by the National Fire Protection Association (NFPA). Since the City has adopted the NFPA standards, we have compared 2007 and prior year data to these standards to give a historical view of performance.

Systemic structural weaknesses and limited oversight practices identified by audit work hinder the City from effectively monitoring and optimizing the City’s overall emergency medical response system. Denver’s EMS system is highly complex and fragmented where three different City entities and a large, third party provider perform significant roles. Despite this complexity and fragmentation, there is no single authoritative oversight entity monitoring and managing the entire process. While the Operating Agreement with the Denver Health and Hospital Authority (Denver Health) identifies three performance criteria, the City’s key performance “goal” for emergency medical response performance and reporting focuses on response time, which by itself is not an optimal measure to assess effectiveness of such a critical and complex system directly affecting public health.

Audit work identified the following three general areas of deficiency that demonstrate system oversight weaknesses.

1. Emergency Medical Response Weaknesses in Agreement Between the City and Denver Health – Audit work determined that the current Agreement between the City and Denver Health related to emergency medical response has significant weaknesses and limitations. Specifically, current ambulance response time performance measures lack clarity and are not reflective of industry response time standards, including NFPA standards. Further, the Agreement contains two ambiguous “clock start time” points for the emergency response measurement and audit work determined that Denver Health is currently adhering to a third “clock start time” point that is less restrictive than the two time points currently in the Agreement. In addition to these ambiguities, audit work determined that Operating Agreement objectives have been weakened over the past several years. Specifically, response time measures in the Agreement have been relaxed over time as the “compliance rate” was reduced from 90% (the generally accepted percentage nationally) to 85% in 2003 and the “average aggregate response time” was increased from 6 minutes 30 seconds (6:30) to 6 minutes 45 seconds (6:45) in 2004. Additionally, the list of allowable exemptions has increased from five exemptions in five general areas, in 2002, to eleven current exemptions in nine general areas. These changes, coupled with the movement of the “clock start time” to a time point further along in the response process may serve to artificially improve
calculated and reported response time results and bring into question the meaningfulness of such reporting, thereby limiting the City’s ability to effectively assess response times.

Audit work also determined that the Agreement lacks effective enforcement provisions specific to the emergency medical services section of the Agreement. For example, performance criteria are generally considered to be “goals” rather than specific conditions or requirements of the Agreement. Additionally, the Agreement does not identify specific consequences if Denver Health fails to meet the performance goals established for emergency medical response services. Instead, the City’s remedy for non-compliance, as allowed by the Agreement, is an extensive dispute resolution process, which may ultimately result in voiding the Agreement under the premise of a material violation of the “Standard of Care.” Audit work determined that this remedy may not be a viable option since the Agreement covers a plethora of other services provided by Denver Health to the City. The absence of clear enforceable requirements specific to emergency medical response services hinders the City from properly administering the Agreement.

2. Lack of Comprehensive City Oversight and Monitoring Process for Emergency Medical Response – Audit work determined that the City lacks an effective oversight process for the emergency medical response system. Specifically, the City has not designated an appropriate oversight entity with the level of authority necessary to monitor and manage the emergency medical response system. Weaknesses in reporting related to emergency medical response exacerbate the City’s inability to properly monitor the system in a holistic manner. For example, audit work revealed that the City does not require the measurement or reporting of the time from when a 9-1-1 call is answered to the time a responding unit(s) arrives on the scene (the time period most important to citizens).

Additionally, Denver Health is the only entity involved with emergency response that is currently required to report performance results to an external entity (i.e. the City). The Denver 9-1-1 Communications Center (Denver 9-1-1 or the Call Center) is not currently required to provide analysis or reports of its response time performance to the City and the Denver Fire Department (Denver Fire) limits its response time performance to internal reporting. Further, while Denver Health does report on emergency response time performance relative to Agreement “goals,” audit work determined that reporting is limited and is only required annually. For example, information such as definitions of performance criteria, the number and type of exempted calls, the methodology used to calculate utilization rates, the number of calls outsourced to private ambulance providers, and analyses of Denver Health staffing and fleet deployment practices would enhance the City’s ability to assess holistic system effectiveness and identify systemic problems and process improvements. Denver Fire should collect, analyze and report similar types of information to maximize its critical first responder role.

3. Process Inefficiencies at Denver 9-1-1 – A third contributing factor to system weaknesses involves inefficiencies with the call processing function at the Denver 9-1-1 Call Center. Comprehensive analysis of various Call Center time segments is not effectively performed and the City has not been adhering to industry standards relative to these established time segments, even though NFPA standards were adopted by ordinance in June 2004. These
standards require formal measurement and reporting of Call Center processes. Audit work
determined that the City utilizes a multi-level call screening and transfer process that
creates a level of redundancy that may be unnecessarily time consuming.

Additionally, current Call Center processes are not consistently aligned to maximize the
Computer Aided Dispatch (CAD) system design and data collection. As a result, data
limitations exist which hinder the City from maximizing efficiency and reporting
capabilities. Specifically, our data analysis for 2007 identified a period of time that
averaged 1:31 from the time the CAD system indicated adequate information had been
collected to dispatch an ambulance to the time an ambulance was actually dispatched. Due
to current data and process limitations it is difficult to determine the cause for this
potentially critical time gap. However, one likely contributing factor may concern
ambulance availability. Denver Health personnel confirmed that it is not unusual to run out
of ambulances but they were unable to report on the frequency of such occurrences since
this specific data is not currently captured.

Our data analysis indicated that inefficiencies within the Call Center may impact response
times more than any other factor. Our analysis revealed not only that the Call Center
response time is significantly longer than industry standards but that this segment of time
has increased in recent years. Specifically, the call processing time for Basic Life Support
(Denver Fire BLS) increased 26% from 2004 to 2007, from 3:10 to 4:00, and the call
processing time for Advanced Life Support (Denver Health ALS) increased 37% during the
same period, from 3:26 to 4:43.

Lack of Comprehensive Oversight Has Several Negative Impacts – Limitations identified
with the current City approach for monitoring and managing the emergency medical response
system result in several negative impacts. Specifically,

• **Emergency Medical Response Times Longer Than Industry Standards** – The City’s
  emergency medical response times are longer than industry standards, including NFPA
  standards, which the City adopted by ordinance in June 2004. Audit work determined
  that in 2007, the total time for an ambulance to arrive on the scene from reception of
  the 9-1-1 call was within 15:48, 90% of the time. The City’s ambulance (Denver
  Health) response time was significantly longer than the NFPA goal of responding
  within 10:30, 90% of the time. Additionally, the City’s BLS (Denver Fire) response
time of 10:29, 90% of the time, was significantly longer than the NFPA goal of
  responding within 6:30, 90% of the time.

• **City Unable To Assess Overall Effectiveness of the Emergency Medical Response
  System** – The City’s reliance on response time as the primary performance measure for
  emergency medical response limits its ability to assess system effectiveness since
  response times have not been directly correlated to patient outcomes. As a result, the
  City cannot currently make an accurate assessment of how well the system is
  performing in terms of a key mission, improving patient outcomes. Based on an
  extensive review of industry research and best practices, audit work determined that
  while response time impacts patient outcomes and is often a key measure of system
performance, clinical outcomes specifically related to emergency medical response can also serve as an important indicator of system performance.

**Recommendations** – The Auditor’s Office acknowledges that many variables and system attributes impact the effectiveness of emergency medical response systems. As response time has been identified both nationally and by the City as the key performance measure for emergency medical response systems, we offer recommendations for improving overall performance of the system and maximizing operational efficiencies that can improve response times and ultimately patient outcomes as they relate to response times. We also include recommendations related to the identification of other supporting performance measures to assess emergency response system effectiveness.
Background

Overview of Emergency Medical Services – Emergency Medical Services (EMS) refers to the network of people, equipment, and procedures utilized when responding to medical emergencies. EMS can be thought of as all medical services provided in an emergency setting, including emergency services provided by a hospital. However, EMS as used in this audit report refers only to pre-hospital services provided, which may or may not include transporting patients involved in a medical emergency to a hospital.

The EMS industry generally emerged out of mortuary services and began with simple first-aid treatment. Some jurisdictions, such as Seattle, established paramedic programs within the fire department. Over the last 40 years, the industry has grown to provide more extensive pre-hospital care in an effort to save more lives. Audit work revealed that the industry remains in a state of evolution as new medical technologies emerge and demand for these services increases.

Emergency Medical Response Industry Standards – Audit work identified several industry-based standards-setting organizations that have developed measures and best practices related to emergency medical response. Standards and best practice information promulgated by these groups are referenced throughout the report.\(^1\)

- NFPA – The National Fire Protection Association is an international nonprofit organization that provides consensus codes and standards, research, training and education. As an authoritative source on public safety, the NFPA develops, publishes, and disseminates more than 300 consensus codes and standards intended to minimize the possibility and effects of fire and other risks. In June 2004, the City formally adopted the 2002 NFPA standards as part of the City’s Building and Fire Code.

- CAAS – The Commission on Accreditation of Ambulance Services is a nonprofit agency, which provides accreditation to private, fire-based, volunteer, hospital-based, or municipal medical transportation systems. Accreditation signifies that ambulance services have met the essential factors necessary as determined by the ambulance industry.

- AAA – The American Ambulance Association is a national membership organization representing more than 600 ambulance services with members including private, public, fire-based, hospital-based and volunteer providers. The AAA provides information at the

---

\(^1\) While these industry standards vary and are not mandated by federal or state law they serve as excellent guidelines and criteria for establishing and monitoring emergency medical response systems. In June 2004, the City formally adopted emergency medical response standards promulgated by the National Fire Protection Association (NFPA). Since the City has adopted the NFPA standards, we have compared 2007 and prior year data to these standards to give a historical view of performance.
local, state and national level to aid in improvements in medical transportation and emergency medical services.²

• **ICMA** – The International City/County Management Association provides independent information as well as benchmarking data to those concerned with operational aspects of local government.

**Responsibility for Providing Emergency Medical Response Services** – State law requires that government entities provide certain public health functions. The State can assign the performance of some of these functions to local jurisdictions. Historically, the City of Denver provided EMS under the City’s Department of Health and Hospitals which included the operations of Denver General Hospital. Pursuant to State legislation in 1994³ and commencing on January 1, 1997, the Denver Department of Health and Hospitals was separated from City governance to become the Denver Health and Hospital Authority (Denver Health), a public authority governed by a board appointed by the Mayor and a political sub-division of the State. State legislation indicated that separation from the City would better enable Denver Health to operate in a manner more conducive to its success in the highly competitive arena of the health care industry.

As part of this transition, the City abolished the Department of Health and Hospitals and established the Department of Environmental Health (Environmental Health) to perform some of the functions previously performed by Denver General Hospital. The City of Denver Charter requires Environmental Health to “…administer and exercise control over all programs and functions pertaining to the physical… health of the people…including (the) performance of functions assigned by law to local health departments, health administrators, the environmental health department, or the health officer of the City and County of Denver.”⁴ Enabling legislation allowed Denver Health to enter into agreements with the City, including contracts for the provision of goods, services, and facilities in support of Denver’s health system. An important component of Denver Health’s mission is to “Provide life-saving emergency medicine and trauma services to Denver and the Rocky Mountain region.”⁵

**City Entities Involved in Denver’s Emergency Medical Response System** – There are four entities involved in various aspects of Denver’s emergency medical response system. These are briefly described below:

---

³ Colorado Revised Statutes, Title 25, Article 29, Sections 101-126, entitled “Denver Health and Hospital Authority.”
⁴ Denver City Charter, § 2.12.1, *Department of Environmental Health; powers and duties*.
⁵ Denver Health web site, *About Denver Health*. 
• **Denver 9-1-1 Communications Center** – The Denver 9-1-1 Communications Center (Denver 9-1-1 or the Call Center) is comprised of staff from three entities, operating under their own separate management and supervisory structures, that provide a centralized public safety call-processing and dispatch function for all emergencies within the City. Each of these three entities has a call-taking and a dispatching function. Specifically, there are 9-1-1 operators and police dispatchers under the City’s Manager of Safety, EMS call-takers and dispatchers under Denver Health, and fire call-takers and dispatchers under Denver Fire.

• **Denver Fire Department** – Denver Fire provides the first response function for most medical emergencies in the City. Denver’s first response is designed to quickly provide Basic Life Support (BLS) care until an Advanced Life Support (ALS) unit arrives. Most Denver firefighters are certified as EMT-Basics\(^6\) enabling them to provide this basic medical care. However, because they respond in fire vehicles, Denver Fire cannot transport patients to a hospital.

