A REVIEW OF THE PATROL STAFFING FORMULA

A Report to the Governor, Senate Finance Committee, and the House Appropriations Committee

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Preface

Pursuant to Item 459 (G) of Chapter 1042 of the 2003 Virginia Acts of Assembly, the Department of State Police is pleased to provide this report on options for updating the patrol staffing formula. The objective of this study is to provide an updated methodology for determining the number of troopers required to enable the Department of State Police to: (1) respond to emergency and non-emergency calls for service from the public in a timely manner; (2) conduct proactive patrol tasks effectively and; (3) allow patrol troopers to conduct all administrative duties, such as court appearances, report writing, vehicle maintenance, etc.

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Executive Summary

After conducting a thorough review of the current methodology used by the Department of State Police since the 1980's to determine staffing levels, the factors in the Modified Mission and Staffing Formula appear to overstate the actual number of troopers needed, thus calling into question the relationships between staffing levels and input variables. Actual patrol staffing levels have been consistently far less than those recommended by the Modified Mission and Staffing Formula. The Modified Mission and Staffing Formula currently recommends a staffing level of 2,092, however, the authorized strength is only 1,042. This represents a recommended staffing increase of 1,050 troopers, an increase of over 100 percent.

Data sources have changed considerably since the development of the current staffing formula. In the late 1990's, the Department of State Police completed the installation of a computer-aided dispatch (CAD) system in each of the seven field divisions and it has provided an independent source of data to measure agency workload and the level of service provided by the Department. Aside from improvements in functioning of the dispatch function, the CAD system records pertinent data for each call for service. Among these are the date and time that a call for service is received by the agency dispatcher, the date and time that a trooper is dispatched on the call, the date and time that a trooper arrives on scene at the call, and the date and time that a trooper completes action on the call. For each call, the dispatcher notes the priority of the call.

In the early 1990's, the National Highway Traffic Safety Administration (NHTSA) realized the need for a manpower allocation method for law enforcement agencies and contracted with Northwestern University to develop the Police Personnel Allocation Manual (PAM) Model for state law enforcement agencies. The PAM model was thoroughly evaluated to determine its appropriateness as a replacement for the Modified Mission and Staffing Formula. Several factors inhibit the effectiveness of the PAM model, including the number of user-defined subjective input variables. As a result, staffing levels produced in the PAM model can be manipulated. In addition, the over complexity of the PAM model rules out its viability as an option for updating the staffing formula.

As a result, the Trooper Allocation and Distribution Model (TADM) was developed and was geared specifically to the Department's unique data collection processes. The model is based on both reactive (calls for service) and self-initiated workload data from CAD, administrative workload data from the Weekly Activity Reporting System (WARS), and proactive patrol workload data (unobligated time) from WARS.

The following table compares staffing levels for the Modified Mission and Staffing Formula and the Trooper Allocation and Distribution Model with authorized and actual staffing levels. It is important to note that 37 additional sergeants are recommended to maintain a 1:12 span of control.

Staffing Level Comparison

	Number of Troopers
Trooper Allocation and Distribution Model	1,397
Modified Mission and Staffing Formula	2,092
Authorized Staffing Level (2002)	1,042
Average Actual Strength for (2002)	913

.Additionally, since the Trooper Allocation and Distribution Model is based on calls for service from the public as reported independently in the CAD system, the VSP staffing model provides a rational basis for requesting changes in the number of troopers authorized.

The following recommendations are provided for consideration:

1. Adopt the Trooper Allocation and Distribution Model as a replacement for the Modified Mission and Staffing Formula.

2. Enhance the CAD system by the addition of a records management system (RMS) capability. This would eliminate the need for troopers to submit weekly activity reports.

3. Evaluate the current level of service being provided by quarterly reviews of response time for calls for service and determine whether or not a higher level of service (a greater percentage of calls for service having a trooper available for immediate dispatch) would be appropriate for Department staffing calculations.

Virginia State Police Uniformed Patrol Structure

Following is an overview of organizational structure of the uniformed patrol service in the Department of State Police.

There are 95 counties in Virginia; 86 have chosen to retain their elected sheriffs as the provider of law enforcement patrol services. Within the group of 86 counties, 57 have no interstate highways (or other controlled/limited access highways) to patrol. The remaining 29 counties have a mix of primary system and controlled/limited access highways to patrol. Each of the remaining nine counties has opted for primary law enforcement services to be provided by a full-service police department that is headed by a chief of police. However, sheriff's offices and full-service police departments can request the assistance of the State Police when needed.

