ARLINGTON COUNTY
FIRE STATION LOCATION ANALYSIS
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Conducted by
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EXECUTIVE SUMMARY

This study was conducted to consider the questions of how many fire stations are needed to protect Arlington County and where they should be located. The County is seeking an efficient, cost-effective plan that will meet the demand for service and the established response time objectives. A computer model of the street network was used to estimate travel times from existing and potential fire station locations to each part of the Arlington.

An evaluation of the existing situation confirms that most of Arlington has very good overall coverage with the 10 existing fire stations. The 4-minute response time objective is met almost 80 percent of the time. In the central part of Arlington, where the majority of calls occur, there is overlapping coverage - units from 3 or 4 stations can respond to some locations in less than 4 minutes. The 4-minute objective is not being met in the northern part of the county and there are small areas, particularly along the perimeters, where it cannot be achieved.

The major consideration of the project was the possibility of closing or consolidating stations in the areas with excessive coverage and relocating stations to cover the weak areas. More than 100 different combinations, involving 35 potential sites, were analyzed and the options were narrowed to the scenarios that appear to be feasible. Each of these configurations has strong points and weak points in relation to different factors. The final determination will depend on the factors that are considered most important and the compromises that are acceptable.

North Arlington has the greatest need for improved coverage, however very few sites are available in this area. At least one fire station should be moved north to provide better coverage for this part of the county. The two candidates for relocation are Stations 3 and 8.

The analysis indicates that the number of stations in the Rosslyn-Ballston corridor could be reduced by at least one, while an additional station will probably be needed in the Crystal City area. The cost of land is a particular concern in these areas, however the cost of a new site could be offset by the market value of the sites that are currently occupied by fire stations.

The demand for service is much higher in the Rosslyn-Ballston corridor and the Crystal City - Pentagon City areas than any other part of Arlington. Continuing redevelopment and expansion of these areas will bring increasing demands for
service over the next 10 to 20 years and will probably require additional personnel and vehicles to be assigned.

In the Fairlington area, Station 7 covers a very small district that has a low demand for service. This area is surrounded by 4 other stations that can respond in less than 4 minutes. The station could be closed or relocated to one of the other areas that is lacking in coverage.

The potential station relocation program could be implemented over a period of 10 years or longer. The basic strategy and general locations of stations should be determined sooner rather than later due to the intricate relationships between coverage areas. The location of a new Station 3, which should be determined in the immediate future, will influence several subsequent decisions.

At least three of the potential station locations could provide coverage into adjoining areas of Alexandria and Fairfax County. It could be very cost effective to develop cooperative arrangements with these jurisdictions to share the costs of building and/or operating these stations.
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1. INTRODUCTION

This study was commissioned by the Arlington County Fire Department to evaluate the locations of fire stations in the county. The specific objective of the project is to provide information to Arlington County regarding the number of fire stations that are needed and the most desirable locations for those stations. This supports the overall objective of providing a desirable level of public safety services at a reasonable and prudent cost.

These issues are considered in relation to established response time objectives and the existing needs of Arlington County and in relation to future needs, based on growth and development projections for the next 20 years. The report also recommends priorities and an implementation schedule.

Background

Arlington County is the smallest in area and one of the most densely populated counties in the United States. The population of more than 187,000 residents occupy a mixture of low, medium and high income residential neighborhoods, within an area of 25 square miles. In most respects it has the physical characteristics of a city, more than a county.

Arlington is even more densely populated during the day. The daytime weekday population of approximately 265,000 is attributable to several major employment areas, a healthy local economy and a highly developed transportation system. The county also has a huge “pass through” population of travelers and commuters from surrounding areas who travel through Arlington on the major highways and the Metro system.

The Arlington County Fire Department provides a full range of emergency and non-emergency services, including fire suppression and emergency medical services, as well as a wide variety of response capabilities for other types of hazardous situations. The Department also protects the City of Falls Church under a contractual service agreement and automatic response agreements are in effect with neighboring Fairfax County and the City of Alexandria. Mutual aid agreements link the Arlington Fire Department with several other agencies.

The Department currently operates from 10 fire stations, including one which is shared with and located in the City of Falls Church. The origins of most of these stations date back to volunteer fire companies that were organized within local communities, before the County Fire Department was established. Although several of the structures used by the volunteers have been replaced, most of the station locations can still be related to their volunteer origins. One of the primary objectives of this study is to determine if those locations still support the
objective of cost-effective coverage and if they will continue to meet that objective in the future.

This analysis comes at a time when major capital expenditures are anticipated to replace or to enlarge and rehabilitate several of the existing facilities. It is also occurring during a period when major redevelopment projects are changing the landscape and the demand for fire and emergency services. Arlington County has changed very significantly over the past 20 years and is expected to continue this process of evolution for the next 20 years.
2. METHODOLOGY

The analysis of fire station locations was performed using the FLAME computer model. This program creates a simulation of the street network to calculate the travel time from each fire station location to each street segment via the fastest route. The model requires a detailed computer representation of the street network, including the length of each street segment, permitted direction(s) of travel and estimated speed. The model must accurately represent all of the streets in the community, as well as freeways with their complex systems of on-ramps and off-ramps, and geographic barriers.

To accurately represent Arlington’s street network, the base map provided by the FLAME program vendor was extensively updated by the contractor. This included manually entering all of the freeway ramps and interchange details and adding links to provide routes into Arlington from nearby Fairfax County and Alexandria stations. The details were checked against three different map bases for accuracy and doubts were resolved by physically verifying the actual situation.