• **Department of Environmental Health** – Environmental Health has been designated oversight responsibilities for the Agreement between the City and Denver Health. In this role, the Department’s oversight activities are primarily restricted to budgetary matters, receiving and distributing Denver Health’s annual performance report and coordinating the annual Operating Agreement review and update process with various City agencies.

• **Denver Health and Hospital Authority** – Denver Health provides both basic and paramedic level care. The majority of Denver Health’s responding units are ALS units staffed with paramedics. This advanced medical treatment and transport capability are two of the most important functions provided by Denver Health’s units. Additionally, Denver Health provides medical oversight and direction as well as training, quality improvement and research activities to enhance and innovate pre-hospital patient care.

---

\(^6\) In order to practice as an Emergency Medical Technician in Colorado, individuals must first be certified by the State. EMT-Basics (EMT-Bs) are certified to provide basic emergency medical care such as administering oxygen, performing cardiopulmonary resuscitation, splinting, managing bleeding, and taking vital signs. Commonly referred to as paramedics, EMT–Paramedics (EMT-Ps) are also trained in advanced assessment, airway management, and the treatment of a range of medical emergencies that may require the use of medication or advanced interventions. Certification at the EMT–P level includes approximately 10 times the training hours as EMT–B training and involves extensive clinical rotations in a hospital emergency department or an ambulance.
consists of three main sections. The first section identifies “Core Services” provided by Denver Health on an exclusive and perpetual basis. The second section identifies “Non-Core Services” provided by Denver Health that may be initiated or terminated upon agreement by both the City and Denver Health. Finally, the third section identifies services provided by the City to Denver Health. Ambulatory medical response and transport services are among the “Core Services” provided to the City by Denver Health.

**Emergency Medical Service Models and Approaches** – Audit work determined that various jurisdictions maintain unique EMS systems. These systems are established based on numerous variables and complex factors. Two key components of EMS systems are described below.

- **Provider Type** – Provider based systems are essentially defined by which entity provides ambulance response, and transportation service, for the patient. According to a 2007 survey of 200 cities conducted by the Journal of Emergency Medical Services (JEMS), the majority of cities utilize private organizations, followed by fire departments, third service providers, and then hospitals, as summarized in Table 1. Generally, because Denver Health provides ambulance response and transportation services for the City, Denver’s EMS system is considered a hospital-based system.

<table>
<thead>
<tr>
<th>Approach to Service Delivery</th>
<th>Percentage of Cities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Organizations</td>
<td>37.5%</td>
</tr>
<tr>
<td>Fire Departments</td>
<td>28.3%</td>
</tr>
<tr>
<td>Third Service Providers</td>
<td>11.7%</td>
</tr>
<tr>
<td>Hospitals</td>
<td>9.2%</td>
</tr>
<tr>
<td>Other^8</td>
<td>13.3%</td>
</tr>
</tbody>
</table>

  While there are a number of approaches to service delivery, the first four noted above are the most common. Each approach has unique characteristics along with advantages and disadvantages. The table in Appendix A summarizes these most commonly used models, including the primary advantages and disadvantages of each.

- **Tiered Response** – Pre-hospital care is generally divided into two broad categories – Basic Life Support (BLS) and Advanced Life Support (ALS). Regardless of the approach to service delivery used, EMS systems can be single-tiered, providing only one level of emergency medical response services, or two-tiered, meaning there is first response capability for providing more basic level services, as well as a second response capability for providing advanced level emergency medical care and transportation to a hospital. Denver’s EMS is delivered through a two-tiered system, which includes both BLS units and ALS units.

  In Denver, most life-threatening emergency medical calls require both BLS response, usually provided by Denver Fire, and ALS response provided by Denver Health.

---


^8 Other provider types include systems based on: public utility, volunteer, or public/private partnerships.
Although this dual-response seems duplicative, each level of response has a purpose. A two-tiered system is based on the premise that there are two types of emergent calls. The first type is time-critical and response time can directly impact patient outcomes. The second type is less time-critical and positive patient outcomes are based more on the skill level of the responder. Although every medical call may not require the faster BLS response, the premise of the City’s system is to err on the side of over-responding rather than under-responding to medical emergencies.

What Happens in a Denver Medical Emergency? – In Denver, calls for emergency medical response generally follow a timeline as summarized in Figure 1. The process for responding to calls for emergency medical assistance is very dynamic and many calls do not follow this timeline in a linear fashion, however, we will refer to this illustration throughout the body of the audit report because a simplified understanding of the process can augment the reader’s understanding of the topics discussed in the text. It is important to note that this timeline does not include all functions or segments of emergency medical response. Specifically, after a responding unit arrives on scene, there are three additional time segments not included in the scope of this audit analysis: scene time (the time spent at the scene of the incident before the patient is transported to a hospital), transport time (the time to transport the patient to a hospital) and hospital turnaround time (the time from arrival at the hospital to when the ambulance is available for service). Audit work did not include analysis or evaluation of these timeframes.

As shown in Figure 1, the timeline is comprised of the following segments:

---

9 For more detailed information regarding this timeline, see Appendix B.
Call-Processing Time (T-0 to T-2)

Call-processing includes the time from when the phone is answered by a 9-1-1 operator to when there is enough information available for an EMS or Fire dispatcher to assign an appropriate responding unit. The first two sections in Figure 1 comprise call-processing activities. Auditors separated these times to distinguish separation in the call-processing function, but both are colored green in the diagram to illustrate that the City’s Computer Aided Dispatch (CAD) system currently does not capture the T-1 time point.

Figure 2 briefly illustrates the call-taking process. As illustrated in the figure, medical-related 9-1-1 calls are routed through the 9-1-1 operator to a call-taker (either EMS or Fire). Data captured by the CAD system appears on the computer screens of entities involved in emergency medical response.

When a citizen calls 9-1-1, they are connected to an operator who asks the caller a series of questions about the emergency they are reporting, such as the location of the incident, the caller’s name and phone number and what happened (the nature code). If the call involves a medical emergency, the 9-1-1 operator transfers the caller to an EMS call-taker who confirms all the data entered. The nature code selected in the CAD system indicates the type of response needed. Once the type of response is known and entered, the information is automatically
transferred to the computers of a fire dispatcher and an EMS dispatcher, who then dispatch a responding fire unit and a responding ambulance, respectively.

After a unit is dispatched, the EMS call-taker generally stays on the phone to provide the caller with patient care instructions by using National Association of Emergency Medical Dispatch (NAEMD) protocols. Like Denver, 95% of cities in the *JEMS 200 City Survey* reported using emergency medical dispatch protocols to provide pre-arrival instructions to the caller. For example, EMS call-takers might give the caller instructions on how to provide CPR. The EMS call-taker will remain on the phone with the caller until the situation is under control or a responding unit has arrived on scene.

**Dispatch Time (T-2 to T-3)** – The dispatch time begins when there is enough information available in the CAD system to assign the appropriate responder and ends when an available unit is notified and has accepted the assignment to respond. Each division within the 9-1-1 Call Center has their own dispatchers and protocol for dispatching the appropriate unit. For the purposes of this audit, auditors focused on the processes of the Denver Health dispatchers and Denver Fire dispatchers. Both dispatchers typically send the closest available unit based on distance to the scene; however, each dispatcher may use their own discretion when selecting a unit and may account for other variables such as road construction. Based on the nature of the call, dispatchers will send either an ALS unit and/or a BLS unit to respond.

**Chute Time (T-3 to T-4)** – Referred to in the NFPA standards as “Turnout Time,” the chute time is the time between when an available unit is assigned to when it is en route, when the “wheels are rolling.” It is common for ALS paramedics to be in an ambulance when they receive a call, but Denver Fire can have slightly longer chute times because responders are typically in a firehouse when they receive a call, which may add some preparation time to mobilize.

**Travel Time (T-4 to T-5)** – This is the actual length of time it takes to drive to the scene of the incident. For most jurisdictions, the arrival time is based on when the wheels “stop rolling” and not necessarily when the responder arrives at the patient’s side. In fact, only 3.3% of first responders and 2.8% of transport providers report ending their time measurement at the point that they reach the patient’s side according to the *JEMS 200 City Survey*. Arguably, the travel time may be the most difficult segment of response time to control due to many factors beyond the driver’s control. Situations such as road
construction, heavy traffic, single-lane or one-way streets, and natural barriers can cause delays, increasing the travel time for emergency responses.

**Interpreting Emergency Medical Response Time Statistics** – In this report, emergency medical response times are expressed primarily in terms of percentiles rather than averages because most EMS industry standards use percentiles as a means of measuring performance. Within the EMS industry, the most commonly referred to urban response time measurement is 8 minutes 59 seconds (8:59) at 90% compliance. The compliance rate of 90% is known as the fractile or percentile method of calculating and reporting emergency medical response times and is used because it provides a more accurate representation of response times than using averages. More specifically, 90% compliance indicates that nine out of ten calls for service were responded to within the specified time.

Response time averages are more easily understood, because averages take into account both the high and low values and can give a general impression of how long it will take for an ambulance or fire truck to arrive. An average is only an estimate in that actual times may vary with some responses being considerably shorter and some considerably longer than the average. Conversely, percentiles are more an expression of reliability, and are stated in terms of a specific performance level, such as 90%. In order to better understand the differences between averages and percentiles, consider the following hypothetical data. The average time it took for an ambulance to arrive was 10:00 after the call was answered. By contrast, the percentile explains that an ambulance arrived within 13:00, 90% of the time. Stated another way, based on these hypothetical numbers an ambulance will arrive within 10:00 on average (actual time may vary), but you can be 90% certain it will arrive within 13:00. Due to the differences in the way the numbers are calculated they cannot be compared to each other directly. However, both averages and percentiles provide a description and measurement to help understand response times.

**Audit Scope & Limitations**

The audit focused primarily on the City and County of Denver’s emergency medical response structure, response times and related processes, and agreements with third parties as key performance indicators. The audit period included January 1, 2003 through December 31, 2007. Owing to our interest in protecting the privacy of patients, we did not conduct ride-alongs with ALS units from Denver Health, limiting our ability to directly observe and test the ambulance response process. Further, certain key time points in the emergency medical response process are currently not captured in the CAD system, limiting auditors’ ability to analyze specific time frames that might have provided more information regarding overall EMS response times and causes for issues identified with response times.

Finally, as noted in the Methodology section below, audit work included the examination of the reliability of data in the City’s CAD system. Although the data was found to be reliable, audit work aimed to evaluate call data comprehensively. Consequently, audit work did not include a detailed analysis of individual call records.
Audit Objectives

Audit objectives included:

- Evaluating the validity of the response time data in the CAD system and determining what data is included in Denver Health’s internal quarterly reports and Annual Report to the City;
- Determining requirements related to Denver Health’s ambulance response times and the Denver Fire Department’s emergency medical response times and identifying any weaknesses existing with Denver Health’s contract terms as well as contract monitoring and amendment processes;
- Conducting data analyses to establish response times as well as to identify trends and possible root causes of increased response times;
- Determining if emergency medical response times reported by Denver Health are in compliance with Agreement terms and if Denver Fire’s response times are in compliance with identified requirements and goals;
- Documenting the emergency medical response system from the time a 9-1-1 call is received to when a unit arrives on scene;
- Evaluating the emergency response process including specifically considering impacts on response times and identifying potential efficiencies in the dispatch process/system and the City’s two-tiered medical response system;
- Determining Emergency Medical Technician (EMT) staffing levels and ambulance capacity and assessing their impact on response times; and
- Identifying standards, structures and other best practices used by other municipalities and governmental entities regarding emergency medical response and comparing this information to the City’s response times and practices.

Audit Methodology

We utilized multiple methodologies to achieve audit objectives. These evidence gathering and analysis techniques included, but were not limited to:

- Interviewing management and personnel in the Department of Environmental Health, the Denver Fire Department, the Denver Health and Hospital Authority and the Denver 9-1-1 Communications Center to understand the emergency response process and related procedures;
- Reviewing and analyzing the Operating Agreement between the City and Denver Health;
- Directly observing personnel and operations at Denver 9-1-1 to gain an understanding of these segments of the emergency medical response process;
• Flow charting call processing in Denver 9-1-1 to understand, evaluate and determine whether there are potential inefficiencies in the process;

• Researching industry standards, studies and publications related to emergency medical response times and comparing these to the City’s 2007 response times; and

• Conducting a benchmarking survey of six EMS systems to identify demographics, characteristics, policies, procedures, and practices regarding their emergency medical response system. Auditors selected peer jurisdictions as well as jurisdictions that are recognized within the industry as having innovative, high performing emergency medical response systems.10 Auditors collected data from the participating systems via a phone survey. Information provided by the participating systems was cross-checked against backup documentation provided. Audit work included comparing specific indicators across systems to draw conclusions.