The smallest organizational unit of the State Police patrol function is the duty post. State Police duty posts may be visualized as confronting one of three levels of patrol responsibility and support for local law enforcement. These are: (1) patrol of primary system highways only; 2) patrol of interstate only; and 3) a mix of primary system highways and interstate patrol. One duty post is under contract solely to patrol the Dulles-Greenway toll-road in northern Virginia.

Table 1 depicts the level of patrol responsibility by patrol division.

Table 1: Patrol Responsibility by Division

Patrol Division	Primary Highways Only	Interstate Only	Primary Highways and Interstate
I Richmond	12	4	5
II Culpeper	6	0	7
III Appomattox	12	1	2
IV Wytheville	9	0	6
V Chesapeake	8	3	5
VI Salem	9	1	7
VII Fairfax	1	5	0
Totals	57	14	29

A complement of 100 duty posts comprise 48 patrol areas and these 48 areas form seven patrol field divisions. The boundaries of Virginia's 95 counties originally defined the boundaries of 95 duty posts. The State Police duty posts existed to provide patrol of primary system highways and to support the elected sheriff as the primary law enforcement officer of the county. Since independent cities have primary law enforcement services provided by full service police departments, each department headed by a chief of police, the State Police typically defer to these departments unless assistance is requested. However, the State Police have responsibility for patrolling interstates in these jurisdictions.

An Overview of Patrol Workload Data

A source of staffing data for patrol operations is the Weekly Activity Reporting System (WARS). Each patrol trooper submits an SP-127 form at the end of each week detailing how the trooper used his/her duty time. This data is then entered at the area office into WARS. The two basic categories of on-duty time, obligated time and unobligated time, can be derived from the data reported on the SP-127. Obligated time is that time during which a trooper is responding to calls for service or conducting related follow-up activities, such as report writing, court appearance, etc. Obligated time also includes expenditures of on-duty time for non-enforcement related administrative activities, such as training, vehicle maintenance, etc. Unobligated time is that time when troopers are normally on routine patrol and are free to conduct traffic enforcement, as the need presents.

The determination of staffing levels is governed not only by actual and anticipated workload, but by federal standards as set forth in the Fair Labor Standards Act (FLSA). FLSA standards govern, among other things, what is considered normal working hours and when workers must have time off from work (e.g., holidays and weekends). FLSA guidelines and historical trends of absence from work can be used to predict the number of hours that a trooper or group of troopers would be available for duty during any given time period. Table 2 depicts a summary of on-duty man-hour expenditures for the period of December 30, 2001, through December 28, 2002.

Table 2: Summary of On-Duty Man-Hour Expenditures for December 30, 2001, through December 28, 2002*

	Totals
Average Number of Patrol Troopers Assigned	913
Total Hours Worked	1,784,039
Total Hours Obligated Time	1,241,222
Total Hours Unobligated Time	542,817
Percentage of Time (Obligated)	69.6%
Percentage of Time (Unobligated)	30.4%
Average Hours to Work Per Trooper Per Year (Less Holidays, Weekends, and Leave)	1,609
Average Hours Worked Per Trooper Per Year	1,952
Average Overtime Hours Worked Per Trooper Per Year	343

Source: Virginia State Police Weekly Activity Reporting System

*NOTE: Weekly hours are recorded beginning on Sunday and ending on Saturday.

In the late 1990's, the Department of State Police completed the installation of a computer-aided dispatch (CAD) system in each of the seven field divisions and it has provided an independent source of data to measure agency workload and the level of service provided by the Department. Aside from improvements in functioning of the dispatch function, the CAD system records pertinent data for each call for service. Among these are the date and time that a call for service is received by the agency dispatcher, the date and time that a trooper is dispatched on the call, the date and time

that a trooper arrives on scene at the call, and the date and time that a trooper completes action on the call. For each call, the dispatcher notes the priority of the call.

By recording these times for each call for service, the Department can track the average time needed to dispatch a trooper on a call for service, the average time needed for a dispatched trooper to arrive on scene at the call, and the time needed by the dispatched trooper to complete the call. From these time measurements, the length of time the public must wait for service can be determined.

The level of staffing at duty posts can have an impact on response time. Increased staffing levels would increase the likelihood that a trooper would be available to respond. The more troopers on patrol at any given time, the more dispersed they could be throughout the patrol area. This dispersal, then, could contribute to a reduction in the amount of time needed for a trooper to arrive on scene at the call, once dispatched.