The speed settings on hundreds of street segments were adjusted to simulate expected emergency response conditions. A basic convention was used to assign speeds, with major surface streets set at 35 miles per hour and local streets set at 25 miles per hour. All of the streets set faster than 25 miles per hour were test driven to establish realistic speeds. These include Arlington Boulevard (US-50), sections of Glebe Road and the George Washington Parkway which were set at 45 mph and the segments of I-66 and I-395 in Arlington which were set at 55 mph. A delay of 15 seconds is added by the program for each turn at an intersection.

The speed settings are indicated on Map 2-1. Although actual speeds and response times vary with conditions and circumstances, these basic settings should provide a very good approximation of actual average response speeds, which is suitable for locating fire stations.

A calibration check was conducted by comparing reported response times on actual emergency runs with the model’s projections to verify that the settings are reasonably accurate. The response data for a 6 month period was very consistent with the predictions of the FLAME model.

Limitations

There are several limitations to the methodology that was used to conduct this analysis, however the system is very appropriate for evaluating existing and alternative fire station locations. The most important limitation is that the analysis
only considers the locations of fire stations in relation to response time objectives. It does not address the issue of how many or what types of units should be assigned to each station to satisfy the demand for service in each part of the county.

The number and types of vehicles assigned to each station should be based on the risk and demand factors that apply to its service area. A station in a high fire risk area may require multiple fire suppression units, in order to rapidly assemble an adequate fire attack force at the scene of a fire. A station may require two or more paramedic units due to the frequency of calls in an area with a high population density. The objective of this study is only to determine where the stations should be located to meet the response time objectives from the closest and next-closest stations to each part of Arlington. It is assumed that these stations will accommodate different combinations of units to suit the requirements of each area.

The computer model only estimates travel the time to each street segment; it does not account for variations in the demand for service or the level of risk at each location. The demand for service includes both qualitative and quantitative components. The level of risk is significantly different if the street segment is bordered by high-rise office buildings, apartments, single family dwellings or a forest. Demand considerations would also include factors such as the number of people who are expected to be present at different times and the number of calls of different types that can be anticipated.

The activity level has a direct impact on the workloads of individual units and the probability that a particular unit will be available when a call occurs in its area. The workload factor can have an adverse impact on response times in busy areas, because units may have to respond from more distant stations. These factors must be evaluated separately and should be considered when interpreting the results.

The established response time objectives, which are described in a separate section of this report, have been applied uniformly to all areas of Arlington. This is based on the desire to respond to any emergency incident that occurs within the desired time. In interpreting the results, a higher priority could be placed on meeting the objectives in a busy, high demand area, compared to an area that has few residents and very few emergency calls.

The model is also calibrated to represent typical response conditions. Response speeds may be faster during periods when the streets are deserted and significantly slower when traffic is gridlocked or during snow and ice storms. The model represents typical conditions which are normally used for planning purposes. The FLAME model has the capability to simulate a variety of potential traffic conditions for detailed analysis, including blockages of key streets.
3. DEMAND FOR SERVICE

The demand for fire and emergency services is closely related to the land use, population and demographics of a community. Arlington is fully built-up with a wide variety of land use areas, from large single family homes to high density multi-use areas. These areas create very different demands for service in terms of the frequency of calls, when calls occur, the types of situation that are encountered and the level of risk to persons and property. In general terms, the fire department workload can be expected to increase as the population of an area increases, however there are many factors that influence these trends.

Development Trends and Patterns

Rapid redevelopment is occurring in several areas of Arlington and is expected to continue for the next 10 to 20 years. Most of this new development involves increasing population density, as existing one and two story buildings are replaced with high-rise and large area structures. Both commercial and multi-family residential developments are replacing older structures in several areas, bringing more daytime-weekday and night-weekend population into these areas.

Most of the intense development is occurring along the two Metro lines that pass through Arlington. Five of the Metro stations (Rosslyn, Pentagon City, Crystal City, Court House and Ballston) are already focal points for intense developments, with some of the highest land use intensity in Virginia. These core areas usually incorporate a broad range of occupancies, including residential, office space, hotels, retail and public facilities. Similar development is occurring or expected in the next few years around the Clarendon, Virginia Square and East Falls Church stations.

This trend is producing two large high density areas in Arlington. The entire corridor between Rosslyn and Ballston is expected to become fully developed with high density projects within the next 10 to 20 years. Additional growth is also expected in the Crystal City-Pentagon City area, where plans for expansion of the Crystal City development to the southern limits of Arlington have been approved. Several major projects are under way or in the planning stages in both of these areas.

The demand for service in terms of emergency responses is already much higher in the Rosslyn, Ballston, Pentagon City and Crystal City areas than any other parts of Arlington. The expansion and increasing density will probably require additional units to be assigned to the fire stations that cover these core areas.
A smaller scale core is developing in the Shirlington area and around the Glebe Road interchange on I-395. Significant growth is anticipated in this area within the next 5 years, however it should involve less density than the major core areas. The demand for service in this area should increase, but it will be lower than the current demand in the four primary areas.

Major redevelopment is anticipated along Columbia Pike within the next 10 to 20 years, particularly if a mass transit line is built within this corridor. This is a relatively high demand area now, due to the concentration of population and the number of calls will increase if more population is added. The anticipated developments in this corridor should be much less intense than the two very high density areas mentioned previously.

While the intense development is occurring in the identified core areas, very little change is anticipated in most of the residential areas. An emphasis has been placed on preserving and reinforcing the character of Arlington’s residential communities, so very little change is expected outside the designated redevelopment areas. Some in-fill, upgrading and replacement of older structures may occur, however these trends should not cause major changes in the demand for fire and emergency services.

Impact of Increasing Density

The most direct impact of increasing density is an increasing number of emergency medical calls. The number of medical responses can be expected to increase in direct proportion to the population of each area within the county. These calls are already concentrated in the high density clusters, particularly around the Metro stations, and in some of the lower income residential areas.

