Minneapolis Fire Department
Standards of Response Coverage

2005

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SECTION ONE: INTRODUCTION AND ADOPTION

The Minneapolis Fire Department is the primary provider of fire and emergency medical response as well as hazardous materials and technical rescue services for the City of Minneapolis, Minnesota. Minneapolis is the largest city in the State, with a year 2000 population of approximately 383,000 people. The city was established in 1858 and is located on the upper Mississippi River. The department operates out of 19 fire stations with 26 front line apparatus as well as a Mobile Command and Air Supply vehicle. The city is rectangular in shape covering 58 square miles. The major topographical feature is the Mississippi River which roughly bisects the city from north to south.

The department is led by Fire Chief Bonnie Bleskachek and consists of 445 full time personnel, with 423 sworn personnel and 22 civilians. A three shift platoon system is used to provide 24-hour staffing. One of the three shifts works a back-to-back 24 hour shift, or 48 hours consecutively. The remaining two shifts have at least 24 hours off between 24-hour shifts. A Deputy Chief is in charge of each shift, with four Battalion Chiefs responsible for each of four fire districts. Each Battalion Chief has 4-5 fire stations under their command.

Like most large metropolitan fire departments, the citizens and elected officials of Minneapolis expect excellent fire and emergency operations from their fire department. Historically, the department has averaged an excellent 3 ½ minute response time to all emergency events. The department responded to 32,630 calls for service in 2004, of which 66% were emergency medical and rescue events.

The Minneapolis Fire Department has established a formal standard of coverage that outlines what level of service citizens can expect from the current level of resources provided to the department through the city budget process. This document also outlines new initiatives that have been undertaken to improve the level of service in the future.

The following document is hereby adopted as the Minneapolis Fire Department standards of coverage. This document will be reviewed and updated on an annual basis as new risks are identified and resource levels are adjusted to meet future challenges.

Bonnie Bleskachek
Fire Chief

SECTION TWO: RISK ASSESSMENT

Minneapolis Building Fire Risk Assessment

In order to understand the importance of response time in achieving satisfactory outcomes, the deployment of resources must be based upon assessment of the values at risk. There are actually many different *types* of values at risk depending upon the nature of the emergency. At a very basic level, a fire in a structure is among the most frequent event with a measurable outcome. A medical aid is a different event, and while it is the most frequent, it is not as threatening to life and property as the structure fire.

The incident reporting system provides a wide variety of different types of events that can result in a call for service, but it is a reported fire in a building that is the essence of the Minneapolis Fire Department's deployment plan. This same reporting system is often the only statistically significant evidence of the frequency and consequence regarding the values at risk in any community.

As is expected in a metropolitan mid-west city, much of the City's area consists of low and medium density residential housing. There are some pockets of higher density residential housing and newer commercial loft building residential redevelopment. Housing areas are of course complimented by retail/commercial/industrial development zones. In addition, the downtown core contains many mid- and high-rise office buildings, theaters and sports venues. The entire city contains all the risks any large, thriving city presents to a metropolitan fire department in the United States today. In addition, the fire department has additional challenges during snow season.

In a Standards of Response Coverage study, building fire risk is typed using a standard classification tool. For this study, the Fire Department staff used the building fire classification tool jointly developed by the Commission on Fire Accreditation and the U.S. Fire Administration. The tool is called RHAVE or "Risk Hazard and Value Evaluation." It is a multi-part analysis tool built in a database format that allows fire personnel to identify key issues about a building such as size, construction type, fire flow, and occupant safety factors. Based on those factors, the tool generates a point value on a categorization scale that ranges from low to Maximum.

The Fire Department staff used this tool to RHAVE score the predominate building type found in each Fire Department "fire box." A fire box is a small geographic unit of measure, smaller than one Fire Company's first due area of response coverage. In Minneapolis, there are 140 fire box areas, which allowed for a fairly discrete level of risk assessment. Minneapolis is no different from most suburban communities where housing and neighborhood low-rise commercial uses comprise most of the building types. The RHAVE tool categorizes these classes of building as ***moderate*** for fire risk.

Most of Minneapolis is moderate fire risk. There is one fire box that is scored as significant for building fire risk (Box 106I) and no fire boxes are rated as maximum risk. The one fire box rated as significant risk is the older downtown commercial area, still mostly without fire sprinklers and sub standard building codes compared to today's standards.

As an additional risk assessment step, the Department asked the national Insurance Services Organization (ISO) to provide its data on Minneapolis. The ISO evaluates fire departments for the insurance underwriting industry. One of their methods is to send an evaluation engineer to assess significant buildings in a community to determine their risk of serious fire. Fire flow is the total amount of water in gallons per minute that a fire department would have to deliver to stop a serious fire from involving most of the building. It is no coincidence that the fire box that was rated significant also contains many ISO evaluated sites, as does much of the urban core. If the RHAVE significant area is taken together with the ISO sites, this is where an "effective response force" must be located. An effective response force is deployment of multiple units so they can arrive close enough together to combat serious fires.

Given Minneapolis's still relatively compact size and the current fire station locations, the Fire Department is able to aggregate fire units into the "core" significant hazard/ISO areas since they are in the interior of the City. In the future, Minneapolis would be well served to use good zoning and fire sprinklers to keep areas of significant fire risk out of city edge areas where they will be hard to serve in a timely manner with multiple units.