Evolution of the Mission and Staffing Formula

The 1984 session of the General Assembly directed that a study be conducted of the Department of State Police mission and manpower needs. The subsequent report completed in December 1984 entitled, A Review of the Mission and Staffing of the Department of State Police, focused on State Police staffing needs in the suburban and rural counties of the state. Minimum patrol staffing standards were developed and adopted. Non-interstate counties that had a population of less than 10,000 were deemed to require a minimum of 16 hours of patrol coverage per day, which required a minimum of four troopers. Non-interstate counties that had a population equal to or greater than 10,000, were deemed to require 24 hours of patrol coverage. This required a staffing level of five troopers. The staffing formula specified that one trooper was needed for each 60,000 vehicle miles traveled (VMT) in a county. When the number of troopers determined by the VMT computation was greater than the population-based minimum, the VMT-based value prevails as the number of troopers needed.

Minimum policy standards were established for interstate suburban/rural counties. It is important to note that minimum staffing standards for the urban interstate duty posts in the Richmond, Northern Virginia, and Tidewater areas were not included in this study. Table 3 depicts the minimum staffing levels for suburban/rural counties with interstate highways.

Table 3: Staffing Levels for Suburban/Rural Counties with Interstate Highways

Average Daily Traffic Volume (ADT)	Number of Troopers Needed
Low ADT (0–12,499 vehicles/day):	5 + (0.2 X number of miles in excess of 20)
Medium ADT (12,500–24,999 vehicles/day)	5 + (0.25 X number of miles in excess of 20)
High ADT (25,000 – 37,499 vehicles/day)	6 + (0.33 X number of miles in excess of 20)
Very High ADT (37,500–50,000 vehicles/day)	8 + (0.5 X number of miles in excess of 20)

In order to completely meet the mandate of the General Assembly and to address the unique staffing problems posed in the State's urban areas, a second study entitled Urban Interstate Staffing was completed in September 1985 by Mr. Peter B. Moreland, Transportation Planning Engineer. This study focused on the staffing needs for patrolling controlled access highways in urban counties and cities of Northern Virginia, Richmond, and the Tidewater area.

The Modified Mission and Staffing Study Method (MMSSM) was based on the formula developed in the 1984 Mission and Staffing Study for "Very High Density" counties in the State for application to the urban counties and cities of Northern Virginia, Richmond, and the Tidewater area. At the time the original formula was developed, highways had only two lanes in each direction, a maximum ADT of 50,000 vehicles per day, and a maximum of seven accidents per mile per year. The consultant felt that increases in these factors created an adverse impact in the urban counties and cities of Northern Virginia, Richmond, and the Tidewater area and made the actual number of miles patrolled seem like a greater number of miles.

As a result, expansion factors were developed for these traits and were used to adjust the number of miles patrolled upward. The modified formula included the use of relatively weighted expansion factors to account for the impact of multiple lanes, heavier traffic, and higher accident per mile rates unique to these areas. This revised, or equivalent, number of miles was then used in the equation for very high traffic density interstate. The effect of the expansion factor(s) is to increase the incremental troopers needed over the base number of troopers. The Department of State Police adopted this modified staffing formula for use.

In July 1986, the Department of State Police, in conjunction with the Department of Planning and Budget, responded to concerns about the use of overtime and compensatory time to maintain existing patrol levels by initiating a study of duty post staffing. Using actual workload data, this study found that seven troopers, not five, were required to provide 24 hours of patrol coverage. In addition, five troopers, not four, were required to provide 16 hours of patrol coverage per day. The Department of State Police subsequently adopted these staffing standards.

In July 1987, the modified formula was further revised for suburban/rural interstate staffing. Table 4 reflects the revised standards.

Table 4: Suburban/Rural Interstate Staffing Levels

Average Daily Traffic Volume (ADT)	Number of Troopers Needed
Low ADT (0–12,499 vehicles/day):	7 + (0.2 X number of miles in excess of 20)
Medium ADT (12,500–24,999 vehicles/day)	7 + (0.25 X number of miles in excess of 20)
High ADT (25,000 – 37,499 vehicles/day)	8 + (0.33 X number of miles in excess of 20)
Very High ADT (37,500–50,000 vehicles/day)	11 + (0.5 X number of miles in excess of 20)

A detailed description of the Modified Mission and Staffing Formula can be found in the Appendix.