Description of Data Analysis – The Auditor’s Office completed a comprehensive data analysis as a key methodology for this audit. For 2007 alone, we analyzed 1,066,841 CAD records (100% of CAD data). Using Computer Assisted Audit Tools (CAAT), the data was filtered and classified for relevance to calculations and all averages and percentiles contained in this report were independently calculated. The population related to EMS and Fire was 177,906 records, which was reduced to 99,523 when limited to actual responses to medical emergencies. EMS calculations were based on a population of 44,218 records, while the Fire calculations were based on 55,305 records. Work activities performed for this data analysis included:

• Obtaining direct and independent access to the historical CAD data warehouse which is hosted by the Denver 9-1-1 Communications Center. This is the same data source that Denver Health uses to produce data to assess compliance with the Operating Agreement. Denver Health does not maintain, host, or have any maintenance responsibility for this data.

• Validating certain Denver Health internal reporting by re-performing their calculations with their programs, but using the data we acquired independently from the Call Center data warehouse. Audit testing replicated their results for 2007 with minimal differences;

• Testing the computer software used by Denver Health to select (filter) and analyzing the data. We concluded their calculations were correct, their filters were acceptable, and found no evidence of data manipulation;

• Independently calculating all averages and percentiles used in this report; and,

• Trending response time data through the years 2004 to 2007 to evaluate whether sections of response times have changed over time.

10 Three of the six participating jurisdictions are similar in structure to Denver’s, meaning they are hospital-based, two-tiered systems – Hennepin County EMS (Minneapolis), Grady EMS (Atlanta), and Wishard EMS (Indianapolis). Pittsburgh EMS and Cleveland EMS are third service providers. Seattle EMS is a fire-based system, but was included because it is often identified as one of the best systems in the country.
We performed data analysis under the supervision of Certified Information Systems Auditors (CISA), and conducted the time interval analysis in compliance with industry standards.

As we performed each step of audit analysis, we monitored several key conditions to ensure our results were reasonable and accurate. Some controls we used included:

- Record counts and control totals;
- Reconciliation with existing reports;
- Charting of data distributions;
- Classifying data to reveal the diversity of certain data fields;
- Calculating statistics to reveal population characteristics, such as data value ranges, the count, total, and average of positive values, negative values, and zeros, as well as displaying the five largest and five smallest values in data ranges; and
- Data scrubbing to eliminate the effect of outlier data values in most calculations.\(^{11}\)

\(^{11}\) The averages and percentiles in this report were calculated using data scrubbing techniques. Upon our examination of the underlying data in the CAD system, we determined that there was variability in the data, which caused time calculations to show unexpected results, such as extremely long times, zero times, and negative times. We considered this outlier data entirely possible and acceptable based on our understanding of how the CAD system collects data and how sometimes the process may not directly correlate to how CAD is designed to collect the data. These conditions do not detract from the integrity of the data or the reliability of the CAD system being able to properly serve its function. For purposes of determining the impact of these unusual or outlier data on calculations, we scrubbed (eliminated) the data from certain calculations for both averages and percentiles. The number of records removed was relatively small (less than 5%). Eliminating outlier data provides numerically more accurate results. The scrubbing criteria was used to eliminate all negative values, zero values in most calculations, and to eliminate time intervals longer than 30 minutes for certain sub-components of a call, and 60 minutes or longer for calculations involving travel time or city averages. For example, in 2007, the average time it took an ambulance to arrive after a call was answered without data scrubbing was 11 minutes 5 seconds. By eliminating the outlier data, the result was 9 minutes 58 seconds. Data scrubbing eliminated only 589 records or 1.33% of the 44,218 records used for this calculation.
Finding: Significant Limitations Identified with City’s Emergency Medical Response System

Audit work determined that the City is not monitoring and assessing the emergency medical response system in a comprehensive, strategic and deliberate manner, resulting in limited levels of transparency and accountability within the system and emergency medical responses that are longer than the timeframes recommended in EMS industry standards. While industry standards vary and are not mandated by federal or state law, they serve as excellent guidelines and criteria for establishing and monitoring emergency medical response systems. In 2004, the City formally adopted emergency medical response standards promulgated by the National Fire Protection Association (NFPA). Since the City has adopted the NFPA standards, we have compared 2007 and prior year data to these standards to give a historical view of performance.

Systemic structural weaknesses and limited oversight practices identified by audit work hinder the City from effectively monitoring and improving the City’s overall emergency medical response system. The system is highly complex and somewhat fragmented where three separate City entities – the Manager of Safety, the Denver Fire Department (Denver Fire), the Department of Environmental Health (Environmental Health) and a large third party provider (Denver Health and Hospital Authority, or Denver Health) perform significant roles.

Despite this complexity and fragmentation, there is no single authoritative oversight entity managing and monitoring the overall emergency medical response process. Further, while the Operating Agreement with Denver Health identifies three performance criteria, the City’s key performance “goal” for emergency medical response performance and reporting focuses on response time, which by itself is not an optimal measure to assess effectiveness of such a critical and complex system directly affecting public health. The City does not currently require performance measures that link emergency medical response time to patient outcomes, and the current system and related processes do not effectively support that analysis. Additionally, the City does not require measurement and reporting of the entire time from when a 9-1-1 call is answered to when a responding unit arrives on scene, which is the time period most important to citizens.

Because of these limitations, the City cannot effectively assess the emergency medical response system and City emergency medical response times are currently longer than industry emergency medical response time standards. Audit testing indicates that medical emergency response times have continued to increase over the past four years. The City should take action to remediate the three critical areas of weakness identified in this audit report. Once the City has established common governance and consistent accountability extended over the entire emergency medical call and response system, appropriate response objectives, performance reporting requirements and Operating Agreement deficiencies can be effectively addressed. Furthermore, these changes will better position the City to conduct an objective and comprehensive assessment of the entire emergency medical response system to ascertain whether the current two-tiered, hospital-based model or alternative structural models are optimal for Denver.
Multiple Factors Contribute to Identified Emergency Medical Response System Weaknesses – Audit work identified the following three general areas of deficiency, which demonstrate weakness with the City’s ability to provide comprehensive oversight over all critical emergency medical response functions.

1. **Emergency Medical Response Weaknesses in the Operating Agreement Between the City and Denver Health** – Audit work identified a number of ambiguities, weaknesses and disparities in the Operating Agreement that inhibit operational transparency and the City’s ability to adequately monitor the level of emergency medical response service being provided to citizens.

   - **Ambulance Response Time Performance Measure Unclear and Not Reflective of Standards** – The current Operating Agreement is inconsistent with and does not include National Fire Protection Association (NFPA) standards that were adopted in City Ordinance in June 2004. Although the City has adopted NFPA standards as part of the Denver Fire Code, entities involved in the emergency medical response process were not subsequently informed of the requirement to adhere to these standards and have not been using NFPA response time objectives as a measure to monitor and improve system performance.\(^{12}\)

     Additionally, ambulance response time goals as stated in the Operating Agreement are ambiguous. Specifically, the Agreement references the Commission on Accreditation of Ambulance Services (CAAS) standards, but does not explicitly require Denver Health to adhere to them. In addition, the 85% compliance rate goal in the Agreement is not consistent with the 90% goal established by CAAS. Specifically, the CAAS standards require that 90% of ALS emergency medical response times be within 8:59, but the Operating Agreement reduces this objective to 85% within 8:59, which makes the “goal” easier to achieve. Benchmark comparisons indicated that all six jurisdictions included in the audit survey utilize a compliance standard of 90% for emergency medical response.

   - **Agreement Has Ambiguous “Clock Start Time” Definitions** – Audit work determined that since 2004 the Agreement has included two “clock start times” designating the beginning point for response time measurement. Further, these start times differ from the actual time Denver Health is using to measure and report response times. The “clock start time” utilized by Denver Health results in a shorter response time than if it was measured from the “clock start times” in the Agreement. This can mask inefficiencies and inadequacies in the emergency medical response system, such as extended call-processing or dispatching times, or the inability of the dispatcher to locate an available ambulance. The differing “clock start times” are as follows:

     1. **Original “Clock Start Time”** – This is the time point “…when the reported address of the patient, the call-back number of the calling party, and probable

\(^{12}\) This requirement was brought to the attention of City officials via an “Audit Alert” issued by the Auditor’s Office on October 16, 2008. See Appendix C.
complaint of the patient are known….” This time point corresponds to the “clock start time” required by the CAAS standards referenced in the Agreement.13 In actual call-processing, this time point can occur when the call is with the 9-1-1 operator (corresponding to a time point between T-0 and T-1) or when it is with the EMS call-taker (corresponding to a time point between T-1 and T-2). However, Denver Health personnel reported that because the Agreement applies only to Denver Health, the start time should only cover the processes directly performed by Denver Health. Considering this point of view, this “clock start time” could correspond to T-2.

2. “Clock Start Time” Modification in 2004 – This is the time point “…when an EMS dispatcher receives the call from the Police or Fire Department.” This time point is ambiguous for two reasons. First, EMS dispatchers do not receive calls or talk to callers. As shown in Figure 2, dispatchers only receive the data transferred to their computer screen. Additionally, the time when the data points in the first “clock start time” are captured can occur when the call is with the 9-1-1 operator (corresponding to a time point between T-0 and T-1) or when the call is with the EMS call-taker (corresponding to a time point between T-1 and T-2). However, Denver Health personnel reported that because the Agreement applies only to Denver Health, the start time should only cover the processes directly performed by Denver Health. Based on this reasoning, the second “clock start time” could correspond to the first “clock start time.”

3. Current “Clock Start Time” Being Used by Denver Fire and Denver Health – This is the time point when the responding unit is dispatched (T-3). Specifically, this “clock start time” measures only the responding unit’s chute and travel times and effectively removes all call-taking and dispatching processes that occur in the Call Center including processes performed by the Denver Health call-taker and dispatcher. Audit work found that this is the “clock start time” that both Denver Health and Denver Fire have been using since 2004 when calculating and reporting response time durations.

- **Performance Criteria Are Considered Goals Rather Than Requirements** – In conjunction with State legislation, as promulgated under Title 25, Article 29 of the Colorado Revised Statutes, the Agreement presumes a collaborative and supportive relationship between the City and Denver Health in providing health care services to the citizens of Denver, including emergency medical services. Under that premise, agencies and personnel view the performance measures in the Agreement as “goals” rather than required levels of service or compliance requirements. Consequently, the specific term “goal” is used within the Agreement instead of the term “requirement.”

- **No Enforcement Provisions** – The Agreement does not identify specific consequences if Denver Health fails to meet the performance goals established for

13 Commission on Accreditation of Ambulance Services, Application Package, Section 201.05.02 Response Time Standards.
emergency medical services. Instead, the City’s remedy, for non-compliance as allowed by the Agreement is to under-go an extensive dispute resolution process, which may ultimately result in voiding the Agreement under the premise of a material violation of the “Standard of Care.”

Audit work determined that this remedy may not be a viable option since the Agreement covers a plethora of other services provided by Denver Health to the City. The absence of clear enforceable requirements specific to emergency medical services hinders the City from properly administering the Agreement. Regardless of provider, high levels of performance can only be assured if there is a clear specification of the requirements and outcomes in terms of response time and productivity and a means of holding the provider contractually accountable for meeting such requirements and outcomes.

In addition to the City’s inability to enforce provisions in the Agreement, there is also a lack of consistent management, enforcement and accountability to ensure timeliness in the other segments of emergency medical response. Specifically, the lack of City established response time requirements for Denver 9-1-1 call processing limits the City’s visibility, oversight and enforcement of any such requirements for this critical function. Additionally, while Denver Fire internally reports their performance results relative to their established emergency medical response time goals, there are currently no consequences established or enforced by the City when these goals are not realized. The ability of the City to impose sanctions or other penalties for non-performance can help the City more effectively manage and monitor the system and ensure time performance meets established criteria.