From a hazard, risk and value perspective the number of structural fires is usually linked to the distribution and concentration of different building types in the community. As is expected in a metropolitan community, the community has a very specific growth and development pattern consistent with past decisions or land use. As would be anticipated there are pockets of various densities of housing stock ranging from low cost, high density housing to high cost low density neighborhoods. There is wide spread distribution of neighborhood retail and commercial facilities. Along the main transit routes are typical commercial, mixed and public uses. Then of course there are areas of high concentration of values in areas that exist in the traditional "downtown" area. There are areas in which many job provider and sales tax businesses are located.

In relating the relationship of loss by the property use, the following chart indicates the distribution of events and losses for the 1,076 structure fires in 2004, which accounted for $18,658,710 in fire loss:

Property Use	Event #s	Estimated Fire Dollar Loss

		($)
1 & 2 Family	366	6,773,075
Apartments	444	2,150,750
Hotels, Motels	4	1,000
Dormitories	30	97,075
Public Assembly	28	1,047,830
Schools	15	8,410
Health Care	20	100
Stores, Offices	34	5,942,460
Industrial, Utilities &Manufacturing	16	1,803,000
Storage	87	765,110
Other Structures	32	79,900

What this data does not provide is an estimate of the values at risk that resulted in that loss. For example, the Department had 28 multiple alarm fires in that same reporting period. These alarms total 9,202,900 of the total loss, or about 49%. From a standpoint of response time goals the initial attack on the other events (1,076 – 30 = 1,046) were successful in containing the fire to the condition found upon arrival. From a risk assessment perspective, the arrival of the first alarm assignment is critical to holding fire losses to a minimum.

According to Fire Department Statistical Report for 2004, 179 of the fire events were "resource intensive." This is defined in that document as events in which hose lines were deployed, excluding detached garage fires. In the Business Plan, the MFD has identified several outcome measures that are focused upon risk, hazard, and values. These are identified as follows:

% of structure fires held to room of origin

$ value of property loss due to fire

% of lives saved by AED

% of calls where BLS is less than 5 minutes

# of incidents that occur

% of occurrences where response time is less than 5 minutes

These measures going forward will be very valuable to assist the city in understanding if its fire deployment system is meeting its needs. Another way to look at risk is the demographics of a community.

The following information is taken from the Census 2000 Demographic Profiles for City of Minneapolis and it provides an overview of the distribution of the population among the various attributes that make up the communities unique character.

General Characteristics	Number	Percent	U.S. Avg.
Total population	382,618	100.0	100%
Male	192,232	50.2	49.1%
Female	190,386	49.8	50.9%
Median Age (years)	31.2	(x)	35.3
Under 5 years	25,187	6.6	6.8%
18 years and over	298,449	78.6	74.3%
65 years and over	34,878	9.1	12.4%
One Race – Total	365,924	95.6	97.6%
White	249,186	65.1	5.1%
Black or African American	68,818	18.0	12.3%
American Indian and Alaska Native	8,378	2.2	0.9%
Asian	23,455	6.1	3.6%
Native Hawaiian and Other Pacific Islander	289	0.1	0.1%
Some other race	16,694	4.4	2.4%
Hispanic or Latino (of any race)	29,175	7.6	12.5%
Average household size	2.25	(x)	2.59
Average family size	3.15	(x)	3.14
Total housing units	168,600	100.0	
Occupied housing units	162,352	96.3	91.0%
Owner occupied housing units	83,408	51.4	66.2%
Renter occupied housing units	78,944	48.6	33.8%
Vacant housing units	6,254	3.7	9.0%
Social Characteristics –			
Population 25 years and over	243,409	100.0	
High school graduate or higher	50,495	85.0	80.4%
Bachelor's degree or higher	59,224	37.4	24.4%
Civilian veteran (civilian population 25 years and older)	27,186	9.1	12.7%
Disability Status (population 21 to 64 years)	40,430	16.9	19.2%
Foreign Born	55,475	14.5	11.1%

Now Married (population 15 years and over)	111,757	36.0	54.4%
Speak a language other than English at home (5 years and older)	68,935	19.3	17.9%
Economic Characteristics –			
In Labor Force (16 years and older)	220,790	72.1	63.9%
Mean travel time to work in minutes (16 years and older)	21.7	(x)	25.5
Median household income (dollars)	37,974	(x)	41,994
Median family income (dollars)	48,602	(x)	50,046
Per capita income (dollars)	22,685	(x)	21,857
Families below poverty level	8,868	11.9	9.2%
Individuals below poverty level	62,092	16.9	12.4%
Housing Characteristics –			
Single family owner occupied homes	69,008		
Median value (dollars)	113,500	(x)	119,600
Median of selected monthly owner costs	(x)	(x)	
With a mortgage	957	(x)	1,088
Not mortgaged	301	(x)	295

As is the case in most communities it has been determined that the daily event in Minneapolis is of the moderate or typical risk type. Fire responses to the high hazard occupancies do not occur frequently enough to analyze any trends.

Finally, the Minneapolis Fire Department will, on an annual basis, update the risk hazard analysis document. The risk assessment will continue to be used as part of the standards of cover document to evaluate the concentration and distribution of resources, in-order to provide a response capable of handling all risks within the City of Minneapolis.

SECTION THREE: HUMAN RISK MANAGEMENT

People are our most valuable asset. All emergency operations will take into account the risk to firefighters and the public before a strategy and the accompanying tactics are employed. It is important to have an understanding of the duties required at a structural fire to meet the strategic goals and tactical objectives of the Fire Department response. Fire ground operations fall in one of two strategies – **offensive or defensive.** The two strategies are based on a standard Human Risk Management Plan that is employed at all structure fires. This is the basis for the following Minneapolis Fire Department procedure:

> We may risk our lives a lot to protect **savable** lives
>
> We may risk our lives **a little** to protect **savable** property
>
> **We will not risk our lives at all to save what is already lost**.