Over time, the factors used in the Modified Mission and Staffing formula appeared to overstate the actual number of troopers needed, calling into question the relationships between staffing levels and the input variables. As an example, Area 9 in Fairfax has an authorized strength of 28 troopers; however, the current staffing formula recommends 154 troopers for patrol of interstate highways. This surpasses the number of troopers authorized for the entire division.

An alternative model, the Police Personnel Allocation Manual model (PAM) was extensively reviewed as an alternative staffing methodology.

The Police Personnel Allocation Manual Model (PAM)

In the early 1990's, the National Highway Traffic Safety Administration (NHTSA) realized the need for a manpower allocation method for law enforcement agencies and contracted with Northwestern University to develop the Police Personnel Allocation Manual (PAM) Model for state law enforcement agencies.

PAM approaches the staffing based on documented man-hour expenditures in each of the four categories of on-duty time expenditures. The four categories of on-duty time are administrative time, reactive time, proactive self-initiated time, and proactive patrol visibility time and are totaled to determine the number of troopers needed. These are then combined to determine to the total number of troopers needed on duty each day.

An explanation of each of the four time components is contained in the following four sections.

1. Administrative Time

Administrative time includes overhead activities that are not necessarily related to any enforcement incidents. While performing these administrative activities, a trooper is not available for responding to a call for service (CFS), performing routine patrol duties, or performing self-initiated duties.

2. Self-initiated Time

While on patrol of the highways, troopers frequently encounter violations of the motor vehicle and/or criminal codes and/or other situations demanding their attention. Self-initiated time includes the time when patrol is stopped until the incident is completed. This type of incident includes issuing summonses, assisting stranded motorists, and directing traffic.

3. Reactive Time

Reactive time is the portion of on-duty time that is obligated to the incident being worked. Obligation to the incident means that the trooper is not available for any other incidents or activities. Reactive time includes working accidents (including travel time to

the accident scene, on-scene time, and time spent writing the accident report) or working on other CFS (such as agency assists, criminal calls, etc.).

4. Proactive Patrol Time

Patrol time has two dimensions. One is based on the theory of deterrence that results from the physical presence of a uniformed officer on patrol (thus the name *visibility criterion*). The other dimension is availability of an officer for immediate dispatch on a reactive call for service (CFS). The ready availability of troopers for immediate dispatch allows attainment of some specified level of service. One possible criterion can be a specified percentage of CFS that have a trooper available for immediate dispatch on the call (thus the name *availability criterion).* The visibility criterion is a mandatory element of the PAM model, while the availability criterion is an optional element.

Patrol Visibility

Inputs for the visibility patrol criterion are number of highway miles to patrol, average speed while on patrol, interval of patrol (i.e., how often a trooper should pass any given point on the patrol route during a shift), and hours of patrol coverage (i.e., 16 hours or 24 hours).

Patrol Availability

For some duty posts, the visibility criterion provides a sufficient number of troopers to achieve the desired availability criterion. For other duty posts, interstate and primary system highways do not generate sufficient visibility patrol troopers to achieve the desired availability criterion response to reactive CFS. The criterion may be expressed as the percentage of reactive CFS that have a trooper available for immediate dispatch or as the maximum allowable response time to a CFS.

When using the availability criterion in PAM calculations, the staffing level needed to maintain the visibility criterion is compared to the staffing level needed to meet the desired performance criterion. The greater of the two values is used in the PAM formula.

The number of troopers needed on duty each day at each duty post to assure that the level of service is met depends on the value of the magnitude of the reactive workload, the magnitude of the self-initiated workload, and the magnitude of the obligated administrative activity workload.

The number of troopers calculated in the PAM formula does not take into consideration such factors as requirements of the federal Fair Labor Standards Act (e.g., the 40-hour workweek, etc.) and the need for annual and sick leave. The number of troopers needed each day can be adjusted for time off from work by computing a shift relief factor (SRF) that is also based on historical man-hour data. The SRF may be interpreted as the number of troopers that must be hired to produce one trooper on duty for one shift each day of the year. PAM also provides for minimum staffing levels that might be dictated by management policy.

Several factors inhibit the effectiveness of the PAM model. Due to the number of user-defined subjective input variables, staffing levels produced in the PAM model can be manipulated. In addition, the over complexity of the PAM model rules out its viability as an option for updating the staffing formula.

As a result, it was determined that a hybrid staffing model could be developed that would be geared specifically to the Department's unique data collection processes.