- **Response Time Measures Have Been Relaxed Over the Years** – A comparative analysis of the amendments to the Agreement from 1997 through 2007 revealed that other provisions of the Agreement have been revised over time to result in less restrictive performance criteria elements. Specifically, audit work found that in 2003 the “compliance rate” was reduced from 90% to 85%, and in 2004 the “average aggregate response time” was increased from 6 minutes 30 seconds to 6 minutes 45 seconds. The Agreement attributed the necessity of these changes to issues with the CAD system, and further indicated that the more stringent objectives would be reinstated once these issues had been addressed. These changes, coupled with the advancement in “clock start time” and the increase in the number of calls exempted

---

14 Operating Agreement between the City and County of Denver and Denver Health and Hospital Authority, January 1, 1997. Article I entitled “Definitions” states that “Standard of Care” shall mean “the then current community standards for health care services by similar health care providers located in the City metropolitan area; provided however, that if no similar health care providers are located in the City metropolitan area, then the then current national standard shall be considered. The performance criteria for each Core Service set forth in the respective Appendix shall be considered a part of the initial Standard of Care for each Core Service.” In the event that the City determines Denver Health has failed to meet or comply with the performance requirements of the Agreement to the extent that a material violation of the “Standard of Care” has occurred, the two parties must follow an extensive dispute resolution process before such a violation could result in the termination of that service. That dispute resolution progressively includes: 1) mediation between the parties via a designated Liaison; 2) negotiations between the senior executives of each party; 3) facilitated negotiations via an appointed Task Force; 4) specific allowances for corrective action, etc.
for “good cause” (discussed below), can serve to further reduce calculated response
time durations without a corresponding decrease in actual response times.

- **Call Exemptions Expanded Over Time** – Over time, the call types that can be
  removed from response time results and therefore excluded from performance
  reporting as “good cause exemptions,”\(^\text{15}\) has expanded. Specifically, the Agreement
  lists specific calls and response situations that may be exempted from response time
  summations for “good cause.” Audit work determined that over time the list of
  allowable exemptions has increased from five exemptions in five general areas in
  2002 to eleven exemptions in nine general areas currently.\(^\text{16}\) The increasing list of
  exemptions without specific reference to industry guidelines or benchmarks regarding
  the need for and appropriateness of such exemptions could serve to eliminate calls
  that are longer than the parameters of any performance measures.

- **The Agreement Does Not Define Terms and Conditions for the Use and Oversight
  of Private Ambulance Providers** – Denver Health obtains assistance to handle the
call volume from private ambulance companies in periods of call overload or when
there are no Denver Health ambulances available to respond to a call. Denver Health
primarily uses six private ambulance companies located in the area.\(^\text{17}\) However,
audit work found that Denver Health only had formalized agreements with two of the
six companies. The lack of any provisions in the Agreement regarding Denver
Health’s use of private ambulance companies, in addition to the lack of any
formalized agreements between Denver Health and private companies could
potentially create liability for the City and may further hinder the City’s ability to
monitor compliance with response time goals and standards.

2. **City Lacks Effective Emergency Medical Response System Monitoring Process** – In
addition to current Agreement weaknesses and limitations, audit work determined that the
City does not utilize a consistent effective, comprehensive approach for monitoring
emergency response performance across all segments.

- **Lack of a Single Authoritative Oversight Entity** – Audit work determined that the
City lacks a single point of accountability that provides oversight and coordination of
Denver’s entire emergency medical response services operations. While

---

\(^{15}\) “Good cause exemptions” are used for calls that have extended response times due to uncontrollable
circumstances or that are missing certain data elements. Such calls are excluded from response calculations.

\(^{16}\) The current Agreement specifically identifies eight “good cause exemptions” relative to such items as obstacles
that could impede response times. Those exemptions include: 1) inaccurate information from the caller; 2) changes
to the original address; 3) road construction or trains; 4) severe weather; 5) protocols not followed by EMT
responders; 6) ambulances already on the scene; 7) incidents of multiple ambulance responses; and 8) mutual aid
responses to other communities. However, the Agreement also specifies that in compiling response time
compliance data, compilations may also exclude such data as: 1) test or training calls; 2) calls whose priority
changed during the responses; and 3) data capture errors. This effectively identifies a total of eleven exemptions.

\(^{17}\) These companies include: Action Care Ambulance Inc., Rural/Metro Ambulance, American Medical Response,
Columbine Ambulance Corporation, Northglenn Ambulance Services, and Pridemark Paramedic Services. In
addition to these companies, Denver Health has entered into mutual aid agreements with numerous agencies
throughout the metropolitan area for the provision of emergency medical response services.
Environmental Health has been designated an oversight role, audit work determined that the Department only conducts limited oversight activities, primarily restricted to budgetary matters, receiving and distributing Denver Health’s annual performance report and coordinating the annual Operating Agreement review and update process with various City agencies. The Department lacks authority and possibly resources to effectively monitor and manage this area of the Agreement. For example, while the City and Denver Health conducted regular meetings over a five-year period to discuss such issues as “right sizing”\textsuperscript{18} the emergency medical response system, few decisions or actions were evident in meeting minutes. The ability to make decisions and take action to make systemic improvements is hindered without an entity that has clear and comprehensive governance authority.

Emergency medical response best practices research revealed that an independent oversight entity is an essential component of an effective system.\textsuperscript{19} Additionally, audit benchmarking found that two of the jurisdictions surveyed (Grady EMS and Hennepin County) have an oversight council or board. Hennepin County’s oversight entity has the authority under ordinance “…to develop and recommend acceptable practice and protocols for the operation of the EMS system….\textsuperscript{20} Hennepin County’s EMS council is also charged with establishing standards and monitoring all ambulance providers’ response times.

- **Ineffective and Limited Reporting** – Audit work determined that weaknesses in reporting related to emergency medical response exacerbates oversight issues and the City’s ability to monitor the system effectiveness.
  - **The Entire Response Time is Not Measured or Reported** – The City does not require measurement or reporting of the time from when a 9-1-1 call is answered to when a responding unit arrives on scene. Specifically, in measuring and reporting emergency medical response times, both Denver Health and Denver Fire include only the chute and travel times (T-3 to T-5). Personnel from both Denver Fire and Denver Health, as well as three of the six benchmark jurisdictions reported that they measure time in this manner because they believe it is the only time segment of the response process where they have direct control and are not reliant on the actions of other entities. This acknowledgement further illustrates the fragmented nature of the system.

\textsuperscript{18}“Right-Sizing” is a term used in system examination to ensure that resources are properly allocated, and no more than the appropriate number and type of units are sent to an emergency situation. Auditors noted this term used in Agreement negotiation meeting minutes reviewed.

\textsuperscript{19}The American Ambulance Association (AAA) identifies an independent oversight entity as one of its five hallmarks for an effective EMS system. “Independent oversight promotes performance accountability by giving the overseeing entity the authority and the tools to improve service or safely replace a non-performing provider. Independent oversight is accomplished by creating a true arm’s-length relationship between an overseeing entity and the provider organization. The independent oversight entity is responsible for monitoring and routinely reporting the provider’s performance and compliance in clinical excellence, response-time reliability, economic efficiency, and customer satisfaction. The oversight entity also requires periodic independent expert audits of the service’s performance against other high-performance services.” \textit{EMS Structured for Quality: Best Practices in Designing, Managing and Contracting for Ambulance Service.} American Ambulance Association, 2008, p.11.

\textsuperscript{20}“Emergency Medical Services Ordinance for Hennepin County”, Ordinance Number 9, Amended June 1, 1999.
and the issues that can result from the lack of a single oversight entity and reporting structure to monitor and manage the City’s emergency medical response system in a comprehensive manner.

- **Not All Agencies Report Response Time Performance** – Via the terms of the Agreement, Denver Health is the only entity in the City’s emergency medical response system required to report performance results to an oversight body. No equivalent performance reporting requirements exist for the City entities involved in the process. As a result, Denver 9-1-1 is not required to provide reports or analysis of its response times. Denver Fire’s response time results are reported internally but are not actively evaluated or utilized to improve performance by an external oversight entity. This inconsistency in reporting makes it more difficult for the City to assess response times for the whole system and to consistently hold City agencies accountable for working together to optimize total response time performance consistent with City requirements.

- **Limitations With Denver Health’s Reporting Required by the Operating Agreement** – As noted, while the Agreement requires Denver Health to report on response time performance, it does not require Denver Health to report sufficient detail regarding response times and related analysis to adequately assess performance, and only requires annual reporting by Denver Health. Audit worked noted that Denver Health’s annual performance reports to the City primarily consisted of the following three “line items:” the prior year’s compliance rate expressed as a percentage, aggregate average response time, and transport utilization rate.

Further, the Agreement does not identify definitions for the performance measures. For example, the ambulance utilization rate is not defined in the Agreement and it is unclear what result would indicate a problem in the EMS system.

Audit work determined that additional information could enhance transparency and performance reporting including such items as: total annual number of emergency medical responses, definitions of the performance criteria, the number of calls removed under each type of exemption allowed by the Agreement, the number of calls outsourced to private ambulance companies, and comparisons to prior years’ results.

In addition to the absence of key data in Denver Health performance reports, audit work determined that queries used to produce Denver Health’s compliance data and the resulting data are not validated by the City (i.e. the accuracy of the reports are not verified). While audit testing found that the 2007 Denver Health query results were reliable, this lack of oversight could be connected to or exacerbate the weaknesses concerning call filtering practices and “clock start time.”
Exempt Calls Not Reviewed or Analyzed – In addition to the increased number of “good cause exemption” categories filtered out of response time data when calculating emergency medical response time compliance, audit work found that the City does not review or analyze calls filtered out under these exemptions. 21 If the filtered data were segregated and reviewed, the City could evaluate such things as the number of records filtered out and whether there are identifiable trends, such as an increase in the number of calls filtered out in specific exemption categories and whether calls being exempted actually meet stated exemption criteria. Consequently, this important data source available to assess response time delays is not being utilized. CAAS standards require that response time exceptions be identified using response time reporting tools, and that the agency utilize this information to guide operational changes. 22

Limited City Oversight and Analysis of Key ALS Response System Components – Audit analysis determined that the City does not review or assess key components of the ALS response system, such as ambulance staffing and deployment practices and related utilization data. Audit work included an evaluation of operational monitoring and analyses performed by Denver Health to determine how staffing and deployment decisions are made and whether strategic decisions are driven by data. We found that while Denver Health utilizes a well-accepted approach for ambulance placement 23 using criteria such as the volume of calls by city location and the maintenance of paramedic skills to determine staffing levels, the decision whether to staff additional ambulances is primarily governed by one criterion – whether Denver Health is meeting the response time goals set out in the Agreement.

City Does Not Review Denver Health Ambulance Staffing and Fleet Deployment Practices – The City does not review or assess Denver Health’s approach and strategy for ambulance staffing and deployment. This lack of oversight can be a barrier to effective and comprehensive system evaluation and management. Denver Health personnel indicated that ambulance staffing requirements are primarily based on service demand. Interviews with Denver Health management revealed that prior to 2006 Denver Health utilized an “ambulance oriented” staffing process. Under this approach, Denver Health

21 As discussed in the Scope and Limitations section, audit work did not include testing of exempted calls in the CAD system.
22 Commission on Accreditation of Ambulance Services Application Package, Section 201.05.04 – Response Time Monitoring states “Trends in response times exceptions will be identified from the Response Time Analysis Reports. Operational changes shall be implemented, and ongoing reassessment of the need for further operational changes will continue until the trend in response time exceptions is no longer present.”
23 Based on Denver Health’s Ambulance Posting policy/procedure effective January 1, 2008, Denver Health utilizes a dynamic dispersal system to provide ambulance coverage for the City, where ambulance units are either assigned to various posts or are in continuous motion throughout the City. As ambulances are assigned to calls, the system dispersal is modified to reposition the remaining ambulances to provide optimal coverage. Ambulance posting is based on a variety of factors, including the number of available ambulances as well as the current posting position of available ambulances.
staffed a specified number of ambulances for each shift. Management reported that this staffing approach led to high overtime costs, resulting in the adoption of a new staffing approach in 2006.

Under the new approach, the available number of paramedics generally drives ambulance staffing decisions. Specifically, although Denver Health reviews the number of calls by hour of the day and day of the week to determine scheduling requirements, they generally allocate ambulance resources based on available staffing levels as opposed to staffing a pre-determined number of ambulances. Denver Health personnel reported that they are understaffed in regards to paramedics but also noted that they believe they are in compliance with response time requirements in the Agreement.

While this staffing approach enables Denver Health to contain costs it may hinder them from performing more strategic analysis to assess the adequacy of current staffing levels and its ambulance fleet. Further, the staffing approach increases the incentive to adhere to the least restrictive approach possible for response time measurement and reporting since poor response times may lead to increased personnel and fleet costs.