Considering the level of risk, the Incident Commander will choose the proper strategy to be used at the fire scene. The Incident Commander must take into consideration the available resources (including firefighters) when determining the appropriate strategy to address any incident. **Unless a confirmed victim is near an exit or other opening in the structure, No offensive interior structure fire attack will occur until at least 4 firefighters have assembled on the fire ground.** The strategy can also change with conditions or because certain benchmarks (i.e., "all clear") are achieved or not achieved.

Once it has been determined that the structure is safe to enter and enough human resources have been assembled on the fire ground (at least 4 firefighters), an **offensive** fire attack centered on life safety is begun. When it is safe to do so, the MFD will initiate offensive operations at the scene of a structure fire. Initial attack efforts will be directed at supporting a primary search – the first attack line will go between the victims and the fire to protect avenues of rescue and escape.

The decision to operate in a **defensive** strategy indicates that the offensive attack strategy, or the potential for one, has been abandoned for reasons of personnel safety, and the involved structure has been conceded as lost (the Incident Commander makes a conscious decision to write the structure off). The announcement of a change to a defensive strategy means all personnel will withdraw from the structure and maintain a safe distance from the building. Captains will account for their crews when exiting a building. Interior lines will be withdrawn and repositioned. Exposed properties will be identified and protected.

SECTION FOUR: ON-SCENE PERFORMANCE EXPECTATIONS

Many fire department deployment studies using the Standards of Response Coverage process, as well as NFPA 1710 guidelines, arrive at the same fact – that a typical risk structure fire needs a minimum 14 firefighters, plus one incident commander. The recommendation is that the first unit should arrive on-scene within 6 minutes of call receipt (1-minute dispatch, 1-minute crew turnout and 4-minute travel time), 90 percent of the time. The balance of the units should arrive within 10 minutes of call receipt (8-minute travel), 90 percent of the time, if they hope to keep the fire from substantially destroying the building.

Combining Outcome Expectations and Hazards at Risk – "Critical Tasks"

Desired community outcomes such as "keep the fire damage to the room of origin" must be related to the hazard class of the building. For an extreme example, to confine a fire to one room in a high rise building requires many more firefighters than in a single story family home in a suburban zone. How much staffing is needed can be derived from the desired outcome and hazard class. If Minneapolis desires to confine a typical one-room fire in a residence to the room or area of origin, that effort will require three to four suppression units plus a battalion chief for a minimum of 17-22 firefighters. This number is needed to safely conduct the simultaneous operations of rescue, fire attack, and ventilation plus providing for firefighter accountability. A serious fire in a one story commercial or multi-story residential building would require at a minimum an additional Battalion Chief, a rescue company, the command van and the lighting/air bottle unit which is 26 personnel. A typical auto accident requiring patient extrication or other specialty rescue incidents will require a minimum of 10 firefighters plus the battalion chief for accountability and control.

The following table of individual duties is required at a first alarm fire scene in a moderate risk building. This set of duties is taken from the Minneapolis Fire Department Business Plan. This set of needed duties is entirely consistent with the usual and customary findings of other agencies using the Standards of Response Cover process and that found in NFPA #1710:

Responsibilities	# of F/F's
Chief assigned as Incident Commander	1
Chief assigned as safety officer	1
Mobile Command Post Operator	1
Min 400 gpm uninterrupted water supply w/operators	2
Attack line @ minimum 300 gpm flow	3
Backup line @ minimum 300 gpm flow	3
Support personnel attack line	1
Support personnel backup line	1
Minimum of 1 search and rescue team with at least	

2 personnel (most structures need 2 teams to quickly cover the area)	
First search and rescue	2
Second search and rescue	2
Minimum of 1 ventilation team	4
Rapid Intervention Team (RIT) to rescue downed F/F's	3
Salvage/mobile air unit for SCBA	1
Aerial ladder operator, minimum 1 operator per truck	1
Total firefighters responding	**26**

The above duties must be grouped into the quantity of responding companies. In order to understand the time to complete these tasks on a typical house fire and emergency medical rescue, the Department conducted several timed trials using their existing standard operating procedures to demonstrate how much time the tasks take. The following tables start with the time of fire crew notification and finish with the outcome achieved.

There are several important themes contained in the charts below:

A. These results were obtained in the best of circumstances on clear, sunny days with optimum arrival times for the units. The Department training building was used, so the crews were familiar with it.

B. It is noticeable how much time it takes after arrival or after the event is ordered by command to actually accomplish key tasks to arrive at the actual outcome. Critical steps are highlighted in the table.

C. The time for task completion is usually a function of how many personnel are ***simultaneously*** available.

D. Some tasks have to be assigned to a minimum of two firefighters to comply with safety regulations. An example would be searching a smoke filled room for a victim.

The tactical scenario time trials were completed using units responding that compose a standard full 1st alarm response assuming no substitutions for companies out of service (training, other runs, maintenance etc.). The companies utilized were not necessarily the same ones that would operate together at an actual fire. The companies were chosen to reflect the actual composition of the Department and not either end of the performance spectrum. The fire control times are based upon a room and content fire without extension to concealed spaces requiring extensive operations involving opening up those spaces and attacking deep-seated fires in walls or attics.