The replacement of older building stock with newer structures tends to reduce the level of fire risk. The older buildings that are being demolished represent a significant portion of the existing fire risk in Arlington, while a large proportion of the newer buildings incorporate fire resistive construction, automatic sprinklers and modern fire detection and alarm systems. Although the newer buildings are much larger and have more occupants, there tend to be fewer fires and a lower probability that a major fire will occur. This trend is evident in the decreasing number of serious fires in Arlington over the past decade.

The remaining older unprotected structures constitute the primary fire risk in Arlington. Although the probability of a serious fire is much lower in the newer complexes, the potential cannot be totally eliminated. While the fires in these buildings are not expected to be large, a relatively small fire in a high-rise building, shopping mall or Metro tunnel can endanger thousands of occupants. The concentrated population areas in Arlington are also prime potential targets.
for terrorist activities with many high profile tenants and government agencies occupying the buildings.

While the level of fire risk is decreasing, the number of fire calls is increasing. The largest category of fire responses involve activated fire alarms, which are increasing with the proliferation of new buildings with automatic detection, alarm and sprinkler systems. The fire suppression companies in the high density areas respond to a large number of these calls, although very few of them require fire suppression intervention. Many of these incidents involve only one or two fire suppression companies.

The demand for other types of emergency services, including rescue incidents, hazardous material releases and other high risk situations also increases along with the population density.

The increasing number of high-rise and large area buildings has an adverse impact on service delivery times, because it may take several minutes to reach the patient or the location of the emergency situation after units arrive at the entrance to the building. (This is referred to as “vertical response time”.) The benefit of reaching the address of the incident within 4 minutes is relatively insignificant if it takes 5 additional minutes to reach a patient who is in cardiac arrest on the 16th floor. It is desirable to maintain quick response times in the high density areas to compensate for this factor.
4. **EXISTING FIRE STATIONS**

The 10 existing fire stations are well distributed to meet the established response time objectives to most parts of Arlington. Most of these stations are functional facilities in reasonable locations, however significant expenditures are anticipated over the next 10 years to enlarge, upgrade, rehabilitate or replace most of the existing structures.

**STATION 1 - 500 SOUTH GLEBE ROAD (22204)**
This is a large station, approximately 10 years old and in very good condition. It is well located for north-south travel on Glebe Road and has quick access to Arlington Boulevard and Columbia Pike for east-west travel. No major capital expenditures are planned for this facility.

**STATION 2 - 4805 WILSON BOULEVARD - BALLSTON (22203)**
This is also a large station, approximately 30 years old, and is already in the process of expansion and rehabilitation. The strategic location is on the edge of the high intensity development area around the Ballston Metro Station. The site has immediate access to Wilson Boulevard and George Mason Drive and easy access to Glebe Road and Fairfax Drive.

**STATION 3 - 3900 LEE HIGHWAY - CHERRYDALE (22207)**
This station, which is owned by the Cherrydale Volunteer Fire Department and leased by Arlington County, is too small for current needs. The building is a historic structure and cannot be modified to meet the needs of the Fire Department. Funding for the construction of a new facility has been approved, however the site has not been determined. The current location allows good east-west travel on Lee Highway and northbound travel on Military Road, while North Quincy Street provides a good route to the Ballston area. The existing site is a poor location in relation to topography and local traffic patterns.

**STATION 4 - 3121 NORTH 10TH STREET - CLARENDON (22201)**
This station is the former headquarters of the Arlington Fire Department and houses the Fire Marshal’s Office, as well as a functional fire station. The station is very close to the Clarendon Metro Station and the site is a prime location for redevelopment. It is also an excellent location for a fire station to cover most of the Rosslyn-Ballston corridor and is strategically located near the intersections of several major streets, including Washington Boulevard, Wilson Boulevard, Clarendon Street and Fairfax Drive. It also has quick access to Rosslyn via 10th street and US-50. A major rehabilitation of the structure is planned within the next 3 to 5 years.
**STATION 5 - 1750 S. HAYES STREET - CRYSTAL CITY (22202)**
This station in an excellent location to serve the southeastern part of Arlington, which includes the Crystal City and Pentagon City development areas, the Pentagon and Ronald Reagan National Airport. A major expansion and rehabilitation project is anticipated within 3 to 5 years, which may involve total replacement of the structure.

**STATION 6 - 6929 LEE HIGHWAY - FALLS CHURCH (22213)**
This station, which is owned by the City of Falls Church, is in a good location, near the intersections of several major response routes, however the existing facility is old and inadequate. A replacement station is already under construction behind the existing station, jointly funded by Arlington and Falls Church. This should be considered as a "fixed" location for the purposes of the study.

**STATION 7 - 3116 S. ABINGDON STREET - FAIRLINGTON (22206)**
This small station was originally built to cover the Fairlington community. It is aging and inadequate for long term operational requirements. If it is retained, significant expenditures will be required to expand and upgrade the facility. The location within a residential area limits responses, since there is no direct access to any major streets.

**STATION 8 - 4845 LEE HIGHWAY - HALL'S HILL (22207)**
This is also a small neighborhood station on a cramped site. The facility is functional, but the site is crowded and poorly situated in relation to the heavy traffic on Lee Highway. The property could be sold for commercial development. The location provides good east-west travel on Lee Highway and north-south travel on Glebe Road and George Mason Drive.

**STATION 9 - 1900 WALTER REED DRIVE (22204)**
This is a large station, in the final stages of a major rehabilitation and expansion project. The location is excellent, with immediate access to Walter Reed Drive, Glebe Road and Four Mile Run. This station should also be considered as a "fixed" location.