Regardless of any approach used, the City could enhance its oversight of the ALS response system by receiving and assessing regular reports on ambulance staffing and deployment practices. While statute limits the City’s role regarding Denver Health’s internal operations, the City can establish the standards of care that it expects in the delivery of services that may be impacted by ambulance staffing and fleet deployment requirements.

- **Need for Enhanced Workload Analysis Reporting** – While Denver Health is required to provide the City with information on ambulance utilization, current reporting only includes data on one element of utilization. Specifically, Denver Health computes two utilization rates. The response unit-hour utilization ratio (response UHU) is a measure of responses (i.e., number of calls where ambulances are dispatched) and the transport UHU is a measure of patient transports. These measures provide information on responder workload. However, while Denver Health is currently required to report only the transport UHU, the City could also require that Denver Health report the response UHU because reporting a transport measure only captures part of responder workload. In other words, because emergency

---

24 Benchmarking work indicated that Wishard EMS in Indianapolis has begun using a software package to enhance predictive analyses and resource deployment. Denver Health has expressed interest in purchasing the same software.

25 Unit-hour utilization (UHU) is a measure of a system’s efficiency and workload. UHU is calculated by dividing the total number of responses or transports into the total number of “unit hours” that an ambulance is staffed and equipped to respond.

26 Auditors attempted to verify the transport utilization rates that Denver Health reported to the City in Annual Reports from 2003 through 2007 against internal Denver Health records but were unable to do so because Denver Health records were incomplete.
medical responses do not always result in patient transport, the response UHU may provide a better measure of responder workload.

Three of the six benchmarking systems surveyed provided their response UHU. Of these jurisdictions, Denver Health had the highest response UHU of 66%. This could be an indication of an excessive demand on ambulances that might result in increased response times and responder fatigue, and could in turn increase the risk of other negative impacts such as errors and accidents.

3. **Process Inefficiencies at Denver 9-1-1** – Audit work identified inefficiencies related to the call-intake and dispatch process at the 9-1-1 Call Center that appear to be negatively impacting response times. Our data trend analysis revealed that 9-1-1 call-processing times appear to be increasing.

- **Call Processing Inefficiencies** – For emergency medical calls, the 9-1-1 operator collects all of the information necessary for dispatch and then transfers the call to an EMS call-taker. Upon accepting the call, the EMS call-taker then re-verifies this information by asking the same questions of the caller. Upon verification, the information is automatically transferred to the dispatcher’s computer screen, and the dispatcher will then dispatch a responding unit to the scene of the incident. This multi-level call-screening process is time consuming and appears to be unnecessarily duplicative. In addition, the process in the EMS division of the Call Center involves waiting to dispatch a unit until the EMS call-taker has processed the call. This may cause additional delays because the call is not necessarily transferred to a dispatcher immediately.

Audit work determined that the City has not established response time goals for the 9-1-1 Call Center and currently does not capture appropriate response times for the call-processing portion of the emergency response process. This lack of comprehensive oversight inhibits the City’s ability to assess the Call Center’s performance relative to established goals and objectives over time. NFPA and CAAS standards include reporting guidelines and requirements for Call Center response times. For example, under NFPA 1221, the 9-1-1 Call Center should record and analyze call and dispatch times monthly and the statistics should be compiled over a one-year period.末端注解27 Under NFPA 1710, Denver Fire is required to evaluate its performance by geographic area on an annual basis and provide a written report to the Authority Having Jurisdiction (AHJ) every four years.末端注解28 Additionally, CAAS standards require “analysis reports for all response time standards, and all geographic areas” on a weekly, monthly and annual basis.末端注解29

---

29 CAAS Standards Application § 201.05.03.
**FINDINGS AND RECOMMENDATIONS**

- **CAD Data Collection and Analysis Limitations & Issues** – The CAD system as currently configured and utilized is unable to capture some time-related data points in the emergency response process. For example, as previously discussed, the system does not capture the time a call is transferred from the 9-1-1 operator to the EMS call-taker (T-1). Without this data point, Denver 9-1-1 is unable to accurately determine how long a call is handled by a 9-1-1 operator and how long it is handled by the EMS call-taker. This limitation inhibits the City’s ability to isolate and address potentially excessive time segments. In addition to limiting the City’s ability to use the data as an analysis tool for management, the absence of key performance data reduces the City’s ability to assess compliance with desired standards.

- **Dispatch Time Gap** – Audit analysis of 2007 CAD data identified a period that averaged 1 minute 31 seconds (1:31) from the time the CAD system indicated adequate information had been collected to dispatch an ambulance to the time an ambulance was actually dispatched as shown in Figure 3. The cause of this average time was difficult to ascertain and quantify because the timeline for processing and dispatching emergency calls, does not necessarily align with the way the CAD system is designed to collect data. Since audit analysis indicated a dispatch time nearly three times longer than the ICMA benchmark of 25 seconds, further examination of the dispatch process and reliability of this “clock start time”\(^{30}\) may lead to significant opportunities for response improvement.

![Figure 3: 2007 EMS Average Dispatch Time Using Clock Start Time](image)

One possible contributing cause for this time gap may concern ambulance availability. Denver Health personnel acknowledged that there are peak periods where no Denver Health ambulances are available but that they do not currently know how often they run out of ambulances or how long such shortages last when they run out. It is difficult to quantify the lack of available ambulances without explicitly capturing this data, although there are several data indicators which suggest the impact. For example, long travel times may indicate that an ambulance stationed nearby is not available. In addition, long dispatch times may indicate that a dispatcher must search for an available unit or wait for a unit to become available.

---

\(^{30}\) According to Denver Health personnel, the CAD data element “Clock Start Time” is unreliable due to the process alignment issue described. We observed high variability in this data element and performed data scrubbing techniques to reveal the dispatch time gap.
• **Benchmarking Analysis** – Several peer entities surveyed have streamlined their 9-1-1 communications process. For example, Seattle, Grady and Cleveland utilize an initial 9-1-1 operator to determine where to direct the call and immediately transfer the call to the appropriate responding emergency call-taker (i.e., police, fire or medical response), who subsequently screens the call with minimal duplication of intake time and information gathering.

**Lack of Effective Oversight Has Several Negative Impacts** – Limitations identified with the current City approach for monitoring the entire emergency medical response system result in negative impacts.

**Denver’s Emergency Medical Response Times Longer Than Industry Standards** – Audit work found response times for the City’s total emergency medical response as well as some individual segments of the emergency medical response process are longer than industry standards, including NFPA standards adopted by the City in June 2004. Additionally, since 2004, Denver Health reported response times from the time of dispatch (T-3). When measured this way, response times met the 8:59, 85% time goal established in the Operating Agreement. However, the Agreement specifies that response times be reported from a point in time which occurs before the time of dispatch (i.e., prior to T-3). Under that standard, Denver Health has not been in compliance with the time measurement requirement in the Agreement.

• **Total ALS Response Time Is Longer Than Industry Standards** – As illustrated in Figure 4, audit work determined that in 2007, the total time\(^{31}\) for an ambulance to arrive on the scene from the time a 9-1-1 call is answered, was within 13:24, 85% of the time and within 15:48, 90% of the time. This ALS (Denver Health) response time was significantly longer than the goal of responding within 10:30, 90% of the time established by the NFPA and the 9:34 response time goal, 90% of the time established by the ICMA.

**Figure 4: Total ALS Response Time Comparison Between 90%, 85% and Industry Standards**

\(^{31}\)Auditors defined total response time as T-0 to T-5, or the time elapsed from when a 9-1-1 call is answered to the time a responding unit arrives on scene. See the Background section and Appendix B for more detail on these time points.
• **Total Denver Fire BLS Response Time Is Longer Than Industry Standards** – Audit work determined that in 2007, Denver Fire’s BLS total response time was within 8:59, 85% of the time and 10:29, 90% of the time, which was significantly longer than the NFPA objective of responding within 6:30, 90% of the time (Figure 5).

![Figure 5: Total Denver Fire BLS Response Time Comparison Between 90%, 85% and NFPA Standards](image)

• **Trend Analysis Indicates Increasing ALS and BLS Response Times** – Audit testing revealed that the City’s total response time and segments of response time have been increasing over the past several years as demonstrated by Figure 6. While the figure graphically represents ALS response, BLS response times generally follow the same trends. Specifically, the figure shows a significant increase in ALS response time within the 9-1-1 Call Center. For BLS responses, the total call-processing time increased from 3:10 in 2004 to 4:00 in 2007, which is an increase of 26.3%. For ALS responses, the total call processing time increased from 3:26 in 2004 to 4:43 in 2007, which is an increase of 37.4%. Travel time represents the smallest percentage of change with Denver Fire travel time decreasing by 1.3% and Denver Health travel time increasing slightly by 4.9%.

---

32 Chute times show the largest percentage increase with a 68% increase in time for ALS response. However, the total increase in time from 2004 to 2007 was only 17 seconds.
In addition to ALS and BLS total response times that are longer than industry standards, audit work determined that response times for segments of the emergency medical response process are longer than industry standards.

- **Denver 9-1-1 Call Center Response Time Is Longer Than Industry Standards** – Denver Health and Denver Fire both maintain staff at the City’s 9-1-1 Call Center. Call takers receive and process calls transferred for medical and/or fire emergencies and dispatchers receive data to enable them to dispatch their respective responding units. While each entity utilizes different processes for unit dispatch, audit work found that the 9-1-1 Call Center portion of total response times (T-0 to T-3) was longer than NFPA standards regardless of the agency involved.

Specifically, NFPA standards set a goal for this segment of emergency medical response within 1:00 for 95% of the calls. As shown in Figure 7, at 95% compliance, the Call Center’s 2007 response times were significantly higher: 13:36 for processing calls involving Denver Health units and 9:19 for processing calls involving Denver Fire units. These results clearly demonstrate that the time it takes for the Call Center to process calls for emergency medical assistance is significantly longer than is recommended by established standards.

---

33 NFPA 1221: Standards for the Installation, Maintenance and Use of Emergency Services Communications Systems, 2007 edition §7.4.2. This standard also contains an objective of 30 seconds for the transfer procedure “Where alarms are transferred from the primary public safety answering point (PSAP) to a secondary answering point…” If the City determines that this section of the standard applies to Denver’s 9-1-1 Call Center, the total call-processing and dispatching segment of Call Center response time could be 90 seconds (1:30).
• Denver Health’s Chute[^34] and Travel Response Times Are Longer Than Industry Standards – As part of audit testing, auditors independently re-performed the data queries used by Denver Health to report on compliance with the Agreement and to calculate Denver Fire’s response time, and did not find significant differences. However, audit work also determined that the goals in the current Agreement are not consistent with objectives established by current industry standards. Specifically, although the NFPA’s chute and travel time objective is similar to Denver Health’s (9:00 vs. 8:59), the NFPA standards require a 90% compliance rate. Additionally, although the CAAS standards referenced in the Agreement have a response time goal of 8:59, they also require compliance at 90%.

Audit work determined that in 2007, Denver Health’s chute and travel times were 0:42 and 8:15 respectively, 85% of the time. If Denver Health reported response times at 90% compliance in 2007, the response time for travel time alone (T-4 to T-5) would have been 9:10 which is longer than the goal in the Agreement. When chute time (T-3 to T-4) is included in this measurement (as it is in Denver Health queries), the response time was longer (Figure 8).

[^34]: Chute time is referred to in the NFPA standards as “Turnout Time.”
• **Denver Fire Department’s Emergency Medical Response Chute and Travel Times Are Longer Than City Goals and Industry Standards** – Audit work determined that for 2007 Denver Fire established an emergency medical response goal of 4 minutes at 87% compliance, which is lower than the NFPA standard, which requires a 90% compliance rate. Additionally, despite the lack of a defined “clock start time” audit work revealed that Denver Fire’s travel time was within 3:50 at 85% compliance, meaning that although we are unable to say whether they were in compliance at 87%, they were in compliance at 85% if travel time is the only time considered. However, the inclusion of chute time at 85% adds 1:35 thereby increasing the 2007 chute and travel response time to over four minutes. Since their response time was longer than the goal at 85% and 87% is a more stringent goal, this means Denver Fire’s response times were longer than their goal for 2007. If they adopted a 90% compliance rate in accordance with NFPA, their response time in 2007 would have been even longer, as shown in Figure 9.