First Alarm Response to a 2 Story Residential Home, Smoke Showing

Units and the typical, historic average response times (notification to on-scene):

Engine 7, 4 personnel @ 3:34

Engine 12, 4 personnel @ 4:05

Engine 16, 4 personnel @ 4:33

Ladder 10, 4 personnel @ 3:51

Rescue 9, 6 personnel @ 7:09

Battalion Chief 1 @ 6:33

The above totals 23 personnel. The additional 3 personnel to make up the 26 personnel for the total effective response force were not time trialed as they are not needed in the initial critical minutes. These are the 2nd B/C for safety, the command unit and the light/breathing air unit.

Bench Marks (Assigned/Completed times)

Engine 7,	3:34/3:44	Scene size-up / Command
Engine 7,	4:06/6:34	Attack line
Engine 12,	5:15/11:30	Supply line w/ a secured water source
Engine 12,	5:15/12:00	Back-up line
Ladder 10A,	3:51/9:25	Primary search 1st floor
Ladder 10A,	3:51/11:37	Primary search 2nd floor
Ladder 10B,	7:48/11:31	Ladder building and put hole in roof
Rescue 9,	7:09/11:00	Secondary search 1st floor
Rescue 9,	7:09/12:49	Secondary search 2nd floor
Engine 16,	4:33/10:00	RIT assigned
Engine 7	12:20	Fire knocked down
BC 1,	6:35/8:51	Progress report (15 min.)
BC 1	13:54	Fire under control
Total Time	***13:54***	

First Alarm Response to a 3-Story Apartment, Smoke Showing

Units and the typical, historic average response times (notification to on-scene):

Engine 4, 4 personnel, @ 3:34

Engine 20, 4 personnel @ 4:05

Engine 17, 4 personnel @ 4:33

Ladder 11, 4 personnel @ 3:51

Rescue 9, 6 personnel @ 7:09

Battalion Chief 2 @ 6:33

The above totals 23 personnel. The additional 3 personnel to make up the 26 personnel for the total effective response force were not time trialed as they are not needed in the initial critical minutes. These are the 2nd B/C for safety, the command van operator and the light/breathing air unit operator.

Bench Marks (Assigned/Completed times)

Engine 4,	3:40	Scene size-up / Command
Engine 4,	3:40/6:20	Attack line
Engine 20,	4:40/9:05	Supply line w/ a secured water source
Engine 20,	4:40/9:15	Back-up line
Ladder 11A,	4:10/8:16	Primary search 1st floor
Ladder 11A,	4:10/8:16	Primary search 2nd floor
Ladder 11B,	6:17/8:04	Primary search 3rd floor
BC 2,	6:33/6:50	Arrives/Assumes command
Ladder	11B/8:00	Ventilation horizontal 3rd floor
Ladder	11A/9:40	Ventilation horizontal 2nd floor
Ladder 11B,	11:40/13:10	Secondary search
Engine 17,	5:20/8:20	RIT assigned
Rescue 9 A & B,	7:30/13:34	Ladders structure in sectors B and D
BC 2	13:34	Fire knocked down
BC 2	7:30/8:45	Progress report (15 min.)
BC 2	15:17	Fire under control
Total Time:	**15:17**	

Medical Response to Auto Accident - Report of 2 Trapped

Engine 22, 4 personnel @ 3:34
Rescue 1, 6 personnel @ 6:33
Battalion Chief 2 @ 6:33

Bench Marks (Assigned/Completed times)

Engine 22,	3:34/3:44	Scene size-up / Command
Engine 22	4:50	Patients assessed
Engine 22,	4:40/5:15	Precautionary line laid and charged
B/C 2 arrival,	6:33/	
Rescue 1,	6:33/6:45	Announces arrival and prepares for forcing passenger compartment of vehicle1
B/C 2 takes IC	7:30/	
Rescue 1	/11:05	Forces entry to vehicle 1
Rescue 1	/15:30	Forces entry to vehicle 2
Engine 22, Rescue 1	/14:52	Patient extricated/boarded from car 1
Engine 22, Rescue 1	/18:57	Patient extricated/boarded from car 2
Total Time:	**18:57**	

In summary, the critical task time studies show:

- Typical house fire, time to fire control: 13:54
- Typical multi-story residential fire, time to fire control: 15:17
- Typical multi-patient auto accident, time to transport: 18:57

As mentioned, these positive outcome completion times are measured from the time of fire crew notification. They do not include 911 dispatch center reflex time to obtain information and get the dispatch formatted and to the crew. At least one minute should be added to the above times for that step. The outcome times are **good** for the following reasons:

1. **The staffing per unit is the optimum 4 per engine and Truck Company**.
2. Minneapolis has excellent station spacing as will be shown later by map measures
3. The times were under ideal conditions, in a familiar building.
4. Snow, or multiple calls for service did not delay road travel times.
5. The crews are well trained and equipped.

What this means is that the citizens of Minneapolis are able to expect very good outcomes and have a better than not chance of survival in a fire or medical emergency. Having said that, the control times are at the outer edge of acceptable performance. Remember that brain death can occur within 10 minutes from the moment of cardiac arrest, not the time of fire crew alerting. Fires can expand explosively after the 8 to 10 minute point. Therefore, the current Minneapolis deployment model gets the initial unit on scene within these limits to start effective intervention. The above times show that first water is applied to fires in under seven minutes and control is obtained in under 15 minutes. In EMS incidents, the patient is initially being assessed within six minutes and able to be transported within 20 minutes. For fires and rescues the other needed units arrive in time to complete an effective intervention. Time is one factor that comes from great station placement. Good performance also comes from ***adequate staffing***. On the fire and rescue time measures, the above outcome times are as good as they are because the units were staffed at four not three firefighters.