**STATION 10 - 1559 WILSON BOULEVARD - ROSSLYN (22209)**
This station is located on the edge of the high intensity Rosslyn area and has rapid access to the Court House area via Wilson Boulevard. The site is extremely valuable in a district that has very few remaining developable properties. The facility will require a major rehabilitation within the next few years to meet long term needs. This station also covers several busy tourist areas, including Arlington National Cemetery and the busy road network along the Potomac River.
Based on this information, the four primary candidates for relocation, consolidation, replacement or closure would be Stations 3, 7, 8 and 10, which are older, smaller and in less desirable locations. Station 4 is also a candidate for closure or relocation, because it is in the center of an area that has overlapping coverage from three other stations.

It would be more difficult to justify changes where the facilities are new, adequate and in desirable locations, unless there is a significant advantage to be gained. The locations of Stations 1, 2, 5, 6 and 9 were considered as "tentatively fixed" although the options of moving, closing or consolidating all of the existing stations were considered at different stages of the analysis.
Station Response Area
Each color represents the closest station by travel time.

MAP 4-1

FIRST DUE AREAS
Existing Stations
5. PERFORMANCE OBJECTIVES

The Arlington County Fire Department operates with two established performance objectives that are directly related to the locations of fire stations:

- A response time of 4 minutes or less from the fire closest station.
- A response time of 6 minutes or less from a second fire station.

In relation to these objectives, response time has been defined as the elapsed time from dispatch of a unit to its arrival at the location of the incident. This definition includes turnout time (the time from dispatch until a unit actually leaves the fire station) and travel time from the station to the address of the call. Allowing 60 seconds to leave the station, the travel time components should be 3 minutes or less for the first arriving unit and 5 minutes or less for the second unit. The 3 and 5 minute travel times were used as basic objectives in the computer model.

RESPONSE TIME COMPONENTS

![Diagram showing response time components]

This definition of response time does not include the time it takes to answer and process calls at the Emergency Communications Center, prior to dispatch, which is estimated at approximately 45 to 60 seconds. The definition also excludes "vertical response time" - the time it may take to reach the actual location of the emergency, after arriving at the address. In the case of a high rise building, a
large commercial complex or an underground Metro station, this could take several additional minutes. This is a particular concern in life-threatening medical emergencies, where the time to reach the patient and initiate treatment can have a critical impact on survivability.

These objectives are consistent with most cities and urban jurisdictions that have similar characteristics. For planning purposes, the objectives have been applied uniformly to all areas of Arlington County. In most cases the desire to meet the performance objectives to every part of the service area must be balanced against budget limitations and practical considerations.

Most jurisdictions apply a factor of 80% or 90%, to allow for geographic areas where it is not feasible to meet the response time objectives. A similar performance level objective of 80% or 90% is used to allow for circumstances when the closest units are unavailable due to other calls or delayed in their response.

Most of the analysis was directed toward the 3-minute travel time from the closest fire station, as opposed to the 5-minute travel time from the second-closest station. The FLAME model quickly revealed that the second-due objective is easily satisfied to most areas of Arlington, if the first-due objective is satisfied. This can be attributed to Arlington’s compact size and the presence of several Alexandria and Fairfax County fire stations around the perimeter.

The consideration of first-due and second-due stations assumes that the first and second arriving units would come from two different stations. If two units are dispatched from the same station, their response times should be equal. Assigning additional units to one station could compensate for a deficiency in the travel time from the second due station.
6. CURRENT PERFORMANCE

The 4- and 6-minute response time objectives (3-minute and 5-minute travel time) can be met in most parts of Arlington County from the 10 existing fire stations. Maps 6-1 and 6-2 indicate the coverage provided by the 10 existing stations as estimated by the FLAME computer model. The colors on the maps indicate the areas where the objectives can or cannot be met. These maps indicate that most of Arlington County can be reached within 3 minutes travel time from at least one of the existing stations and within 5 minutes travel time from at least one additional station.

The model is confirmed by actual run reports, which show that the 4-minute response time objective is met on 78% of the emergency responses in Arlington. (This suggests that the Arlington County Fire Department's current overall performance is very close to meeting the 4-minute objective 90% of the time in 90% of the geographic area.) More than 90% of first arriving units are on the scene in less than 5 minutes. This can be attributed to the fact that the high density and high activity areas, where the highest call volume occurs, are very well covered from the existing stations.

There are significant geographic areas on the north side of the county where the response time objectives cannot be achieved, however there are relatively few calls in these areas. These areas account for approximately 3% of the total emergency activity or about 2 calls per day. The longest travel times in these areas are approximately 5 minutes from the closest station.

There are some additional small areas where the 3-minute travel time objective cannot be met from the existing stations, however almost all of these areas can be reached in less than 4 minutes. These areas include:

- Between Four Mile Run and the Fairfax County boundary, between Columbia Pike and Arlington Boulevard.

- South of Crystal City and along Arlington Ridge Road (close to the Alexandria city limits)

The possibility of relocating stations to provide more balanced overall coverage was a focal point of the analysis. There are some areas, particularly in the Rosslyn-Ballston corridor, where 3 or 4 stations can respond in less than 4 minutes. It would be desirable to relocate stations from areas that have "excessive" coverage to the areas that have "inadequate" coverage.

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1 The calibration check confirmed that actual response times closely matched the patterns predicted by the computer model.
Automatic Response Areas

In addition to covering the City of Falls Church, Arlington has automatic response agreements with the Alexandria and Fairfax County Fire Departments, which allow for the closest units to respond any incident, without regard to boundary lines. Arlington has a few small areas where the first due coverage is provided by an Alexandria or Fairfax station, while Arlington stations cover some adjacent areas.

Map 6-3 indicates first due coverage with the stations that respond automatically into Arlington, while Map 6-4 indicates second due coverage with these stations. Map 6-5 highlights the specific areas where outside units cover first due areas in Arlington and where Arlington units cover first due areas in neighboring jurisdictions.