**Figure 9: Denver Fire Chute and Travel Times at 90% and 85% Compared to NFPA Standards**

![Figure 9: Denver Fire Chute and Travel Times at 90% and 85% Compared to NFPA Standards](image)

**City Cannot Effectively Assess Emergency Medical Response System** – The City’s reliance on response time as the key emergency medical response performance measure limits its ability to assess total system effectiveness, since response times have not been directly correlated to patient outcomes or measures of clinical effectiveness such as successful endotracheal intubations performed by paramedics. As a result, the City cannot currently make an accurate assessment of how well the system is performing in terms of its key mission, improving patient outcomes. A review of industry literature confirmed that the success of an emergency medical response system can be difficult to measure. Based on an extensive review of industry

---

35 Denver Fire’s response time goal does not define the clock start time.
36 Like Denver Health, Denver Fire includes only chute time and travel time (T-3 to T-5) in its response time calculation.
37 According to the 2005 200 City Survey conducted by JEMS, “Response times are confusing - The ‘standard’ was derived while cardiac arrest survival was being studied in the early 1970s by Alvarez and Cobb in Seattle. They noted dramatic increases in survival, which they attributed to at least three factors: reduced response times of less than eight minutes, first responders performing CPR and citizen CPR training. Later, Mickey Eisenberg, MD, et al catapulted Seattle's results to national attention by publishing several landmark studies. These studies resulted in countless systems being designed during the past four decades to deliver response times to all emergency cases within nine minutes.”
research and best practices, audit work determined that while response time can certainly impact patient outcomes and is a key measure of system performance, other measures of clinical effectiveness related to emergency medical response also serve as key indicators of system performance. Clinical outcomes are typically measured in terms such as, cardiac arrest survival rates or successful endotracheal intubations and can provide a way for EMS systems to evaluate performance across jurisdictions. Some studies have shown that clinical outcomes are better in cities that employ fewer paramedics who are able to regularly apply life-saving skills.  

From a citizen’s perspective, response time is the key operational measure used to assess emergency medical services and there are distinct patient needs which make response time critical to patient survival. For example, the ICMA has indicated that “First responders have the greatest effect in four areas: stopping bleeding; opening blocked airways; restarting a stopped heart with an automated defibrillator; and giving an injection of epinephrine, via a pre-filled automated syringe, to a patient who is having an allergic reaction, but these actions generally can be undertaken by personnel at the EMT level or below.” Denver Health also identified a similar focus on four time-sensitive patient needs including CPR, AED, oxygen and hemorrhage control, but indicated that Denver Fire EMT’s do not inject epinephrine. Best practices research indicates that effective EMS systems must be based upon multiple factors. Specifically, according to the AAA “high-performance emergency ambulance service is the delivery of clinical excellence, response-time reliability, economic efficiency, and customer satisfaction—simultaneously. For a system to be considered high performance, it must measure its performance using nationally accepted high-performance standards, and it must continually compare itself to other high-performance emergency ambulance services using independent expert evaluation.” The AAA further recommends the following five “hallmark” areas required for effective EMS service delivery: (1) holding the emergency ambulance service accountable; (2) establishing an independent oversight entity; (3) accounting for all service costs; (4) requiring system features that ensure economic efficiency; and (5) ensuring long-term high performance service. As demonstrated by issues discussed throughout this report, the City has opportunities to make improvements in most if not all of these areas.

**Recommendations**

The Auditor’s Office acknowledges that many variables and attributes impact the effectiveness of emergency medical response systems. As response time has been identified both nationally and by the City as a key performance measure for emergency medical response systems, we provide recommendations for enhancing such response times. We also include recommendations related to the identification of other supporting performance measures to assess emergency medical response system effectiveness.

---

38 A study from Ohio State University found that the city with the best outcome of cardiac arrest survival arrived three minutes after the city with the worst outcome. The study attributed the difference to the point that the paramedics in the city with the best outcomes annually treated 4.7 cardiac arrests per paramedic on average as opposed to 1.6 cardiac arrests per paramedic for the city with the worst outcome.


41 Ibid.
1. We recommend that the City establish an oversight entity or position with authority and responsibility for the entire emergency medical call lifecycle including all segments and agencies involved from call receipt to the time a responding unit is returned to service.

2. We recommend that the oversight entity or position be responsible for consistent monitoring and reporting of emergency medical response performance, including the Denver 9-1-1 Call Center, ALS ambulance services (Denver Health and other private services) and BLS (Denver Fire and Denver Health) medical response services.

3. We recommend that the oversight entity or position establish clear performance objectives and reporting requirements for each segment and agency involved in the emergency medical response process, with direct accountability to the City’s oversight authority. The following reporting requirements and performance objective considerations should be included as part of this process:
   a. Utilization of industry best practices and benchmark information;
   b. Determining whether NFPA standards and/or other standards governing emergency medical response will be utilized and addressing any related current Denver Revised Municipal Code compliance issues;
   c. Inclusion of clear sanction authority within the Operating Agreement for non-performance;
   d. Developing performance measures that place a greater correlation of patient outcomes to emergency response times where possible through greater use of clinical outcome data;
   e. Clearly and consistently defining: (1) performance criteria and appropriate CAD data points that represent most appropriate time intervals for each agency and maximize transparency in reporting; (2) “good cause exemptions;” and (3) “clock start time”;
   f. Focusing performance measurement reporting and analysis on percentile/fractile calculations to avoid limitations inherent with time averages;
   g. Tracking and reporting use of private ambulance services to assist in the assessment of ambulance staffing and deployment adequacy; and
   h. Enhancing data analysis and data reliability utilizing data scrubbing techniques to improve reporting.

4. We recommend that the oversight entity or position provide direction and continuity by facilitating ongoing process improvements and operational efficiencies within and across agencies involved in the emergency medical response process including:
a. Performing analysis of 9-1-1 call intake and processing function to identify specific actions to reduce response time and eliminate duplication of effort; and

b. Exploring alternative ambulance staffing and deployment models.

5. We recommend that the oversight entity or position partner with City Attorney’s Office to establish an agreement with Denver Health and other private providers for the provision of emergency medical response services including serving as City lead to negotiate and define terms and conditions of the Agreement to be consistent with performance objectives and reporting requirements.
## Approaches to Service Delivery

<table>
<thead>
<tr>
<th>Model / Percent Used</th>
<th>Characteristics</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| **Private Organization**     | Service provided through an exclusive or nonexclusive contract with the local government that may or may not include rights to provide non-emergency services. Contracts may be based on the level of effort or performance. Clinical performance, assets, capitalization, and day-to-day operations are managed wholly within the private sector. | • Little day-to-day involvement for the local government  
• Performance contracts generally define services provided, allowing for better evaluation and benchmarking  
• Labor costs generally lower than for public sector providers | • Accountability and transparency issues associated with the use of private firms  
• Little financial oversight  
• Unregulated competition, which may compromise the quality of care  
• Higher turnover because of lack of opportunity for career development  
• Risk of sudden service withdrawal |
| (37.5%)                      |                                                                                |                                                                             |                                                                                                                                               |
| **Fire Department**           | Fire EMS agencies typically categorized as either single role (when ambulance workers operate as a separate division within the fire department) or dual role (when the same staff provide both fire protection and emergency medical transport). | • Public confidence in the fire department  
• Integrated command and control  
• Public officials in direct control of day-to-day operations  
• Use of capacity currently available within the fire department | • Primary reliance on 24-hour shifts, which limits the ability to match resources with demand  
• Complexity of labor agreements  
• High labor costs  
• Requirements based on level of effort rather than on performance |
| (28.3%)                      |                                                                                |                                                                             |                                                                                                                                               |
| **Third Service**             | Considered a uniformed public safety service (like police and fire), but typically employs civilians in a separate department or ambulance district. The parent government provides finance, purchasing, vehicle maintenance, and other support functions. | • Use of civilian workforce, which increases scheduling flexibility and lowers personnel costs  
• Single-service delivery focus  
• Local government in direct control of day-to-day operations  
• Public sector ownership | • Expenditure control dependent on the parent organization’s budgetary and managerial processes  
• In general, no performance-based requirements  
• May be assigned less importance than other public safety departments |
| (11.7%)                      |                                                                                |                                                                             |                                                                                                                                               |
| **Hospital-based**            | Service provided by a local hospital or a stand-alone entity owned or controlled by a hospital. Contracts may be based on level of effort or performance. Services are frequently nonprofit and draw on the hospital’s clinical and administrative resources. | • Public confidence in the health care institution providing the service  
• Robust opportunities for clinical improvements and career development  
• Capital usually provided by the hospital | • Low priority within the hospital’s financial and operational structures  
• May be isolated from top leadership  
• EMS revenue-recovery efforts may be overshadowed by hospital revenue-recovery efforts |
| (9.2%)                       |                                                                                |                                                                             |                                                                                                                                               |
# APPENDIX B: TIMELINE OF EVENTS

## How the Public Perceives Response Time

<table>
<thead>
<tr>
<th>T-Time</th>
<th>Description of Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>T-0 to T-5</strong></td>
<td>How the Public Perceives Response Time: The length of time from when a 9-1-1 call is answered to when an ambulance arrives at the scene of the medical emergency.</td>
</tr>
<tr>
<td><strong>T-0 to T-1</strong></td>
<td>9-1-1 Operator Time: The length of time from when a 9-1-1 operator answers the phone to when the EMS call-taker answers the call. This includes call processing by the 9-1-1 operator and transfer to an EMS call-taker.</td>
</tr>
<tr>
<td><strong>T-1</strong> to <strong>T-2</strong></td>
<td>EMS Call-Taker Time: The length of time from when an EMS call-taker answers the call to when enough information is available to dispatch a unit. A unit can be dispatched when the address of the incident, the nature of the problem, and the caller's callback number are known.</td>
</tr>
<tr>
<td><strong>T-2 to T-3</strong></td>
<td>Dispatch Time: The length of time from when enough information is available to dispatch a unit to when the dispatcher assigns a unit to respond.</td>
</tr>
<tr>
<td><strong>T-3 to T-4</strong></td>
<td>Chute Time: The length of time from when a unit is assigned to when the unit is en route (i.e. wheels are rolling).</td>
</tr>
<tr>
<td><strong>T-4 to T-5</strong></td>
<td>Travel Time: The length of time from when the unit is en route to when a unit arrives on scene (i.e. wheels stop rolling).</td>
</tr>
</tbody>
</table>

*Note: The T-1 time point represents when an EMS call-taker answers the phone. T-1 is not captured in the CAD data, but the time point is needed to compare Denver’s performance to standards and benchmarking.*
National Fire Protection Association (NFPA) Standards Appear to Apply to Denver’s Emergency Medical Response System

Key Issue:
Audit work conducted as part of an ongoing performance audit of the City’s Emergency Medical Response System determined that the City and County of Denver adopted the 2007 National Fire Protection Association (NFPA) Standards as part of the Denver Building and Fire Code. As a result, the City is required to minimally adhere to NFPA Standards associated with emergency medical response.

The requirement that emergency medical response entities adhere to the NFPA Standards may directly affect the City’s 9-1-1 Emergency Communications Center, the Denver Fire Department, and is pertinent to the City’s Operating Agreement with the Denver Health and Hospital Authority (Denver Health). Specifically, the NFPA Standards are not reflected in the City’s 2008 Operating Agreement with Denver Health, meaning the City may not be in compliance with the legal requirement that they adhere to these emergency response standards. The current Operating Agreement sets the response objective, defined as the amount of time an emergency response takes, at 85% within 8 minutes 59 seconds (8:59), whereas the NFPA response objective is 90% within 9 minutes (9:00). The 9 minute standard refers to the time from which a call is dispatched to when an advanced life support unit arrives at an emergency medical incident. While audit work continues, the Auditor’s Office wanted to alert City officials to this issue as it relates to the on-going negotiations involving this Agreement.

Background:
The National Fire Protection Association is an international nonprofit organization that provides consensus codes and standards, research, training, and education. As an authoritative source on public safety, the NFPA develops, publishes, and disseminates more than 300 consensus codes and standards intended to minimize the possibility and effects of fire and other risks.

Under the Denver Revised Municipal Code §10-16, the City has adopted by ordinance the International Fire Codes and Standards (IFC), together with the Denver Fire Code Amendments (DFCA), as the basic Denver Fire Code. Additionally, the 2008 DFCA adopts the 2007 edition of the NFPA Codes and Standards in their entirety. In other words, the 2007 series of the NFPA Codes and Standards are currently incorporated as part of the Denver Fire Code. Section 101.2 of the DFCA contains language that applies the Denver Fire Code to the City’s emergency response system, which involves Denver Health and includes the City’s 9-1-1 Emergency Communications Center in addition to the Denver Fire Department.