Previous critical task studies conducted by Citygate, the Standard of Response Cover documents reviewed from accredited fire departments, and NFPA recommendations all arrive at the need for 15+ firefighters arriving within ten minutes (from the time of call) at a room and contents structure fire to be able to ***simultaneously and effectively*** perform the tasks of rescue, fire attack and ventilation.

SECTION FIVE: DISTRIBUTION AND CONCENTRATION STUDIES

In brief, there are three perspectives to fire station deployment:

- **Distribution** – the spreading out or spacing of first-due fire units to stop routine emergencies.
- **Concentration** – the clustering of fire stations close enough together so that building fires can receive enough resources from multiple fire stations quickly enough.
- **Effective Response Force –** the collection of a sufficient number of firefighters on-scene arrived within the concentration time goal to stop the escalation of the problem.

To analyze first-due fire unit travel time coverage for this study, Citygate (an outside consultant) used a geographic mapping tool from ESRI Corporation called *Network Analyst* along with a fire department response-mapping program called *FireView*™ that can measure travel time over the street network. Citygate and the Fire Department used city GIS street data with the most recent speed limits. Using these tools, Citygate ran several deployment options and measured their impact on various parts of the community. The time measure used was 4 minutes travel over the road network, which is consistent with current Minneapolis Fire Department first-due unit response goals. Again, this equals a 5-minute fire department response time, which is from the time of notifying the fire crew, to their arrival on-scene. When dispatch reflex time is added, a four-minute map is really the six-minute time coverage from the caller's viewpoint.

The response map shows the Fire Department 140 fire boxes. Much of the City is suburban residential and as such under a nationally used typing system, is rated moderate or average risk for possible severity of building fires. There is one area of significant risk in the downtown area, where if a fire occurs, it will be more severe, requiring more resources in a shorter time frame to control. (Fire Box 106I)

Real dispatch data will shows some response times longer than 4 minutes in some of the edge areas. This is due to traffic congestion or the crew being on a prior call and another unit covering the incident. It is not possible to serve every road segment out to the edge of the city in four travel minutes, However, there is 90+ percent of the city covered and in the edge areas, most of them are covered within one more travel minute (5 minutes total).

Concentration or massing of fire crews for serious fire or rescue calls is also very important. Building fires in particular require 15+ firefighters arriving within a reasonable time frame to work together and effectively to stop the escalation of the emergency. Otherwise, if too few firefighters arrive, or arrive too late in the fire's progress, the result is a greater alarm fire, which is more dangerous to the public and the firefighters.

Almost all of Minneapolis is effectively covered by an initial effective response force of 3-engines, 1-ladder and 1-B/C. The largest area without total coverage is at the northwest corner of the city in Engine 20's district. However, given the few cross streets around the rail

yard, this is a hard to serve area. The area is covered by three units within 8 travel minutes and the 4th unit gets in within 10 minutes or less. Given this, and the limited cross streets, it would not be cost effective to add another station north of the rail yard. This area also gets slow Battalion Chief coverage and as will be shown later, relocating Battalion Chief 4 to new Station 14 in 2006 solves that issue.

It is apparent that while most of the city is covered by the full effective response force within the 8 travel minutes, especially in the downtown core, three of the four corners of the city do not receive the rescue in 8 travel minutes. Given there are only two rescues, this is understandable. However, there is considerable overlap between the two rescues. There is not a good location to pull Rescue 9 further north given the river and the wide separation between Stations 14 and 15. Rescue 1 is located downtown where most of the high angle and technical rescue risk is located.

Overlap of units and ensuring the delivery of a very good concentration for the effective response force are key. The city's best concentration is where the greatest density of calls for service occurs. Minneapolis is fortunate to have good station and multiple fire crew overlap in the core of the city where most calls for service occur. If hot spots of workload were to occur in concentration "gaps" or out at the edges of the city, then additional fire stations or crews would be required. Multiple crews provide the 2nd due resource when multiple calls for service occur. Given the density of calls for service in the center 50% of the city, without multiple crews, response times would not be maintained. Any reductions to deployment in the highest workload areas should be based on accurate call for service back-to-back statistics, not just map travel time measures.

The Fire Department closed Ladder #2 at the start of 2004. Without this Ladder in service, Ladder 5 at Station #17 is covering the lower third of the city and five station first-due areas. This is a large area when two or more fires occur at the same time. Ladder #11 from downtown must cover, and there is no way for them to effectively cover the three southern station areas in 8 to 10 travel minutes. Giving Truck #5 this large an area also means that anytime it is on a call or out of the area for training or maintenance, a cover truck will have to be moved into Station 17.

As the effective response force compliance statistics will show in the next section, the southern third of the city is not performing at 90% in nine minutes response time for 2-engines and 1-ladder.