Trooper Allocation and Distribution Model (TADM)

Based on the above discussion of the limitations of the PAM model, a suitable VSP staffing model would be one based on both reactive (calls for service) and self-initiated workload data from CAD, administrative workload data from WARS, and inclusion of unobligated time for proactive patrol. Some of the methodological techniques of PAM would be applied to integrate the two sources of data in the model.

The VSP model, called the Trooper Allocation and Distribution Model (TADM), reflects an attempt to determine the number of troopers that must be physically present on duty each and every day of the week, the month, and the year. This number of troopers represents the minimum number of troopers needed to accomplish the workload generated at the duty posts. Since time must be allocated for weekends, holidays, annual leave, and sickness, more troopers than this basic value must be maintained in the force. Therefore, the basic number of troopers required must be adjusted upward to account for these patrol availability factors.

Unobligated hours are expressed as a proportion of total hours worked. The Trooper Allocation and Distribution Model has included 25 percent of on-duty time for proactive patrol (unobligated time). Using terminology borrowed from PAM, the number of troopers needed on duty each day (N_o) for incidents, activities, and allowance for unobligated time is given by:

$$N_o = \frac{\left[\frac{(\text{CAD Reactive Hours}) + (\text{CAD Self-Initiated Hours}) + (\text{WARS Activity Hours})}{364 \times 8}\right]}{[1 - (\text{Allowable Proportion for Unobligated Hours})]}$$

Since data are for a 52-week year, dividing by 364 yields average *daily* workload hours that must be covered. Dividing the average daily workload by 8 yields the number of troopers needed to perform the work. Then dividing by the quantity (1 – proportion of unobligated time) yields the number of troopers needed for all workload components. This calculation is performed for each duty post to determine its unique staffing needs.

The value for N_o at each duty post must then be adjusted for legitimate absences from duty by a shift relief factor (SRF, also borrowed from PAM). Using data recorded in WARS for patrol availability, the SRF (statewide average) is 2.43.

The number of troopers needed to be assigned at each duty post (N_t) is given by:

$$N_t = N_o \times SRF$$

The workload, including obligated and unobligated time, at some duty posts is insufficient for the model to generate the number of troopers necessary to maintain an adequate two-shift or three-shift State Police presence at the duty posts. Therefore, the computed value of N_t must be compared to the population-based minimum staffing level for each duty post. If the number of troopers recommended by the Trooper Allocation and Distribution Model is less than population-based minimum standard for patrol coverage, the minimum value (either five or seven troopers) is used as the recommended staffing level (N_t).

Table 5 compares staffing levels for the Modified Mission and Staffing Formula and the Trooper Allocation and Distribution Model with authorized and actual staffing levels.

Table 5: Staffing Level Comparison

	Number of Troopers
Trooper Allocation and Distribution Model	1,397
Modified Mission and Staffing Formula	2,092
Authorized Staffing Level	1,042
Average Actual Strength for 2002	913

Table 6 depicts staffing levels by division as generated by the Trooper Allocation and Distribution Model, compared to authorized and average actual staffing levels for 2002.

Table 6: Staffing Level Comparison by Division

	Patrol Division	**Trooper Allocation and Distribution Model**	**Authorized Staffing (2002)**	**Average Actual Staffing (2002)**
I	Richmond	289	214	188
II	Culpeper	168	121	104
III	Appomattox	146	115	100
IV	Wytheville	167	126	113
V	Chesapeake	238	188	162
VI	Salem	180	141	127
VII	Fairfax	209	137	120
	Totals	1,397	1,042	913*

*Note: Total may be off due to rounding

Several points about the Trooper Allocation and Distribution Model are noteworthy. First, the superiority of TADM over both the PAM and Modified Mission and Staffing models is derived from its use of workload data that is objective. PAM suffers mostly from its reliance on the self-reported measures from the WARS database. Additionally, since the Trooper Allocation and Distribution Model is based on calls for service from the public as reported independently in the CAD system, the VSP staffing model provides a rational basis for requesting changes in the number of troopers authorized.

Recommendations

The review of the Modified Mission and Staffing Formula has established that over time, the input factors used in the formula appear to overstate their relationship to staffing. Actual patrol staffing levels have been consistently far less than those recommended by the Modified Mission and Staffing Formula. The Modified Mission and Staffing Formula currently recommends a staffing level of 2,092, however, the authorized strength is only 1,042. This represents a recommended staffing increase of 1,050 troopers, an increase of over 100 percent.

The following recommendations are provided for consideration:

1. Adopt the Trooper Allocation and Distribution Model as a replacement for the Modified Mission and Staffing Formula.

2. Enhance the CAD system by the addition of a records management system (RMS) capability. This would eliminate the need for troopers to submit weekly activity reports.