Specifically, NFPA Standard 1710 provides detailed criteria for emergency response particularly in regards to response times. Because the Fire Code applies to the City, it is the City’s responsibility to ensure minimum response time criteria are met. In addition, Section 4.3.3 of this Standard requires that the Authority Having Jurisdiction (AHJ), which in this case is the City of Denver, based upon recommendations from
AUDIT ALERT

Purpose of Audit Alerts: To quickly communicate significant audit issues or concerns about fraud, waste, or abuse which have come to the attention of the Division through an audit or otherwise which require immediate action or review by management.

the fire department, shall include minimum response criteria in any contract, service agreement, governmental agreement, or memorandum of understanding between the AHJ and any outside agency or private provider.

Further, NFPA Standard 1221 provides criteria related to communication center operations, including response time criteria. Because all City agencies must adhere to the Denver Fire Code, these criteria apply to the City’s 9-1-1 Emergency Communications Center. For example, this Standard requires that “Ninety-five percent of emergency call processing and dispatching should be completed within 60 seconds, and 98 percent of call processing and dispatching shall be completed within 90 seconds.” In addition, this standard specifies certain events which should be captured in the Computer Aided Dispatch (CAD) system, and requires monthly and annual performance measurement analysis for call and dispatch activities.

Next Step(s):

The Auditor’s Office will complete and issue the performance audit of the City’s Emergency Medical Response System later this year. The report will include detailed information and recommendations identifying possible emergency response system improvements. It should be noted that this Audit Alert addresses only one component of the Operating Agreement currently being negotiated for 2009. Upon completion of audit testing and validation, we expect to identify and report additional issues related to the Operating Agreement.

Contact:

If you have any questions, please contact me at 720-913-5029.

Kip R. Memmott, CGAP
Director of Audit Services

Distribution:

John Hickenlooper, Mayor’s Office
Alvin LaCabe, Manager of Safety’s Office
David Fine, City Attorney’s Office
Chief Nick Nuanes, Denver Fire Department
Nancy Severson, Department of Environmental Health
Honorable Members of City Council
December 16, 2008

Mr. Dennis Gallagher
Auditor
202 West Colfax Avenue, Dept. 705
Denver, CO 80202

Dear Mr. Gallagher:

We appreciate the opportunity to respond to the findings of Office of the Auditor's Performance Audit of the Emergency Medical Response System. The Denver Health and Hospitals Authority (DHH) will submit its comments under separate cover.

On December 8, 2008, the Denver City Council approved an ordinance that requires the City to continue to review the appropriate performance criteria to serve the Denver citizens well and provide an interim report to City Council by January 30, 2009. By March 30, 2009, the City and the Authority shall agree whether changes in the performance criteria stated in Appendix A-2 are required, and changes to the criteria shall then replace the existing language in Appendix A-2. The performance criteria shall include a method of calculating response times, a method of reporting response times, clinically relevant outcome criteria and other issues as agreed upon by the parties.

Below please find the City's response to the findings of the Audit that takes into account the interim and final reports that will be made to the City Council.

First, however, we take this opportunity to share with you and your staff some of the steps we have taken since the Denver Auditor's Office began its performance audit of the EMRS that are not reflected in your report. The Denver Fire Department (DFD), the 911 Communications Center (911 Center), and DHH have worked jointly to make improvements that we believe will improve emergency response services to Denver citizens. These steps include:

- Staffs at the 911 Center, DFD, and DHH have met to agree on common terminology and methodology in calculating and measuring response times including definitions of clock start time. This common terminology agreement is an important first step in being able to accurately measure the entire response period beginning with when the call is received to when the emergency unit arrives at the scene. Please see the attached Exhibit 1 for the process and the glossary of terms.

- As your report is limited to the period of 2003 to 2007, it does not report improvements made in the last 18 months to the 911 Center. Since the period in which the data was analyzed (2003 to 2007), a number of improvements have been made:
December 18, 2008
Page 2

- Employee work schedules have been modified to deploy more employees during higher activity levels and fewer at lower activity levels.

- Employee assignments have been modified so that all Denver 9-1-1 Agents (call-takers) are assigned to the 9-1-1 queue; and only when all of the 9-1-1 calls are answered do agents move on to answer the DPD non-emergency line.

- In May 2007 Denver 9-1-1 upgraded its telephone system that enabled it to better measure system and individual employee performance. The new phone system has also enabled 9-1-1 to better measure its queue delay system, design new protocols for call answering, and reduce its average wait time from 14 seconds to 5 seconds.

- 911 Agents have decreased their Not Ready Time from 26% to 15.6% since 2007. The generally accepted industry standard is 15%.

- During the past year Denver 9-1-1 has been at or near to full staffing for the entire year, even as other 911 Centers around the country struggle with short staffing and high turn-over.

- In partnership with the Leadership Team at Denver 3-1-1, 3-1-1 related calls are automatically redirected to 3-1-1 call takers without intervention by the Denver 9-1-1 Agent resulting in an 11% drop in call volume at 911, allowing the 9-1-1 call takers to focus on real emergencies.

- Equipment designed to assist in improving call entry process has been identified and approved for purchase.

- The DFD, 911 Center and DHHA have established regular meetings designed to address the concerns identified by this team as well as many of those identified in your report. This internal working group has identified the following first steps in addition to those described above:

  - Implementation of a Toyota LEAN Rapid Improvement Exercise to make recommendations for improvements to the call taking process. The goal of this LEAN Rapid Improvement Exercise process was to develop recommendations for supporting accurate, consistent call processing and unit assignment that could reduce the amount of time required to process emergency calls. These recommendations will be reviewed as part of the report to be submitted to the City Council in March 2009. (November 2008)

  - Implementation of a Toyota LEAN Rapid Improvement Exercise to make recommendations for improvements to dispatch system. (December 2008)

These LEAN recommendations and others will be considered as part of the report that will be made to the City Council in March 2009. That report will include the following aspects of the EMRS system:

- A Denver standard for EMRS that is based upon NFPA standards as required by City Council ordinance. As noted within your report, the issue of monitoring EMRS effectiveness is a complex and difficult area to measure because there is not an agreement as to national standards or to appropriate measures of effectiveness. The Audit Report itself cites four different standards:
December 16, 2008

Response time measurement from call receipt (911 Center) to arrival of emergency equipment including BLS and ALS services (DFD and DHHA).

Uniform benchmarks for performance that reflect the entire EMRS service continuum; that utilize and build upon the collaborative process that has recently been established between DFD, the 911 Center and DHHA; and, include correlations between response time and patient outcomes. This uniform benchmarking, although outside the parameters of the operating agreement, better reflects the entire emergency response system and enables all parties to more efficiently and effectively provide the quality of service Denver citizens expect.

Recommendations for language to be included within the operating agreement that reflects the commitments DHHA and the City will make to improving both accountability and oversight to the EMRS. This language will reflect performance standards, benchmarks for success, and monitoring protocols.

Response to Findings

Finding 1: Emergency Medical Response Weaknesses in the Operating Agreement between the City and Denver Health

Action Step: Establishment of common terminology, standards, performance measures

Effective immediately, the DFD, 911 Communications Center and DHHA will use a common terminology and methodology in calculating and measuring response times including definitions of clock start time. This common terminology and measurement agreement is an important first step in being able to accurately assess the entire response period beginning with when the call is received to when the emergency unit arrives at the scene.

DFD, the 911 Center and DHHA have also taken initial steps to develop recommendations for standards and performance measures. This team recognizes the importance of establishing a team approach to developing new measures as this performance continuum relies on three different agencies each with specific but interrelated responsibilities. They have also quickly taken steps to identify improvements in the call taking process and the dispatch system through:

- Implementation of a Toyota LEAN Rapid Improvement Exercise to make recommendations for improvements to the call taking process. (November 2008)
December 16, 2008
Page 4

- Implementation of a Toyota LEAN Rapid Improvement Exercise to make recommendations for improvements to dispatch system. (December 2008)

These LEAN recommendations and others will be considered as part of the report that will be made to the City Council in March 2009.

Action Step: Development of standards for performance and reporting protocols

A Denver standard for EMRS that is based upon NFPA standards or equivalent as required by City Council ordinance will be established and reported to the Denver City Council in March 2009. As noted within the audit report, the issue of monitoring EMRS effectiveness is a complex and difficult area to measure because there is not an agreement as to national standards or to appropriate measures of effectiveness. The Audit Report itself cites four different standards: NFPA, CAAS, AAA, and ICMA. In addition, the report concedes that these standards themselves fail to adequately measure effectiveness: "response time ... by itself is not an optimal measure to assess the effectiveness of such a critical and complex system directly affecting public health." Audit at p. 20. The lack of national standards that include both response time and patient outcomes offer the City and DHHA the opportunity to build upon the NFPA standard (as required by City ordinance) and to institute one that best reflects Denver's human and geographic demographics as well as its human and financial resources. The standard for performance to be submitted to the City Council in March 2009 will take into consideration both response times and patient outcome as part of the performance measures. This March 2009 report will include:

- Response time measurement from call receipt (911 Center) to arrival of emergency equipment including BLS and ALS services (DFD and DHHA).

- Uniform benchmarks for performance that reflect the entire EMRS service continuum; that utilize and build upon the collaborative process that has recently been established between DFD, 911 Communications Center and DHHA; and, include correlations between response time and patient outcomes will be part of the measurement criteria. This uniform benchmarking will better reflect the entire emergency response system and will enable all parties to more efficiently and effectively provide the quality of service Denver citizens expect.

- Recommendations for language to be included within the operating agreement that reflects the commitments DHHA and the City will make to improving both accountability and oversight to the EMRS. This language will reflect performance standards, benchmarks for success, and monitoring protocols.

Disagreement with Auditor Findings:

The Audit Report finds that the Ambulance Response Time Performance Measure Unclear and Not Reflective of Standards.

The Operating Agreement contains an equivalent standard as specifically allowed under Standard 1710 of the NFPA: "1.3 Equivalency. Nothing in this standard is intended to prohibit the use of systems, methods, or approaches of equivalent or superior performance to those prescribed by this standard." The standard from the Commission on Accreditation of Ambulances is included in the Operating Agreement and it is
EXHIBIT A – AGENCY RESPONSE

December 16, 2008
Page 5

comparable or more stringent if complied with (CAA 8 minutes 59 seconds; NFPA 9 minutes). The NFPA compliance goal is 90%, while the compliance goal in the Operating Agreement is currently 85%. The 85% compliance goal that is currently being used will be adjusted to reflect the NFPA goal or an equivalent goal that takes into account evidence based patient outcomes.

The Audit Report finds that the Agreement Has Disparate “Clock Start Times” Definitions.

The “two” clock start times stated in the Operating Agreement are not inconsistent when read in context. The standard in the Operating Agreement is meant to apply to operations that Denver Health performs: dispatch of ambulances and route time for ambulances. The “original clock start time” states that measurement should begin “when the reported address of the patient, the call-back number of the calling party, and probable complaint of patient are known.” As your audit states on page 22: “this point in time can occur either when the call is still with the 9-1-1 Operator, prior to transfer . . . or when the call has been transferred to the EMS call-taker (T-2).” The only relevant point in time for purposes of a performance standard for Denver Health, however, is when the information is known to the EMS dispatcher. Therefore the appropriate clock start time for DHHA is “when an EMS dispatcher receives the call from the call taker . . .” as clarified in the 2004 amendment to the Operating Agreement. The response time standard developed over ten years and has been clarified over time. As indicated in previous remarks (Page 1, first bullet) DHHA, DFD and the 911 Center have agreed to common terminology and methodology in calculating and measuring response from the time the call is received to the time of emergency unit arrival.

The Audit Report finds that the Performance Criteria Are Considered Goals Rather Than Requirements.

This is consistent with the NFPA which describes the response times as “objectives.” “4.1.2. The fire department organizational statement shall provide service delivery objectives, including specific response time objectives for each major service component . . . and objectives for the percentage of responses that meet the response time objectives.” (emphasis supplied). The appendix to the standard gives further explanation of the intent: “There can be incidents or areas where response criteria are affected by circumstances such as response personnel who are not on duty, no staffed fire station facilities, natural barriers, traffic congestion, insufficient water supply, and density of population or property. The reduced level of service should be documented in the written organizational statement by the percentage of incidents and geographical areas for which response time criteria are achieved.” Section A.4.1.2.