The three departments closely coordinate their operations and standard operating procedures to facilitate this regional approach. This is a valuable and efficient system that benefits all of the participants. Station location planning for the borderline areas should be closely coordinated with these jurisdictions.

The existing dispatch systems involve a delay of 30 to 60 seconds when a unit from an adjoining jurisdiction must be dispatched to a call, as the request must be transferred from one communications center to the other. This factor has been incorporated into the model for the outside stations responding into Arlington. This delay could be reduced or eliminated by linking the computer systems in the three communications centers or by consolidating the three facilities into one.

Mutual aid agreements with other surrounding jurisdictions and agencies provide additional depth of resources for major incidents and high demand periods. The potential coverage from these stations is not illustrated on the maps, because they are not dispatched automatically. The medic unit from Ronald Reagan National Airport is often requested to cover calls in Crystal City and the southern part of Arlington when Medic 105 is unavailable.
Travel Time for the FIRST-IN company
- 0 - 3.0 min
- 3.0 - 4.0 min
- 4.0 - 5.0 min

FIRST DUE TRAVEL TIMES
With Automatic Aid Response
Station Response Area
Each color represents the closest station by travel time.

First Due Areas Covered by Automatic Response Units
7. ALTERNATIVE LOCATIONS

The FLAME model was used to test a wide variety of station location configurations to determine different combinations that would be feasible and cost-effective. Approximately 200 different combinations were evaluated, using all of the existing sites and 25 additional "potential" sites. At least one alternative location was evaluated for each existing station and the possibility of closing each existing station was also considered.

Most of the analysis effort was directed toward potential sites for the stations that were identified as candidates for relocation or consolidation, improving coverage in the areas where there are gaps and redistributing coverage where there are overlaps. Some of the potential locations that were considered related to specific sites, including all of the sites that were identified as candidates by the Fire Department. Several additional locations were used to represent non-specific sites within target areas, although there may not be a suitable site available in each of these area.

The lack of suitable sites appears to be a serious concern in several areas. The most desirable fire station locations are along or adjacent to major streets and close to the intersections of other major streets to allow for travel in multiple directions. These strategic locations provide the most efficient coverage, by allowing units to cover large areas. A station that is located on a secondary street or buried in a neighborhood is limited by the time it takes to reach a major street.

An ideal site for a new fire station should meet several requirements, including:

1. At least two acres in area,
2. On a major street or with easy access to the major street network,
3. In a location that would be compatible with neighboring properties,
4. In a location that would meet the response time objectives.

Some compromise from these requirements could be accommodated in different circumstances, if the overall objectives are met.

Evaluation of Alternative Locations

The detailed analysis of station locations is divided into four zones to allow for close examination of the alternatives.
ALTERNATIVE STATION LOCATIONS
All Sites Considered in Study

MAP 7-1
NORTH ARLINGTON

The most deficient coverage currently exists in the northern part of Arlington. (Refer to Map 7-2) Responses to the north end, in the vicinity of Chain Bridge, currently take 5 to 6 minutes. Either Station 3 or Station 8 should be moved north to improve response times in this area. Since both of the existing stations are candidates for replacement, several different configurations were evaluated to determine where these stations could be relocated.

Funding for the replacement of Station 3 has already been approved, although the site has not been determined. Rehabilitation or replacement of Station 8 is anticipated within approximately 5 years.

The ability to move these stations is constrained by the limited number of response routes to the north end of the county and the difficulty of finding a suitable site. Military Road and Glebe Road are the only through streets leading into this area and both are almost fully built-up from Lee Highway to their intersection. The only connection between Glebe and Military Roads is the combination of North 26th and 31st Streets, which is limited to less than 30 miles per hour in some areas. Compatibility with the adjacent properties would be an additional concern for most potential sites in this area.

The reasonable options were narrowed to three potential locations:

1. Military Road & Lorcom Lane (33)
2. Military Road & Old Glebe Road (31)
3. North 26th Street & Old Dominion Road² (82)

Either Station 3 or Station 8 could be moved to one of these sites. If this occurs, the other station would have to remain in the southern part of the district to maintain coverage. It is not feasible to replace the two existing stations with one new station.

Five potential location combinations appear to be feasible alternatives.

**Alternative Combinations**

A. New Station 3 in the vicinity of Old Glebe and Military Road (31)  
   Station 8 moved to the vicinity of Old Dominion and Lee Highway (39/89)

B. New Station 3 in the vicinity of Military Road and Lorcom Lane (33)  
   Station 8 moved to the Old Dominion & N. 26th Street location (82)

² A suitable site at this intersection is currently owned by the County. No specific properties were identified for the other potential locations.
C. New Station 3 in the vicinity of Military Road and Lorcom Lane (33)
Station 8 remaining in the vicinity of Glebe and Lee Highway (8)

D. New Station 3 close to its current location (3)
Station 8 moved to the Glebe/Old Dominion location (82)

E. New Station 3 in the Vicinity of Lee Highway and Bryan Street (36)
Station 8 moved to the Old Dominion & N. 26th Street location (82)

The coverage provided by each of these combinations is illustrated on maps 7-2A through 7-2E. The best coverage would be provided by Option A. The least desirable combination would be Option E.

Four of these combinations involve the construction of two new stations. Option C, which allows Station 8 to remaining in the same area, could provide some cost savings by rehabilitating the existing station instead of building a new one.
ROSSLYN - BALLSTON CORRIDOR

The three existing stations in the Rosslyn-Ballston corridor could be replaced by two stations. With three stations, the longest travel times in this corridor are approximately 2 minutes. *(Refer to Map 7-3)* With two stations the longest travel times in the corridor would be approximately 3 minutes.