SECTION SIX: RESPONSE RELIABILITY

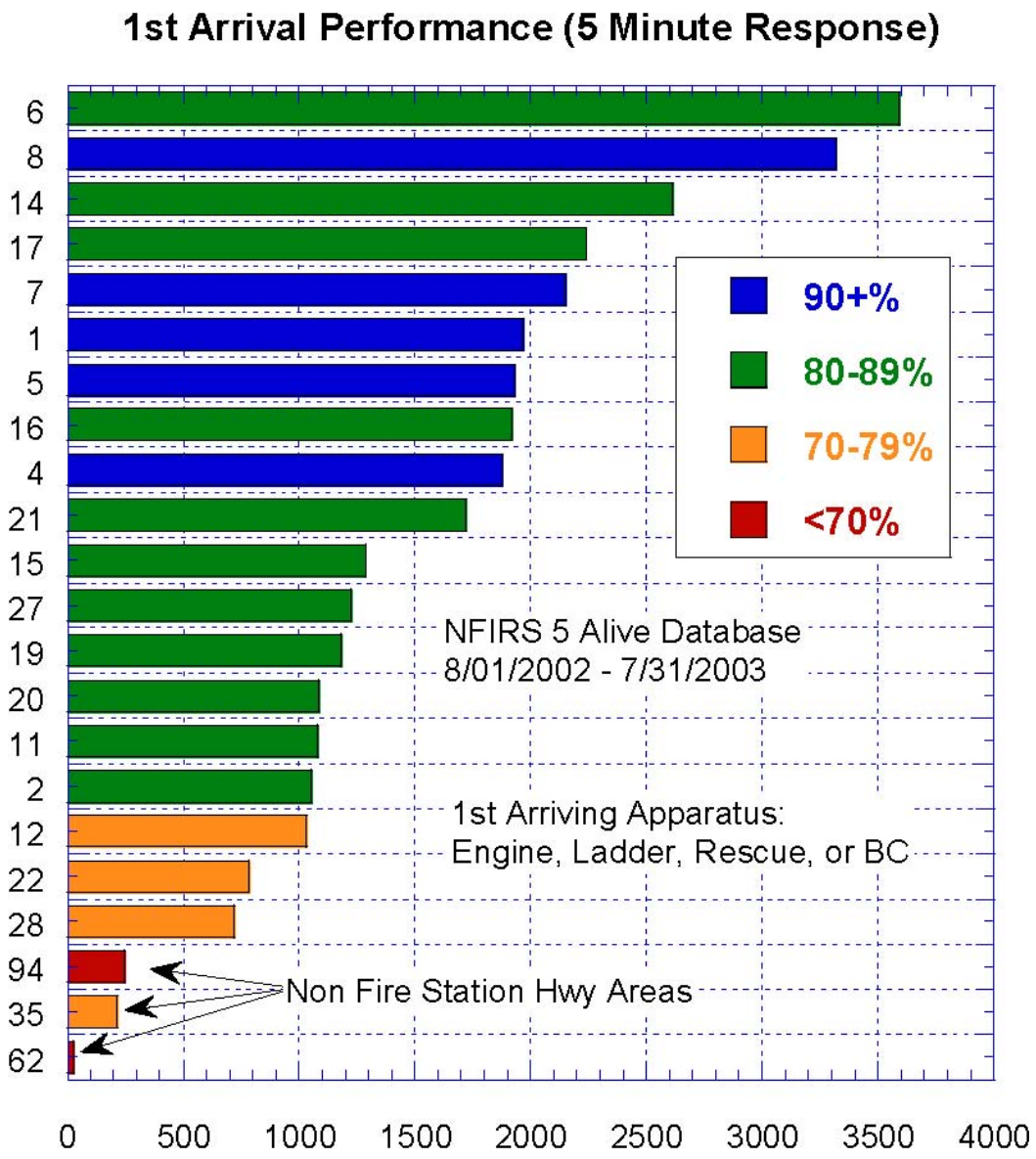
Response reliability is defined as the probability that the required amount of staffing and apparatus will be available when a fire or emergency call is received. If every piece of fire department apparatus were available every time a call was received, then the department's response reliability would be 100 percent. If, however, a call is received for a particular company but that company is busy at another call, a substitute (second due) company must be assigned from another station. If the substituting station is too far away, that company cannot respond in the maximum prescribed travel time. As the number of emergency calls per day increases, the probability increases that a needed piece of apparatus will already be busy when a call is received. Consequently, the department's response reliability decreases.

When looking at response reliability it is also important to consider the size of the area that a station covers (the bigger the area the more likely a second due call will occur). As a review of actual performance occurs, there are two perspectives to keep in mind. First, NFPA #1710 only requires that a citywide performance measure of 90 percent of the historical incidents (not geography) be maintained. As discussed earlier in this report, this allows the possibility that a few high performing stations can "mask" the performance of stations with poorer travel times. In the Standards of Response Coverage approach, it is recommended that the performance of each response box or zone also be determined to ensure equity of coverage. However, even this approach is not perfect – a station area may well have under 90 percent performance, but be low risk or under developed thus not yet have an economic justification for better performance. In addition, the study must discuss just what is measured within the under performing statistic. For example, a station area with a first-due performance of 88 percent with only 50 calls in the 88 to 90th percentile is far different from an area with 500 calls for service in that 88-90th percentile.

All measures then must be understood in the complete context of geography, risk, and actual numbers of calls for service "under preformed on." The Department's response time performance must be compared to outcomes such as fire loss or medical cases and be contrasted to the community's outcome expectations. A community could be well deployed and have poor outcomes or the reverse. A balanced system will avoid such extremes and strive for equity of service within each category of risk.