3. Evaluate the current level of service being provided by quarterly reviews of response time for calls for service and determine whether or not a higher level of service (a greater percentage of calls for service having a trooper available for immediate dispatch) would be appropriate for Department staffing calculations.

APPENDIX

Overview of the Modified Mission and Staffing Formula

The Modified Mission and Staffing Formula is used to determine the number of patrol troopers recommended for each duty post. Duty posts are responsible for interstate patrol only, county area patrol only, or a combination of the two.

Interstate Patrol Duty Posts

The number of troopers needed for interstate patrol depends upon the number of interstate miles and the average daily traffic density (ADT or vehicles per day). The formula was derived from the "standard" interstate with ADT of 50,000 or less, two lanes in each direction and no more than 7 accidents per mile per year.

For each ADT category, the formula determines the number of troopers needed for 20 miles or less of interstate. If a duty post has more than 20 miles, the formula then determines the additional number of troopers needed. The basic formula is as follows:

Average Daily Traffic Density (ADT)	# of Troopers for 20 miles or less	# of Additional Troopers for 20+ miles
Low: (0 to 12,499)	7	1 for each additional 5 miles
Medium: (12,500 to 24,999)	7	1 for each additional 4 miles
High: (25,000 to 37,499)	8	1 for each additional 3 miles
Very High: (37,500 to 50,000)	11	1 for each additional 2 miles

To account for interstates that have ADT in excess of 50,000 miles per day, more than two lanes in each direction, and more than 7 accidents per mile per year, the basic formula is then revised to include the following impact factors:

Lane Impact Factor

Number of Lanes	Expansion Factor
2+2 (Standard)	1.00
3+3 and 2+2+2	1.16
4+4 or greater	1.33

Traffic Impact Factor

Average Daily Traffic Density **(ADT)**	***Expansion Factor***
0 – 50,000 (Standard)	1.00
50,000 – 75,000	1.16
75,000 – 100,000	1.50
100,000 – 125,000	2.17
125,000+	3.50

Crash Impact Factor

Average # of Crashes Per Year Per Mile	**Expansion Factor**
0 – 7 (Standard)	1.00
8 – 15	1.33
16 – 22	1.67
23 – 30	2.00
31 – 37	2.33
38 – 45	2.67
45+	3.00

Once the impact factors are determined, the combined expansion factor is obtained by multiplying the three individual expansion factors together. The equivalent number of interstate miles is the actual number of miles multiplied by the combined expansion factor. The recommended number of troopers is determined by then using the equivalent number of interstate miles in the basic formula.

Area Patrol Duty Posts

The minimum number of troopers needed for county area patrol is based on population as follows:

For 16 hour/day coverage: 5 troopers for counties with less than 10,000
For 24 hour/day coverage: 7 troopers for counties with population of 10,000+

To account for increased primary system traffic as measured in vehicle miles traveled, the staffing formula specifies that one trooper is needed for each 60,000 vehicle miles traveled in a county. If this value is greater than the minimum number of troopers needed based on population as specified above, it is used as the staffing recommendation.

Combination Interstate and Area Patrol Duty Posts

The staffing requirements for each type of patrol are calculated and added together.

Example:

The Spotsylvania County/City of Fredericksburg duty post in Division II is a combined duty post with 15.59 miles of Interstate 95. To calculate the staffing requirements for interstate patrol, the impact factors are determined as follows:

Impact Factor	Expansion Factor
Lane impact: 3 lanes in each direction	1.16
Traffic impact: Average daily traffic 94,134 vehicles/day	1.50
Crash impact: 11 accidents per mile per year	1.33

The combined expansion factor is 1.16 x 1.50 x 1.33 = 2.3
The number of equivalent miles is 15.59 miles x 2.3 = 36.1 miles

Using the basic formula, since this is a Very High Density interstate (94,134 ADT), the number of troopers for interstate patrol is:

11 for the first 20 miles + 1 for each additional 2 miles

or

$$11 + (36.1-20)/2 = 19$$

To calculate the number of troopers for county area patrol, the county population is 90,396 and the annual vehicle miles traveled is 934,079. The policy minimum for area patrol is 7 troopers; however, the annual vehicle miles traveled divided by 60,000 is equal to 16 troopers. Since the greater value is used, area patrol staffing is 16. Total staffing recommended for the duty post is 35 (19 troopers for interstate patrol and 16 troopers for county area patrol).