Station 2 should remain in its present location, close to the Ballston end of the corridor. It would be feasible to close Station 4 and cover the corridor with only Stations 2 and 10. *(Refer to Map 7-3A)*

It would also be feasible to consolidate Stations 4 and 10 into one new station in the Courthouse area (Site 41) or between the Rosslyn and Courthouse areas (Site 42). Both of these locations would meet the 3-minute travel time objective. *(Refer to Map 7-3B)*

The possibility of consolidating Stations 3, 4 and 10 into one large station in the area of Lee Highway and Bryan Street (Site 36) was also evaluated. Units responding from this location could cover most of the corridor between Rosslyn and Clarendon within 3-minutes, however response times in the lower part of Rosslyn and south of Arlington Boulevard would exceed the objective by up to one minute. This location would also increase response times to Arlington National Cemetery and along the Potomac River between Rosslyn and the Pentagon. *(Refer to Map 7-3C)*

While a two-station plan would be more efficient, the option of maintaining three stations would result in faster response times in the Rosslyn-Ballston corridor. Station 4 is strategically located to provide back-up in either direction, toward Rosslyn or Ballston as well as north and south to other parts of Arlington. This plan could partially compensate for "vertical response time" and provide more flexibility to redeploy units in the future as the workload changes.

There would be no significant impact on operating costs with a two-station or three-station plan, since the same total number of units would be required with either option. *(4 fire suppression companies and 2 paramedic units)* One or more additional paramedic unit will probably be required in this area in the future with the expected increase in population.

The value of property in this corridor is a significant consideration. Stations 4 and 10 both occupy sites that are suitable for long-term use, however both of these sites would also be valuable to commercial developers. The cost analysis should consider the options of selling the Station 4 site and building a larger station on the site of Station 10 or selling both properties and using the proceeds to acquire a new site for the consolidated station. It may be feasible to sell or
trade either of the existing sites to a developer and to incorporate a replacement station into a larger project.
CRYSTAL CITY - PENTAGON CITY

Station 5 is in an excellent location to cover most of the Pentagon City - Crystal City area, however the southern part of its district, which includes the Arlington Ridge area, is beyond the 3-minute travel range. (Refer to Map 7-4) It is also the only station that can reach this area within the desired response times. Second due coverage for most of Pentagon City and Crystal City comes from stations that are beyond the 5 minute travel range. Traffic congestion and the complicated traffic pattern in Crystal City also tend to increase response times in this area.

Significant increases in density are occurring in this area and the Crystal City development is expected to expand to the southern limits of the county, into the former railroad yards. This growth should occur over the next 10 to 15 years. The resulting increase in workload will require additional units to adequately cover this area.

The two options in this case are to expand Station 5 to accommodate more units or to add a second fire station in the southern part of this area.

Development of the southern part of Crystal City will create a demand for an additional station to cover this area. Accommodation for a new fire station has already been incorporated into the development plans (Site 51), although building a station in the vicinity of Glebe Road and US-1 (Site 52) would solve the response time deficiency for a larger area. (Refer to Maps 7-4A & B)

Land for a station may be available on County-owned property adjacent to the Wastewater Treatment facility on Glebe Road. A station in this area would also be able to cover the north end of Alexandria, where rapid development is already occurring in the former railroad yards. It would be very reasonable to work with Alexandria on a joint plan to improve coverage to this area.

A site on Arlington Ridge (Site 53) was also considered. This location would be of little benefit to the southern end of Crystal City, where the major increase in demand is expected. (Refer to Map 7-4C)
FAIRLINGTON - SHIRLINGTON

The south-western part of Arlington is covered by three existing fire stations. Station 1 is relatively new and Station 9 is in the final stages of a major rehabilitation and expansion project. Station 7, which covers Fairlington and Shirlington, is an older and much smaller station that will have to be rehabilitated or replaced within the next few years. It would be very difficult to upgrade or replace the existing structure at the present location.

This area could be fully covered by two stations if they were optimally located, however, Stations 1 and 9 are too close together. Station 7 is needed to meet the 3-minute travel time objective to the Fairlington and South Fairlington areas.

The possibility of closing Station 7 has been proposed and debated in the past. This station has the smallest response area and fewer calls than any of the other Arlington stations. Approximately half of its calls are actually in Alexandria or Fairfax County.

Units from four other stations can reach the Fairlington and South Fairlington neighborhoods in less than 4 minutes. This coverage comes from Arlington Station 9, as well as Alexandria Stations 203 and 206 and Fairfax County Station 410. Station 7 also responds into Shirlington, however Station 9 can reach this area in less than 3 minutes.

No major changes are anticipated in the Fairlington communities, which have a moderate fire risk level and relatively few calls in comparison with other parts of the county. Some increase in density is anticipated in Shirlington with the growth that is planned, however Station 9 should be able to accommodate an increase in workload, as it will be feasible to add resources at the newly enlarged facility.

The possibility of moving Station 7 was also considered. The station could be moved north, to the vicinity of George Mason Drive, to improve coverage to the area between Columbia Pike and Arlington Boulevard close to the Fairfax County boundary. There is a relatively small area with weak coverage between Four Mile Run and the county boundary. Fairfax County Station 410 currently provides the initial response to part of this area with a travel time in the 3 to 4 minute range, however there are a few pockets where the travel time exceeds 4 minutes.

The area around Carlin Springs Road and Arlington Boulevard includes some high activity apartment complexes and the anticipated redevelopment along Columbia Pike, which is anticipated over the next 10 to 15 years, could increase the demand for service in this area. An Arlington station in this vicinity would improve the response time, but it would also inherit a significant workload of calls into the adjacent area of Fairfax County.
8. DECISION CONSIDERATIONS

The detailed analysis of each area indicates that several different combinations of fire station locations are feasible, each presenting different advantages and disadvantages. Many considerations must be weighed to determine the most desirable plan. Several factors that could influence these decisions are discussed in this chapter.