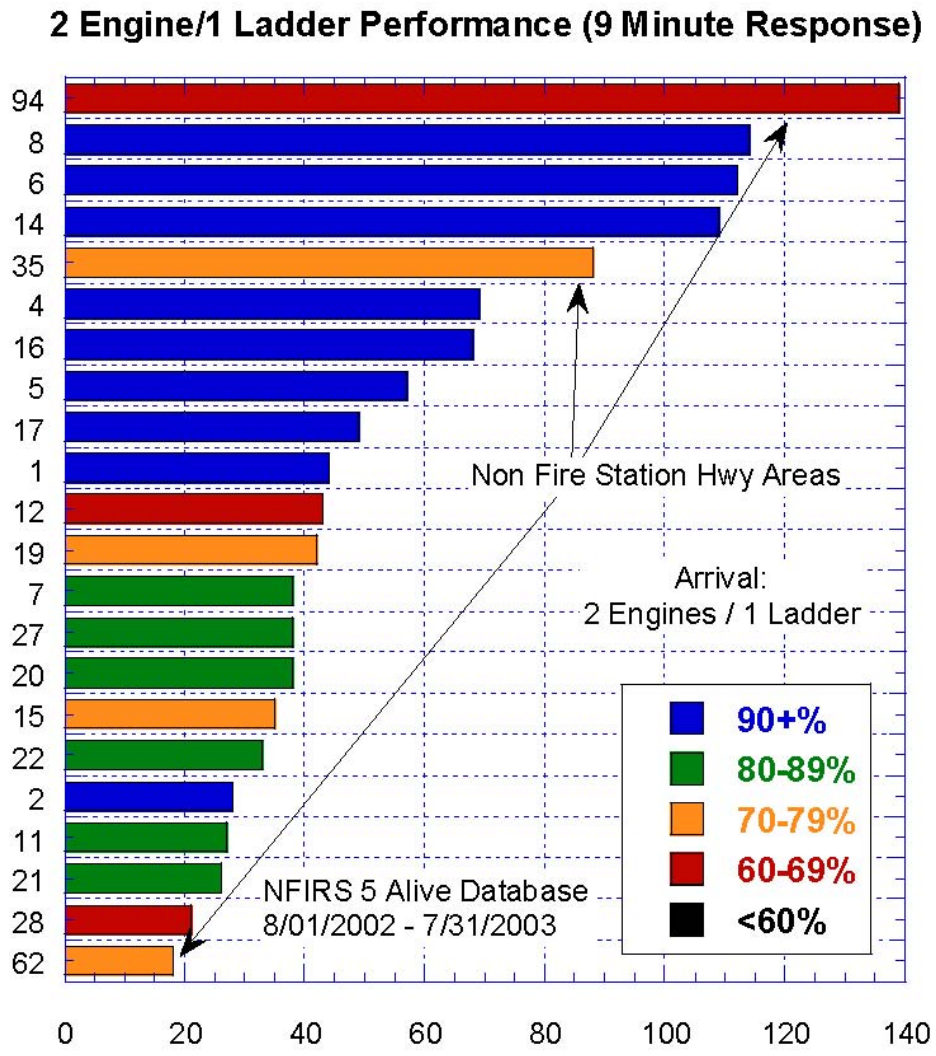
Detailed Analysis and Fractal Performance Measures:

The following chart shows Minneapolis response performance as a function of station area call volume for first arriving apparatus. Response time is one minute for turnout and 4 minutes for travel. First "arriving" includes engines, ladders, Battalion Chiefs, rescue and other apparatus types. As seen, the station coverage areas with the largest call volumes have the highest levels of performance. This shows that Minneapolis station area deployment tends to provide the "best-bang-for-the-buck." In other words, limited resources are positioned to try to provide the best operational response to the city's incident call volume.



The above chart looks at first-due performance. The next step is to look at fractal compliance for the effective response force or "First Alarm assignment."

The following chart shows *2-Engine/1 Ladder* response performance as a function of coverage area call volume. If areas 94, 35 and 62 (which are not fire station areas) are removed, one sees that the eight highest 2-Engine/1-Ladder call volume areas are under a 9-minute response criteria over 90% of the time. Stations 12 and 28's low performance levels show that they are just too far from a ladder-equipped station.



SECTION SEVEN: MINIMUM STAFFING

The Minneapolis Fire Department has established the following minimum daily staffing in order to meet our standard of cover:

	NFPA 1710	Minimum Staffing	Total
14 Engine Companies	4	3	42-56
5 Quints	4	4	20
5 Ladder Companies	4	4	20
2 Heavy Rescues	6	6	12
1 Command Vehicle	1	1	1
1 Salvage/Air Supply	1	1	1
1 Ladder 2 (Not in service)	4	0	0-4
Total Fire Suppression Staff			96-114
4 Battalion Chiefs	4	4	4
1 Deputy Chief	1	1	1
Total Command Staff	5	5	5

Using the above table, the optimal staffing level would be 114 fire personnel below the rank of Battalion Chief working each day. At this level, the department will meet all of the requirements contained in NFPA Standard 1710. This optimal staffing level was affirmed by Citygate Associates (an outside consultant) in 2003 based on an extensive study of the city.

Current Staffing: The Minneapolis Fire Department is below authorized staffing by 13 firefighters. At the current staffing level of 410 sworn personnel, the fire department **averages** 96 firefighters working per day. A new class of 17 Cadets began training in May 2005 and will move into the stations in October. This group will increase fire department staffing up to the authorized level of 423 firefighters and result in average daily staffing of 99.

In no case will daily staffing be allowed to fall below 96 personnel below the rank of Battalion Chief. While this staffing level puts all engine companies at three fire fighters, it allows all truck and quint companies to ride with four fire fighters. With current station placement and rig deployment this is a critical staffing level to maintain. Off duty personnel will be hired back to meet this minimum staffing level.

With the addition of another truck company staffed with four personnel, coupled with other initiatives outlined in Section Ten of this document, the department believes that it can return to meeting one part of the NFPA 1710 response time standard of 5 minutes 90% of the time.