The Audit Report finds that there are No Enforcement Provisions.

Each year the City negotiates its operating agreement with DHHA. This yearly negotiation provides the opportunity to make adjustments if deficiencies are identified and defined. In addition, the City may terminate, through a process clearly defined within the operating agreement, any particular service if DHHA does not meet the standard of care for that service.

The Audit Report cites an expansion of call exemptions.

The call exemptions allowed under the current operating agreement are standard exemptions that are allowed among other cities within the Metro area. The number of exemptions has expanded from 5 to 8 over 10 years as data has been gathered and analyzed. A review of the good cause exemptions shows that these are out of the control of Denver Health or would skew response time data. The Audit Report also suggests that test or training calls, calls whose priority change during the response and data capture errors
December 16, 2008
Page 6

should be included in evaluating response time to emergency calls. We do not agree with this finding. Many of these calls may well be excluded as outliers under the Auditor's data scrubbing protocol.

The Audit Report finds that the City should determine the terms and conditions for the use and oversight of private ambulance providers.

We disagree that the City should place itself as an expert in determining the contractual relationships that DHHA establishes with outside providers. The operating agreement between DHHA and the City assigns responsibility for services requested by the City to DHHA. The Authority is responsible for delivering the same quality of service through its contractual relationships with its outside providers.

Finding 2: City Lacks Effective Emergency Medical Response System Monitoring Process

Action Step: Establishment of EMRS Monitoring Group

The Mayor's office will establish a monitoring group that will immediately begin to receive progress reports on the development of EMRS recommendations and the report to be developed for presentation to the City Council in March of 2009. This monitoring group will include representatives from the Mayor's Office, Denver Health, including the Director of Emergency Medicine and the Chief Operating Officer; the Denver City Council, the Manager of Safety's Office, the Office of Budget and Management, and the Department of Environmental Health. This monitoring group will continue in its role beyond March of 2009 and be responsible for:

- Regularly reviewing the EMRS continuum of service,

- Establishing the standards, assessment measures, and reporting requirements for the DFD, 911 Center, and DHHA team and reported to Council in March of 2009. As mentioned earlier in our response, these standards and measures will be based on NFPA or equivalent standards; take into account both response time and patient outcomes; utilize available technology to improve service and assess success; and build upon the recommendations that have been provided in the audit report.

- Providing direction and continuity by facilitating ongoing process improvements and operational efficiencies within and across agencies involved in the emergency medical response.

- Providing quarterly updates to the Mayor regarding all aspects of EMRS continuum of service. The 3rd quarter report will be delivered in time to inform the City and the DHHA as they develop their yearly operating agreement that is submitted for City Council consideration in December of each year.

Finding 3: Process Inefficiencies at Denver 911

Action Steps: Update findings of Auditor's report; report recent steps taken by DFD, 911 Center and DHHA to upgrade and improve the processing of incoming calls at the 911 Communications Center.

As the audit report is limited to the period of 2003 to 2007, it does not report improvements made in the last 18 months at the 911 Center. These improvements include:
December 16, 2008
Page 7

- Employee work schedules have been modified to deploy more employees during higher activity levels and fewer at lower activity levels.

- Employee assignments have been modified so that all Denver 911 Agents (call-takers) are assigned to the 9-1-1 queue; and only when all of the 9-1-1 calls are answered do agents move on to answer the DPD non-emergency line.

- In May 2007 Denver 911 upgraded its telephone system that enabled it to better measure system and individual employee performance. The new phone system has also enabled 911 to better measure its queue delay system, design new protocols for call answering, and reduce its average wait time from 14 seconds to 5 seconds.

- 911 Agents have decreased their Not Ready Time from 26% to 15.6% since 2007. The generally accepted industry standard is 15%.

- During the past year Denver 911 has been at or near to full staffing for the entire year, even as other 911 Centers around the country struggle with short staffing and high turn-over.

- In partnership with the Leadership Team at Denver 3-1-1, 3-1-1 related calls are automatically redirected to 3-1-1 call takers without intervention by the Denver 911 Agent resulting in an 11% drop in call volume at 911.

- Equipment designed to assist in improving dispatch time has been identified and approved for purchase. This equipment will automate the call entry process and significantly reduce the call taking period.

In addition to these previously made changes, the 911 Center, DFD, and DHHA have jointly planned and participated in two Toyota LEAN Rapid Improvement Exercises (RIE) to develop recommendations for improving both call taking and dispatch services. The RIE participants included call takers and dispatchers from DFD, DHHA, and the 911 Center in a 4.5 day intensive process designed to develop recommendations for improving the process defined in the auditor's report as T-0 to T-3 (Figure 1, Page 13). Immediate improvements as a result of RIE have helped the 911 Center to improve its call taking significantly in the last two weeks. The RIE team continues to develop its recommendations for improvement. These recommendations will be considered as part of the whole report that will be presented to the Denver City Council in March 2009.

Response to Recommendations

Recommendation 1

The Mayor's office will establish a monitoring group that will immediately begin to receive progress reports on the development of EMRS recommendations and the report to be developed for presentation to the City Council in March of 2009. This monitoring group will include representatives from the Mayor's Office, Denver Health, the Denver City Council, the Manager of Safety's Office, the Office of Budget and Management, and the Department of Environmental Health. The monitoring group will provide ongoing and
December 16, 2008
Page 8

regular monitoring and reporting of emergency medical response performance beyond the March 2009 report to City Council.

Recommendation 2

The responsibilities of the monitoring group will include:

Regular review of the EMRS continuum of service, Establishment of the standards, assessment measures, and reporting requirements for the DFD, 911 Center, and DHHA team and reported to Council in March of 2009. As mentioned earlier in our response, these standards and measures will be based on NFPA or equivalency standards; take into account both response time and patient outcomes; utilize available technology to improve service and assess success; and build upon the recommendations that have been provided in the audit report.

Recommendation 3

The monitoring group will provide quarterly updates to the Mayor regarding all aspects of EMRS continuum of service. The 3rd quarter report will be delivered in time to inform the City and the DHHA as they develop their yearly operating agreement that is submitted for City Council consideration in December of each year.

Recommendation 4

The monitoring group will provide direction and continuity by facilitating ongoing process improvements and operational efficiencies within and across agencies involved in emergency medical response.

Recommendation 5

The City Attorney will provide staff to the monitoring group so as to provide support and guidance regarding EMRS issues during the annual operating agreement review.

We appreciate the effort that the Auditor’s Office has given to this important topic. In particular we would like to acknowledge the work of your staff in preparing this report. Their professionalism and dedication to providing their recommendations will serve the entire city as we move toward improving this important service to Denver’s citizens. We take seriously the recommendations you have made and will continue to use these recommendations and collect additional data as we strive to deliver excellence in Denver’s emergency response system.

Sincerely,

Katherine Archuleta
Senior Advisor to the Mayor
911 EMS Call Processing Timeline

Current State

1. 911 Alarm Rings at PSAP
2. PSAP Alarm Answered
3. Call Transferred to Appropriate Agency, and is Processed
4. Call Ready to Be Dispatched
5. Call Dispatched to Response Unit(s)
6. Unit(s) Respond
7. Unit(s) Arrive at Scene
8. Providers Arrive at Patient

95% of calls received on emergency lines answered in 15 seconds, 99% of calls in 40 seconds PER NFPA 1221, 7.4.1

Alarm transfers from the primary PSAP to a secondary answering point shall not exceed 30 seconds for 95 percent of all alarms answered, per NFPA 7.4.4

95% of emergency call processing and dispatching in 60 Seconds, 99% in 90 Seconds PER NFPA 1221, 7.4.2

Turnout Time, 90% in 60 Seconds PER NFPA 1710, 4.1.2

DFD- 85% Four Minutes (240 seconds) or less for arrival of the first unit at an EMS incident
DHPD- 90% Eight Minutes (480 Seconds) or less for the arrival of an ALS unit
Both PER NFPA 1710, 4.1.2.1

DFD- 85% four minutes, fifty-nine seconds for arrival of the first unit at an EMS incident
DHPD- 85% eight minutes, fifty-nine seconds for arrival of the first ALS unit at an EMS incident
Both per the current operating agreement with the City and County of Denver
911 EMS Call Processing Timeline

Current State, New Standard

1. 911 Alarm Rings at PSAP
2. PSAP Alarm Answered
3. Call Transferred to Appropriate Agency, and is Processed
4. Call Ready to Be Dispatched
5. Call Dispatched to Response Unit(s)
6. Unit(s) Respond
7. Unit(s) Arrive at Scene
8. Providers Arrive at Patient

Call Processing Unit Selection
90% Four Minutes (240 seconds) or arrival of the first unit at an EMS incident
90% Eight Minutes (480 Seconds) or for the arrival of an ALS unit
Both Per NFPA 1710, 4.1.2.1

Event Timeline
- 15 Seconds
- 30 Seconds
- 60 Seconds
- 60 Seconds
- DFD 240 Seconds
- DHPD 480 Seconds

- NFPA Standard
- Event Timeline
- Current Call Taking Elements

95% of calls received on emergency lines answered in 15 seconds, 99% of calls in 40 seconds Per NFPA 1221, 7.4.1

Alarm transfers from the primary PSAP to a secondary answering point shall not exceed 30 seconds for 95 percent of all alarms answered, per NFPA 7.4.4

95% of emergency call processing and dispatching in 60 Seconds, 99% in 90 Seconds Per NFPA 1221, 7.4.2

Turnout Time, 90% in 60 Seconds Per NFPA 1710, 4.1.2

DFD - 90% Four Minutes (240 seconds) or less for arrival of the first unit at an EMS incident
DHPD - 90% Eight Minutes (480 Seconds) or less for the arrival of an ALS unit
Both Per NFPA 1710, 4.1.2.1
Timeline Events Descriptions

1. Caller initiates a 911 call to the PSAP, which rings at the Denver Combined Communications Center (Denver’s primary PSAP)

2. Alarm is answered by 911 call taker at 950 Josephine. The interval between 2. and 3. consists of the call taker confirming the phone number and location information received on ANI/ALI interface, and determining the appropriate response agency(ies) to transfer the call to.

3. Two parallel processes are happening- a telephone process, and a CAD process. The voice call is transferred to an EMS call taker, and the initial information the 911 call taker has entered into CAD is electronically transferred to the EMS call taker’s Waiting Incidents Queue as a “Call in Progress”. For EMS calls, the 911 call taker transfers the call to EMS and remains on the line. The 911 call taker and the EMS call taker enter notes into the notes field, while the EMS call taker is interrogating the caller. The 911 call taker adds DPD to calls where they are needed, to respond with EMS. When sufficient information has been obtained to determine a nature and priority, the call is ready for dispatching.

4. Once a determination of nature and priority has been made, the call is ready for assignment. The interval between 4. and 5. represents the time period when the dispatcher is selecting the most appropriate unit based on location of the call, priority of the call, and service level (ALS or BLS), and dispatching them to the call.

5. The selected unit(s) are assigned to the call by radio communication from the dispatcher, by pager, and by MDT if the vehicle is equipped with one. The interval between 5. and 6. represents the time period when the unit prepares to respond to the response address.

6. The selected unit begins traveling to the address. The interval between 6. and 7. represents travel time.

7. The unit arrives at the response address (scene). Arrival at scene is defined below. The interval between 7. and 8. represents the time between leaving the parked vehicle and patient contact.

8. The EMS providers contact the patient.
Glossary of Terms

Alarm- 911 telephone call
ALS- Advanced Life Support (Paramedics)
ANI/ALI- Automatic Number Identification/Automatic Location Identification
Appropriate agency- DFD or DHPD, depending on nature of call
Arrival- Arrival at curb of response address
BLS- Basic Life Support (EMT-B)
CAD- Computer Aided Dispatch
Call processing- Determination of scope and nature of the alarm, such that appropriate resources are dispatched
Dispatch- Unit assignment to call
Emergency line- This needs collaborative definition
En route- Travel to call address
EMS- Emergency Medical Services
MDT- Mobile Data Terminal. Mobile computer interface with CAD system, which also has a GPS transponder
PSAP- Public Safety Access Point. Denver Combined Communications Center for this analysis
Response unit- EMS or fire department vehicle staffed with trained personnel
Secondary answering point- specific agency communications personnel (DFD or DHPD)
Turnout time- Interval of time between unit assignment (responding unit notified of call), and response (unit begins traveling to call)
Waiting Incidents Calls Queue- CAD field which holds calls waiting for assignment to a response unit