Strategic Options

Arlington County should consider two basic strategies in relation to the number and locations of fire stations. One option is to operate the least number of fire stations that will meet the response time objectives and to concentrate resources in these stations. The second option is to operate more stations with fewer units assigned to each location. Each option presents significant advantages and disadvantages.

Arlington currently has 14 fire suppression companies and 5 paramedic units operating from 10 stations. If fire stations could be placed at the most efficient locations, it would be possible to provide equal or better coverage with fewer stations. This plan should lead to a reduction in long-term operational and maintenance costs for the facilities.

The alternative strategy would involve more stations, with fewer units assigned to each location. This approach would support a “neighborhood” service delivery concept. In most cases this strategy would also result in somewhat faster overall response times, since response distances would tend to be shorter. The long term cost of maintaining the extra facilities would be higher, however the individual stations could be smaller and could fit into some locations more easily than a large multi-company station.

To illustrate the extreme cases of these two options, if it is assumed that the 14 existing fire suppression companies will be needed in the future, they could be located at 7 stations with two units at each location, or at 14 stations with one at each location. If calls were evenly distributed, the 14 station plan would result in faster response times, however this advantage would be offset if large numbers of calls were concentrated in very small areas. The heavy workload in the high demand areas could impact on the availability of the closest unit and require more calls to be covered by units from more distant stations.

\[3\] An optimization of the number and types of units that are required in Arlington requires a much more powerful and sophisticated computer model than the one that is being used for this project. This analysis is expected to be conducted in a second study within the next six months. This study is limited to examining station location options.
High Density Areas

The “more stations” option would be preferable in the high density areas of Arlington, particularly the Rosslyn - Ballston corridor and the Pentagon City - Crystal City area. These are very high activity zones where a large number of calls occur and traffic congestion slows response times during the busy periods of the day. These areas also present the problem of “vertical response time” - the time it takes to reach the location of the incident inside the building.

The units in these areas have high workloads, which are expected to increase over the next 10 to 20 years in proportion to the population. The increasing workloads will probably require additional resources to be assigned to these areas.

Based on these characteristics, it would be desirable to have more than the minimum number of stations in the high density areas. These stations could be located within the core areas or in the periphery on streets that provide direct access into the high density zones.

Low Density Areas

The lower density areas in Arlington are more suited to the “fewer stations” approach. There are fewer calls and fewer people at risk in these areas. The network of major streets makes it feasible to cover relatively large areas from stations that are strategically located. The locations of stations in these areas can be determined by the response time objectives, without special consideration of the workload issues or “vertical response time”. The major problem in some areas may be the availability of sites in desirable locations.

Efficiency versus Cost-Effectiveness

The most “efficient” distribution of fire stations would involve the minimum number of stations, strategically located to meet the response time objectives to all areas, without gaps or overlapping coverage. The FLAME model indicates that it would be feasible to provide better overall geographic coverage\(^4\) with 8 or 9 stations than with the 10 existing stations.

In the real world, absolute efficiency is often compromised by feasibility. It is seldom possible to place fire stations in the best locations, particularly in a community that is already fully developed. It may be preferable in some areas to operate more than the minimum number of stations.

\(^4\) This only considers geographic area coverage and does not account for the major variations in demand, workload and risk in different areas.
Limited access highways may provide fast response routes in their direction of travel, but they are also major barriers preventing travel from one side to the other. These barriers can only be crossed where overpasses or underpasses have been constructed. The fire department also has to respond to incidents that occur on the highways, where the resulting traffic congestion often delays their arrival.

**Land Values**

Unless the County has available property at a suitable location, the land for a new station may cost as much as the facility itself. The sites that are suitable or fire stations also tend to be valuable for commercial development. The acquisition of property for a new station in Arlington would probably involve the demolition of one or more existing structures.

The existing fire stations occupy several valuable properties that could be sold to partially offset the cost of a new site. In some cities the land occupied by a fire station has generated enough revenue to fund the purchase of a new site and the construction of a replacement facility in a more desirable location.

Land values in Arlington are directly impacted by development opportunities. It may be feasible to incorporate a new fire station into a larger scale redevelopment project. Some cities have sold or leased the development rights for valuable fire station properties and incorporated a replacement fire station into the new project. If this approach is adopted, the existing station would probably have to be maintained in service or temporary quarters would have to be found until the new station could be built.

**Acceptable Performance**

An acceptable fire station location plan will necessarily involve some compromises. The determination of acceptability should include a maximum acceptable response time to any area. The FLAME model was set to indicate areas where the travel time is 3 minutes or less in green, between 3 and 4 minutes in yellow, and between 4 and 5 minutes in red. All of the built-up areas in Arlington can be reached in less than 5 minutes with all of the configurations that were seriously considered.

The analysis should also consider where response times exceed the objectives. In general, the emphasis should be placed on meeting the 3-minute travel time objective in the areas that have the highest risk levels, the most population and the highest call volumes. Longer response times would be more acceptable in a low density neighborhood of single family homes or an industrial area than a high density core area.
Some of the locations in Arlington that are most difficult to reach are highly populated at certain times. These areas include the George Washington Parkway and Interstates 66 and 395, which are occupied by thousands of commuters during rush hours. It is also difficult to reach Arlington National Cemetery, which draws thousands of visitors, in less than 5 minutes. It would be more feasible to cover these areas by temporarily stationing units at strategic points than to build additional fire stations.
9. **COST ANALYSIS**

The cost of building and maintaining fire stations is relatively small in comparison to the cost of operating those stations. Operating costs, which are dominated by salaries and benefits, would not change significantly with most of the station location options. It appears that Arlington will need to maintain or increase the number of units in service and the number of personnel on duty, whether it has more, fewer or the same number of fire stations.