SECTION EIGHT: RESPONSE TIME DEFINITIONS

There are 10 elements when doing response time calculations. They are as follows:

- **Event Initiation** - The point at which factors occur that may ultimately result in an activation of the emergency response system. Precipitating factors can occur seconds, minutes, hours, or even days before a point of awareness is reached. A patient who ignores chest discomfort for days until it reaches a critical point, at which the patient makes a decision (Point of Awareness) to seek assistance. Rarely is it possible to quantify the point at which event initiation occurs.
- **Emergency Event** - The point at which an awareness of conditions exists which require an activation of the emergency response system. Considered the Point of Awareness, it may be the recognition by an individual that assistance is needed, or it may consist of a mechanical or electronic recognition of an event such as smoke or heat detector activation.
- **Alarm** - The point at which an emergency response system activation is initiated. The transmittal of a local or central alarm to public safety answering point is an example of this time point. Again it is difficult to determine with any degree of reliability the time interval during which this process occurs.
- **Notification** - The time point at which an alarm is received by the agency. This transmittal may take the form of an electronic or mechanical notification to the point at which a call is received and answered in the pubic safety answering point.
- **Alarm Processing** - The time interval from the point at which a request or alarm is received and transmitted to emergency responders.
- **Turnout Time** - The time point at which responding units acknowledge receipt of the call from the dispatch center. Total turnout time begins at this point and ends with the beginning of travel time.
- **Travel Time** - The point at which units are en-route to the call. When responding from a fixed facility, the point at which the apparatus exits the facility. Total travel time begins with this initial time point and ends with the on-scene time.
- **On-Scene Time** - Time point at which the responding unit arrives on the scene.
- **Initiation of Action** - Time point at which operations to mitigate the event begins. May include size-up, resource deployment etc.
- **Termination of Incident** - Time point at which unit(s) have completed the assignment and are available to respond to another assignment or emergency request.
- **Total Response Time** - Calculated from the time point at which the Alarm is reported (Notification) to the time point when units arrive at the emergency event (On-Scene).

The citizen calling for help is in control of the first four elements, including event initiation, recognizing the emergency event and activating the alarm or calling 911. Once the call is

received by a 911 operator, the Minneapolis Emergency Communications Center is responsible for Alarm processing time. This includes how long it takes to answer the telephone, enter the data into the computer regarding the emergency, transmitting the data to the fire dispatchers and for the fire dispatchers to transmit the alarm to the fire stations sent on the call. The standard set by the Emergency Communications Center for all of this activity is 50 seconds or less, 90% of the time.

The Minneapolis Fire Department has direct responsibility for the final elements, including turn-out time, travel time and initiation of action. Termination of the event is variable depending on the emergency.

SECTION NINE: STANDARD OF RESPONSE COVERAGE STATEMENTS

The Minneapolis Fire Department hereby establishes the following standards of response related to the combined total of turn-out time and response time:

1. The Minneapolis Fire Department will maintain a response time standard to Fire and EMS calls of 5 minutes or less for the first unit to arrive on scene 90% of the time.

2. The Minneapolis Fire Department will maintain a response time standard to technical rescues, hazardous materials incidents and weapons of mass destruction events of 6 minutes or less for the first unit to arrive 90% of the time.

3. The Minneapolis Fire Department will maintain a response time for fires, technical rescues, hazardous materials incidents and weapons of mass destruction events of 9 minutes or less for the first three companies and a Battalion Chief to arrive on scene 90% of the time when dispatched as part of an initial response assignment.

4. The Minneapolis Fire Department will maintain a response time for fires, technical rescues, hazardous materials incidents and weapons of mass destruction events of 10 minutes or less for the full first alarm assignment including a Battalion Chief to arrive on scene 90% of the time when dispatched as part of a full first alarm response.

SECTION TEN: FUTURE PLANS

The following two initiatives are being undertaken in 2005 to help move the department toward the goal of increasing service. The ultimate standard of coverage goal for the department is to meet the standards outlined in NFPA 1710.

1. Explore Automatic Aid Opportunities

High Priority -- To be started in 2005

Description:

As resources diminish, making it more difficult to adequately staff fire apparatus and with the threat of terrorism, partnering with neighboring communities becomes a greater issue. The MFD is exploring automatic aid with the surrounding communities in an effort to provide the best service to the entire community. Automatic aid is a system in which the closest fire apparatus is sent to a call regardless of city limits. This could address some of the deficiencies noted in the CityGate report.

We are currently in the planning stages with the Richfield, Edina and St. Paul Fire Departments and will look to create automatic aid with other departments. This initiative requires a new CAD for the MFD, one that is compatible with any partners with which we would like automatic aid agreements. As we select the CAD system, the MFD will prioritize systems that are compatible with our neighbors systems.

Resource Implications: The MFD has secured grant funds for the new CAD system, which is the largest cost of this initiative.

Project Leads: Seal, Bleskachek, Steinhilber

2. Partner on CAD Upgrade

High Priority: To be started in 2005

Description:

The current software and hardware that allows 9-1-1 Operators and Dispatchers to efficiently and effectively do their jobs is antiquated and in danger of breakdown. CAD is the central feature or the start-point for much of the dispatch and records management function. Currently, it doesn't automatically link to the Police, Fire, or City Attorney's records management system as it should. Likewise, database querying and report writing for analysis purposes is cumbersome and labor-intensive. Without a functioning CAD, public safety dispatch services would be nearly impossible to perform in the current manner and with the number of personnel involved. Currently, there is no back-up capability for off-site CAD utilization. In addition, there is limited functionality that would hamper large/disaster-scale operations. A new CAD would not only be able to accommodate Minneapolis Police, Fire and EMS, but would also allow automatic mutual aid for regional operations.

Resource Implications: Replacement costs will be grant-funded. Cost of replacement: ~$5 M; plus ~$200K annually for maintenance contract.

Project Leads: Steinhilber, Seal