The major cost consideration that is involved in most of the fire station location decisions relates to construction costs and land values. This would involve the funds that will be needed to renovate, expand or replace most of the existing stations, if they remain in the same locations, as well as the costs of land and construction for any new stations.

The only station location decision that has a direct relationship to operating costs is the issue of keeping Station 7 in service versus closing or relocating the station. If it is closed, the personnel could be reassigned to cover a different area. If Station 7 is maintained in service, these personnel would not be available for reassignment.

The value and availability of land is a major cost issue relating to Stations 3, 4, 8 and 10. The replacement of Station 3 is already funded, however the site has not been determined. Significant expenditures are anticipated for renovation or replacement of the other three stations within 5 to 10 years.

If the sites currently occupied by Station 4 and Station 10 are sold, they could provide enough revenue to purchase a site and build one new station as a replacement. The response time objectives could be met from one station in the upper part of Rosslyn or in the Courthouse area. It may be feasible to sell one or both of the existing sites to a developer and to incorporate a new station into the new project. In this case the developer may be willing to build the new station at no cost to the County.

The lowest cost plan would be to consolidate Stations 3, 4 and 10 into one new station and to move Station 8 to the County-owned site at Old Dominion and North 26th Street. The funds that are already allocated to replace Station 3 would cover a large portion of the cost of the consolidated station. Additional revenue would be gained from the sale of the Station 4 and Station 10 properties after the new station is built. The cost of construction for a new Station 8 could be offset by the value of the existing site.

This plan would result in an increase in overall average response times due to longer travel distances to some of the busiest areas in Arlington. While response
times to North Arlington would be slightly improved, the response time objective
would be exceeded by about one minute in the lower part of Rosslyn and in
some areas between Military Road and the George Washington Parkway. The
Rosslyn area has a very high demand for service and has numerous high rise
buildings that involve vertical response time.
10. RECOMMENDATIONS

North Arlington: Stations 3 and 8

The highest priority issue is the location of a new Station 3, which is directly related to the future location of Station 8. The decision on where to build Station 3 will also influence several other station location decisions, however most of the remaining projects can be accomplished gradually, as development occurs and as opportunities are presented to buy, sell or trade land for fire station sites.

The best location for Station 3 would be as far north as possible along Military Road, in order to provide the greatest improvement in response times to the northern part of Arlington. Two sites appear to be available in this area:

- At the intersection of Old Glebe and Military Roads
- In the median of Glebe Road near Military Road

The disadvantage of this location is that it would move Station 3 away from a high demand area and into a low activity area, however the high demand area is adequately covered by other stations.

From this location, Station 3 could also cover a significant first due area outside Arlington County. The details of this arrangement should be worked out with Fairfax County, which has weak coverage in the adjacent area.

If Station 3 is not moved to the far north location, Station 8 should be moved as far north as possible along Glebe Road. The only readily available site appears to be the County-owned property at the intersection of North 26th Street and Old Dominion Drive. This location provides a good response route along Glebe Road to the northern part of Arlington.

If Station 3 is moved north, Station 8 should remain in the Lee Highway area. If Station 8 is moved north, Station 3 should remain in the Lee Highway area. The best coverage combination would be to locate Station 3 at Glebe and Military Roads and Station 8 in the vicinity of Lee Highway and Old Dominion. The actual sites for these stations could be adjusted within a range around each of the suggested locations:

- Station 3 could be located within a radius of approximately one half mile of the intersection of Lee Highway and Military Road
- Station 8 could be located within a triangle that includes the existing site, the North 26th/Old Dominion site and the Lee Highway/Old Dominion site.
Crystal City: Additional Station

The best location for a new station to cover the southern part of Crystal City would be on Glebe Road in the area of the Wastewater Treatment Plant. This location would also improve response times to the Arlington Ridge area, as well as the Potomac Yard area of Alexandria.

The construction of this station should be scheduled to coincide with the major development that is planned in the southern end of Crystal City. If the new station is built sooner rather than later, it could provide an alternative facility while Station 5 is rehabilitated or replaced at its current location.

Fairlington: Station 7

There is very little need for Station 7 at the existing location. The Fairlington area can be adequately covered from Arlington Station 9, as well as Alexandria Stations 203 and 206. Station 7 should be either closed or relocated.

The reliance on Alexandria stations to respond into this area is a reasonable trade-off for the coverage that a new Arlington station could provide for the Potomac Yard development in Alexandria.

Moving Station 7 to a site on George Mason Drive, east of the Fairfax County boundary, should be considered in the future. A station in this area would provide a modest improvement in response times to a small geographic area and does not appear to be justified at this time. The value of a station in this area could increase when the upper part of Columbia Pike is redeveloped.

Rosslyn-Ballston Corridor: Stations 4 and 10

The decision on whether to retain Stations 4 and 10 or to consolidate them into one new station depends on several factors. A new station in the Courthouse area could meet the response time objectives in the areas currently served by the two existing stations, as well as some of the area that is currently covered by Station 3. Maintaining separate stations in Rosslyn and Clarendon is less efficient, however it would provide faster response times in these high demand areas.

The best location for a consolidated station would be as close as possible to the Courthouse complex. A site between the Courthouse and Rosslyn areas would be acceptable. A decision should be made, at least tentatively, to determine whether the existing properties should be offered for sale or trade and if a consolidation site should be acquired. The actual implementation of this plan could be made at any time in the future to coincide with development opportunities.
Recommended Plans

The maps on the following pages illustrate the coverage that would be provided with the recommended plans: