TECHNICAL ASSISTANCE REPORT

DETERMINING MAXIMUM SUPERINTENDENT WORKLOAD AS A FUNCTION OF TRAFFIC LOAD

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Virginia Transportation Research Council
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INTRODUCTION

In 1993, Governor George Allen established the Governor's Commission on Government Reform (GCGR) to investigate and recommend changes in state government that would streamline its operation and improve its efficiency and service. The GCGR reviewed the Virginia Department of Transportation's (VDOT) organization as a part of their investigation. The review resulted in the following recommendation concerning the Department's field maintenance organization:

> VDOT should eliminate or combine area headquarters facilities that are no longer needed, looking at the following served by each facility: vehicle miles traveled, lane miles served and area served (see Appendix[1]).

In response to the GCGR's recommendation, VDOT set out to determine the optimum number of physical facilities that were needed to maintain the current road system. One factor considered in this determination was the size of the workload the area superintendent could effectively administer. This workload has a direct impact on the size of the maintenance area, and in turn influences the location, size and services available from the area headquarters (see Appendix[2]). One of the primary contributors to the superintendent's workload is the number of road miles administered.

In 1991, a similar investigation was undertaken as part of a study for the Secretary of Transportation (VDOT, 1991). That investigation recommended a reduction in the number of area headquarters statewide. The methodology defined workload in terms of road miles administered by an area superintendent. The maximum workload any superintendent was expected to effectively manage was determined as a function of the volume of traffic using that road mileage. The 1991 study considered both lane miles and vehicle miles traveled. Since it involved two of the factors recommended by the GCGR for consideration, an update of the 1991 study was ordered.

The 1991 Study

The 1991 study determined the maximum workload that area superintendents were effectively managing and supported increasing the workload assigned to other superintendents so that the workload on all superintendents was more equally distributed. The premise was that an area superintendent's workload can be represented by the road miles assigned to him and that the maximum workload that can be effectively managed is a function of the vehicle miles traveled per lane mile on those roads.

The study defined workload as road miles administered by a superintendent. Road miles were chosen because they are an easily measured inventory item and the time required to review a mile of road is relatively constant. The premise assumed that other factors such as terrain, traffic by road system, width and location have little effect upon the superintendent's ability to observe problems, determine the solution, assemble resources and schedule those resources to correct the problem. To accomplish these four steps requires only time, if money is properly allocated to maintain the road system. The study assumed that the maintenance dollar is properly distributed for this purpose.

The number of miles that a superintendent could effectively manage was assumed to depend primarily on how quickly the highway deteriorated, and that the rate of deterioration was a function of road use. The study chose vehicle miles traveled per lane mile (VMT/LM) as an indicator of road use. The time available to accomplish the four steps associated with the administration of the superintendent's workload is dependent on how fast the road system deteriorates. While many factors, such as weather, traffic volume and weight, and the adequacy of roadway design, affect the rate of deterioration, traffic volume is the most easily measured. The premise was that when comparing maintenance areas with large road mileages, the effects of the other factors would be neutralized and the rate of deterioration would be reflected as a function of traffic volume.

The 1991 study determined the number of road miles maintained by every superintendent in the state. In counties with more than one maintenance headquarters, the figure was determined as the average number of road miles maintained by each superintendent. This was necessary since the first opportunity to tabulate the average VMT/LM occurs at the county level, not at the area headquarters level. The data was graphed (Attachment A). For each county, the average road miles per superintendent (Y-axis) was plotted against the VMT/LM on those roads (X axis). This created a scatter diagram of all the superintendents' workloads versus the VMT/LM.

Analysis of the scatter diagram indicated a wide divergence between the road miles maintained (workload) by the superintendents at any given VMT/LM (traffic load). Since the objective of the study was to equalize and maximize the workload on each superintendent at any given traffic load, a maximum workload level had to be established for each traffic load. Recognizing the limitations of using road miles as the only indicator of workload, the study managers established a maximum workload by connecting, with a straight line, the two points on the scatter diagram that caused all other points to have a lower workload than the line at any given VMT/LM. This established a maximum workload level that at least two superintendents were carrying while effectively managing their responsibilities. This line was called the Amelia Rule after the higher of the two points.

The study managers realized that road miles maintained do not fully represent the workload on a maintenance superintendent. Some of these other factors which add to this workload or to the time, effort, knowledge and skills the superintendent must bring to bear are population served, terrain, prevailing weather conditions, employees supervised, employee turnover, employee skills, soil conditions, and other facilities maintained (for example, rest areas). To compensate for these other factors during the general review of the superintendents' workload, a line equal to 85% of that established by the Amelia Rule was adopted as the limit of average road mileage to be assigned to each superintendent. This line was called the 85% Amelia Rule or the 85% Rule.

Once the 85% Rule was established, the number of maintenance areas in each residency was adjusted to increase the average road miles per superintendent to a point as near to the line as possible without exceeding the workload established by the 85% Rule. Road miles and the average VMT/LM for each residency were estimated for 1994, to allow for the effects of growth on workload and the rate of deterioration so that superintendent positions and headquarters would not be recommended for elimination only to be needed again in a short time. The study recommended reducing the number of area superintendents, maintenance areas and area headquarters, eliminating 17 to 34 area superintendent positions.

The study recognized that the 85% Rule does not fully consider other factors influencing workload in individual residencies. After a review of the locations recommended for elimination considering these factors, 17 area superintendents were eliminated and the headquarters were consolidated, reduced to subareas, converted to storage lots, or closed.

PURPOSE, OBJECTIVES AND SCOPE

The purpose of this study was to consider the area headquarters from the perspective of the workload of the area superintendent, as one tool for evaluating the number of area headquarters needed to maintain VDOT's road system. Other tools will also be needed for the evaluation to be comprehensive.

The objectives of this study were (1) to determine the maximum road mileage area superintendents are effectively managing at each traffic load level and (2) to redistribute the statewide road mileage among the area superintendents so that (a) their individual road mileage is maximized and (b) the number of area superintendents is minimized. The study used the methodology developed for the 1991 study. The determination and redistribution of road mileage was based on the most recent data available, which was through December 31, 1993.

The results were "current" as of that date. The study also estimated growth to the year 2000 and redistributed the estimated road mileage in that year using the maximums developed for current (1993) conditions. The year 2000 was chosen to assure that any changes would be applicable for at least a five-year period. Since the purpose was to develop a tool for evaluating the number of area headquarters needed by updating existing study material, no review of the literature or of other study methods was included.

A management criterion affected the results of this study. Unlike most states, Virginia maintains local (secondary) roads through its state transportation department. In many counties, VDOT's local presence is strong. To retain this local contact, management directed that each county have at least one area headquarters, administered by an area superintendent.

The influence of factors other than road mileage on the workload of the superintendent is difficult to quantify. The 85% Rule used in the 1991 study was somewhat arbitrary, and the individual review process used at locations recommended for elimination further undermined its credibility as a rule. To avoid this ambiguity, the current study did not reduce the mileage levels determined by the new rule.

METHODS

1991 Study Appropriateness

This study is basically an update of the 1991 unpublished research on the same subject. The first step in the study was to review the 1991 research and determine its appropriateness for use with updated data. The 1991 Study used the following information to develop the area superintendents' workload:

Road miles maintained by VDOT, tabulated by county. This included roads in the interstate, primary and secondary road systems, but did not include service roads. Roads in the urban system are not maintained by VDOT and were not included. This information was obtained from the Traffic Engineering Division and was current through 1989.

Lane miles of roads maintained by VDOT, tabulated by county. The lane miles represented the same mileage of interstate, primary and secondary roads as measured for the road miles. The service road lane miles were not included. This information was obtained from the Traffic Engineering Division and was current through 1989.

Vehicle miles traveled (VMT) on VDOT maintained roads, tabulated by county. This information was obtained from the Traffic Engineering Division and was calculated from traffic count data collected in 1989 for the interstate and primary systems. Secondary system data was current through 1986.

Area superintendents per county. This information was obtained from the 45 residency offices and was current through 1991.

All data, except secondary VMT, were current through 1989. To estimate the secondary VMT in 1989, secondary traffic growth for each county was assumed to equal the county's population growth between 1986 and 1989. Population growth data between 1986 and 1989 were obtained from the Tayloe Murphy Institute and applied to the 1986 secondary VMT for each county. The resulting secondary VMT estimate was added to the 1989 VMT data for the interstate and primary systems to create a total VMT for each county.

The data described above were used to graph the superintendents' workload versus vehicle miles traveled per lane mile (VMT/LM) (Attachment A). The graph was used to develop the Amelia Rule, applied to reduce the number of superintendents and redistribute their road mileage. The 1991 study confined the adjustments in the number of superintendents and area boundaries within residency boundaries, to retain the maintenance of all roads in any county under the residency to which it was assigned. The maintenance area boundaries, however, were allowed to cross county lines included within each residency to which they were assigned.

An estimate was developed of the workload expected for each superintendent in the year 1994. Since the adjustment of the number of superintendents was to be restricted to residencies, the estimates were made based on residency totals for road miles, lane miles and VMT. The process chosen to estimate their growth was to determine the median growth rate among the residencies for road miles, lane miles and VMT for the period from 1986 to 1989. These growth rates were then applied equally to each residency to estimate 1994 road miles, lane miles and VMT.

There are two objections to the process used to estimate growth in the 1991 study. The first involves the growth estimates for secondary traffic counts. Comparison of secondary traffic count growth with population growth between 1980 and 1986 indicates no correlation between the two. In most cases the traffic grows at a faster rate than population. The comparison showed that secondary traffic usually increased even when total population fell. An investigation of factors influencing secondary traffic growth is not complete for inclusion in this report; however, it appears that some other method should be used to estimate growth in secondary traffic. The second objection is the use of a single growth rate for road miles, lane miles and VMT in all residencies. The growth rates of all three varied widely between residencies. It would have been more accurate if they had been applied on a county or residency basis.

To improve the accuracy of the VMT estimates for the current study, Transportation Planning Division estimates were used where actual traffic count data did not exist. This included secondary counts for 1993 and 2000 and interstate and primary counts for the year 2000 (see Appendix[3]).

To make road mile and lane mile estimates for the year 2000 more reflective of local growth, the growth rate of each was determined for each county between 1989 and 1993. The growth was then considered to continue at the same rate for each county until the year 2000. An exception was made for the interstate road miles, where the year 2000 figure was considered to be the same as that in 1993. To assure that all road mileage and lane mileage was considered, the service and frontage road data were included in the totals for each county.

Determination of Maximum Manageable Road Mileage

The objective of the current study was to estimate the maximum road mileage area superintendents are effectively managing. To accomplish this objective the study reviewed current (1993) conditions. The road mileage, lane mileage and vehicle miles traveled on VDOT-maintained roads currently assigned to the area superintendents in each county were tabulated (Attachment B).

A scatter diagram of each county's average road miles per superintendent versus VMT/LM was plotted (Attachment C). Using the scatter diagram, a straight line was established connecting the two points which result in all other points having a lower average road miles per superintendent than the line for any given VMT/LM. The two points chosen were Dickenson County and Hanover County. The adequacy of the maintenance and the superintendent's span of control in those two counties was investigated and determined to be adequate (see Appendix[4]). The resulting line became the rule. To distinguish it from other formulae, the line is titled the "Dickenson Rule." Each rule is defined by its Y axis intercept and the slope of the line. The Dickenson Rule has a Y axis intercept of 499, and a slope of -0.04483.

Maximizing Current Conditions

Once the Dickenson Rule was established, the number of superintendents needed in each residency under current conditions could be calculated. To accomplish this, the road mileage, lane mileage and VMT estimates were combined to create totals for each residency. The number of superintendents needed in each residency in the current year (1993) was determined by dividing the road miles in the residency by the maximum road miles per superintendent established by the Dickenson Rule. This maximum road miles figure was determined by entering Attachment C at the appropriate VMT/LM for the residency and reading the average road miles per area superintendent level at the line established by the Dickenson Rule. Attachment D tabulates the results by residency.

Estimating Conditions in the Year 2000

To estimate conditions in the year 2000, growth of road miles and lane miles between 1993 and 2000 was determined for each county. To make road mile and lane mile estimates for the year 2000 more reflective of local growth, the growth rate of each was determined for each county between 1989 and 1993 (Attachment E). The growth was then considered to continue at the same rate, for each county, until the year 2000. An exception was made for the interstate road miles. The year 2000 figure for interstate mileage was considered to be the same as that in 1993, since the interstate road mileage is complete in Virginia. Interstate lane mileage is assumed to continue to grow, however. Using these rates of growth, the 1993 data for road and lane mileage was projected to the year 2000. VMT estimates, by county, for the year 2000 were obtained from the Transportation Planning Division.

The road mileage, lane mileage and VMT estimates for each county were combined to create estimated figures by residency for the year 2000. Attachment F tabulates the results by residency. The number of superintendents needed in each residency in the year 2000 was determined by dividing the estimated road miles per residency by the maximum road miles per superintendent established by the Dickenson Rule. The objective of the study was to determine the maximum road mileage the superintendents are currently effectively managing, not to determine what the maximum might be. Therefore, the maximum road mileage assigned to each superintendent remains as established by the 1993 data.

FINDINGS AND DISCUSSION

The results of the process described above were a recommended number of superintendents for each residency for the current year (1993) and the year 2000. These results are shown in Attachment D for 1993 and in Attachment F for 2000. The recommendations represent the number of superintendents needed if the average road miles assigned each superintendent are increased to the level determined by the Dickenson Rule.

Attachments D and F indicate that if the road mileage in each residency was reassigned, the number of maintenance superintendents could be reduced now by 82 (37.2%) or be reduced by 76 in 2000 (34.5%). There are currently 220 maintenance area superintendents statewide. Reductions would occur in all residencies except Ashland, which remained unchanged.

The study rounded the number of superintendents determined by the Rule up to the next whole number if the number was XX.3 or above. The rounding was down if the number is XX.2 or below. This created conditions in 12 residencies, in both the current year (1993) and 2000, where the average road mileage assigned each superintendent exceeded the maximum established by the Rule. To reduce the average road mileage assigned to area superintendents in those counties below the number determined by the Dickenson Rule, one superintendent should be added to the number assigned to each.

VDOT management has decided to retain a minimum of one area headquarters with a superintendent in every county in the state. The 1993 data indicated that four residencies (Luray, Saluda, Sandston, and Warsaw) would have fewer superintendents than counties assigned to them. Each would have one superintendent restored to them as a result of this decision. In 2000 the number would be three since Sandston is one of the six residencies that would gain a superintendent, based on growth of road mileage and VMT/LM, between 1993 and 2000.

The net effect of these considerations suggests that the number of superintendents be reduced by between 66 to 82 positions now or between 61 to 76 positions by 2000.

CONCLUSIONS

The purpose of this study was to develop a tool for determining the number of area headquarters needed to properly maintain Virginia's road system; specifically, a process to determine the number of area superintendents and maintenance areas needed to administer the maintenance program.

While the data support a recommendation to reduce the number of maintenance areas and area superintendents by one-third, there are other factors affecting workload that are not considered here. Those factors were outlined above in the description of the 1991 Study. The 1991 Study attempted to account for those other factors, first by adjusting the number of recommended superintendents to 85% of the Amelia Rule developed at the time, and then by individually reviewing the residencies recommended for position reductions. The current study has not attempted to account for those factors..

In conclusion, the reductions in the number of maintenance areas and superintendents suggested by the study should be considered as a maximum number, and other factors influencing workload should be investigated to determine the extent of their influence.

REFERENCES

VDOT (1991) *A Preliminary Report to the Secretary of Transportation on the Organization and Administration of the Virginia Department of Transportation.* Virginia Department of Transportation, Richmond.

APPENDIX

1. *Definitions*

Maintenance Area- A geographical area containing a specific road mileage. It is managed by an area superintendent who has responsibility for the maintenance of the road mileage.

Area Headquarters- A physical facility consisting of buildings and grounds. It serves as the home base for one or more maintenance areas and is used as a location to store equipment and materials for the maintenance of the road system.

Subarea: A physical facility similar to an area headquarters. The people, equipment and materials housed there may be administered by a maintenance supervisor or crew leader, but the whole operation is under the administration of an area superintendent housed at another location. While the subarea may have primary responsibility for the roads in a geographical area, these roads are included in the maintenance area assigned to the area superintendent. The subarea is not to be considered as a geographical area as is the maintenance area.

Road Miles- The length of a road measured along its centerline. The number of lanes and whether the road is divided has no effect on the number of road miles. A two lane gravel road one mile long or an eight lane divided highway one mile long are both one road mile long.

Lane Miles- The length of a road determined by multiplying the number of lanes the road has by its centerline length. A two lane gravel road one road mile long is two lane miles long. An eight lane divided highway one road mile long is eight lane miles long.

Vehicle Miles Traveled- A calculation obtained by multiplying the daily traffic count for a section of road by the centerline length of the road.

2. *A Discussion of the Influence of Superintendent Workload on the Number of Area Headquarters Needed*

In the past many area headquarters (AHQs) housed two or more area superintendents (A/S) (Ex: Newington in Fairfax County and Fremont in Dickenson County). Today Camp 30 has at least three maintenance areas (M/A). There are also many M/A that are serviced out of an AHQs and a subarea (Ex: Zions X-roads and Ferncliff). *This would seem to indicate that there is no connection between the number of A/S (or M/A) needed and the number of AHQs needed.*

If the number of A/S and M/A don't affect the number of AHQs needed, what factors do?

The *response time* or *travel time* to points within the M/A served by the AHQs should be considered. AHQs should be located to allow what management determines is an adequate response or travel time. When response and travel time exceed the limits set, subareas are warranted.

The *physical capacity* of the AHQs. This is defined as the area available for storage of equipment and essential materials as well as accommodate the people assigned to the M/A. When the AHQs will not accommodate the full needs of the M/A, subareas or storage lots are warranted.

Environmental or socio-economic concerns may not allow certain essential items to be available at the AHQs (Example: Storage of snow removal chemicals). In such cases subareas or storage lots may be needed.

What should we do if we were just starting to divide the state into maintenance areas?

1. Set a response/travel time limit

2. Develop response/travel time contours for each residency (in accordance with VDOT policy that AHQ boundaries will not cross residency boundaries) to determine the minimum number of AHQs needed. Use the time limit from the residency boundary to determine areas (location area) that are suitable for locating AHQs based on response time.

3. Determine the number of M/As needed in each residency based on A/S workload and VDOT policy that each county will have a minimum of one A/S.

4. Distribute the M/As to the AHQ location areas.

5. Determine the facilities needed at each AHQ to properly serve the M/As assigned.

6. Find AHQ sites within the location areas that meet the size and environmental requirements for the M/As

7. Design and construct the AHQs

In summary, if we were just starting to locate and design AHQs, we should

1. Let response/travel time determine the general area where AHQs would be built.

2. Let the number and size of the M/As assigned determine the physical size of the AHQs

3. Let the environmental and socio-economic concerns, combined with 1 and 2, determine the exact site and design of the AHQs

If we were just starting to locate and design AHQs, the number of M/As in a residency determines only the size of the AHQ. The number of A/S needed determines the number of M/As needed.

We are not just starting out. We must use existing AHQs for M/As. How does that fact change the connection between AHQs and M/As?

If the number of M/As determine only the size of the facilities needed, then knowing the number of M/As determines the total size needed. This size can be spread over the existing AHQs. The effect will be:

If lots are too small to accommodate the full M/A, this will determine the number of AHQs and subareas needed. Response/travel time may dictate a subarea even if the AHQ lot has the capacity for the M/A. If a subarea is not available, the M/A should be downsized.

If the lot is large enough to accommodate more than one M/A, this will determine the number of M/A assigned to the AHQ. Response/travel time may dictate a subarea even if the AHQ lot has the capacity for the M/A. If a subarea is not available, the M/A should be downsized.

What's the conclusion?

A/S workload determines the number of M/A needed. The number of the M/A and their service needs determines the physical size and facilities needed. The physical size and facilities needed determine the number of AHQs, subareas, and storage lots needed. The number needed will be different between a new start condition and the current condition, but the way A/S and M/As influence the number of AHQs remains the same.

3. *The Transportation Planning Division (TPD) bases their estimates for VMT in future years on growth of traffic over the last three available years data.* For the Secondary System, they collect traffic counts for arterial and collector routes and assume the count on local secondaries remains at the same level as the last previous count. In some cases the last previous count is 1986. While this method would seem to produce an estimate that is lower than the actual volume, the figures they produce are higher than those produced when population growth is used as an indicator. The TPD estimates are used by VDOT to develop plans for future transportation needs and appear to be the most reliable information available.

4. *Contact was made with both Wise Residency (Dickenson County) and Ashland Residency (Hanover County)*. Responses were as follows:

Dickenson County: On 5/1/95, I spoke to Leland Branham, RE at Wise Residency, concerning the Fremont AHQs in Dickenson County. He said the AHQ has responsibility for all the VDOT roads in Dickenson County and is under the administration of one superintendent. The area has a MEL of 34 and he has two maintenance supervisors to assist him.

This area was changed in 1991 from two maintenance areas on the same lot, each with a superintendent, to a single maintenance area under one superintendent. All the operators are distributed evenly between the maintenance supervisors and the county is split geographically between the two supervisors. Leland feels this is a better arrangement than existed prior to 1991, since a single person, on site, is now responsible for the lot, the county's roads and the people working at the AHQ, instead of having this responsibility split as it was in the past. He feels the superintendent is able to handle the workload, in road miles, and the people under this arrangement. He considers the two factors of 1) adequate supervisory help (the maintenance supervisors) and 2) having all the area personnel at one location, essential to the success of this operation.

In Wise County, the other county in his residency, he has three AHQs, each with a superintendent. Their work force varies from 12 to 20 people each. Access from one side of Wise to the other passes through Norton, which slows traffic and acts as a bottleneck. Also the AHQs lots are small and cannot be expanded to accommodate more people and equipment. Leland feels splitting an AHQ between two locations, with one becoming a subarea, would be difficult to administer.

Hanover/Goochland: On 5/1/95, I spoke to Miles Pierce, MOM at Ashland. He says that Sandy Hook AHQ in Goochland maintains 46 road miles in Hanover County. The distribution of road miles, lane miles and manpower among the three AHQs in Ashland are as follows:

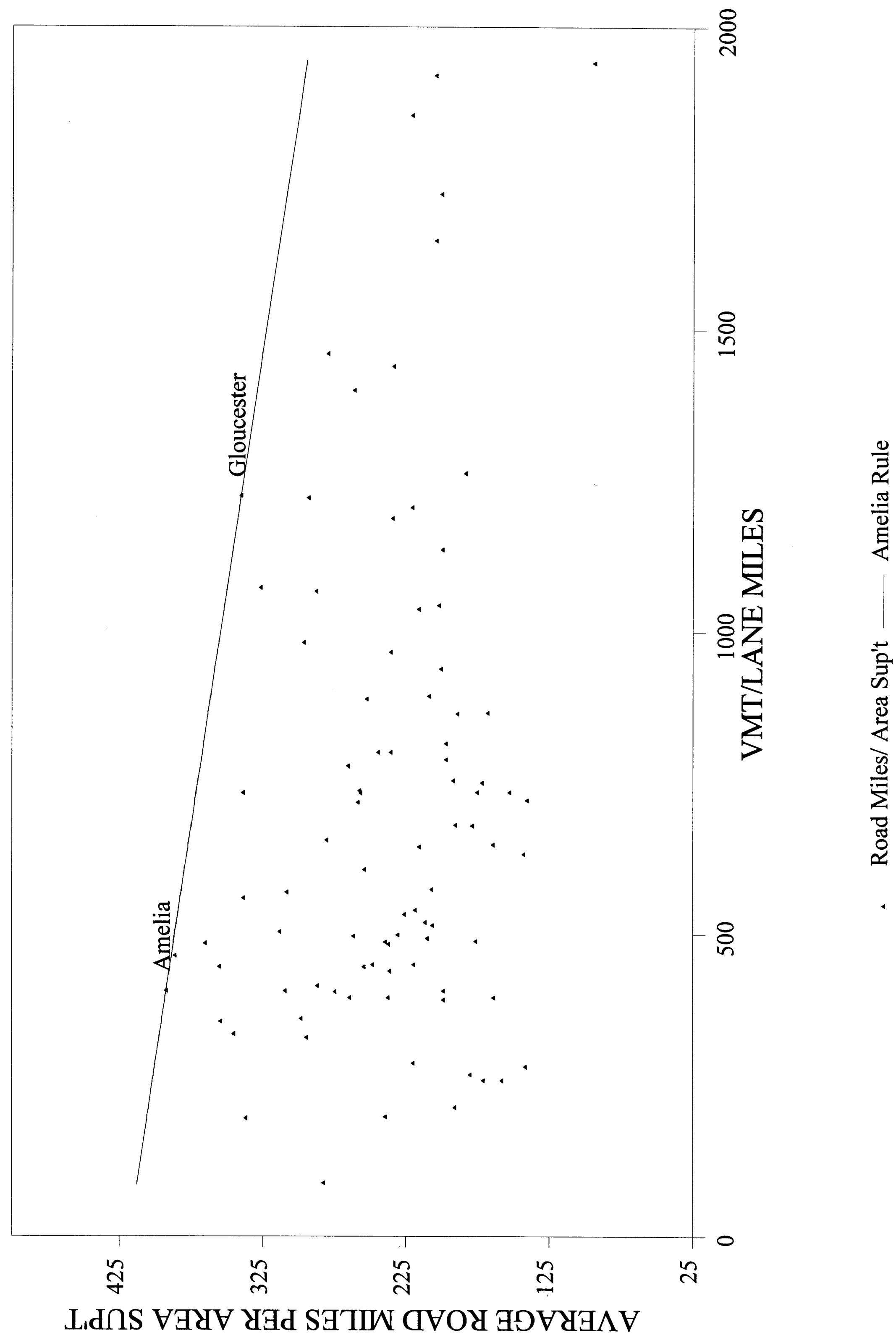
AHQ	Road Miles	Lane Miles	MEL
Sandy Hook	433.16	961.6	29
East Hanover	335.16	796.82	30
West Hanover	426.86	960.94	31

The road miles and lane miles for Sandy Hook and West Hanover exceed the averages per

AHQ attributed to Hanover County in the AHQ Study (418.60 RM, 933 LM). East Hanover operates with all personnel reporting to a single location. Goochland and West Hanover have their personnel split between the main AHQ and a subarea located some distance from the superintendent. The level of service (LOS) at East Hanover is acceptable most of the time. The LOS at West Hanover and Goochland fails to meet standard more often. Miles indicates that it is more challenging to maintain the areas and administer the people when the personnel is split between the headquarters and the subarea. He attributes the differences in LOS between East Hanover and the other two areas to this situation.

1989 SUPERINTENDENT WORKLOAD

AVERAGE ROAD MILES BY COUNTY

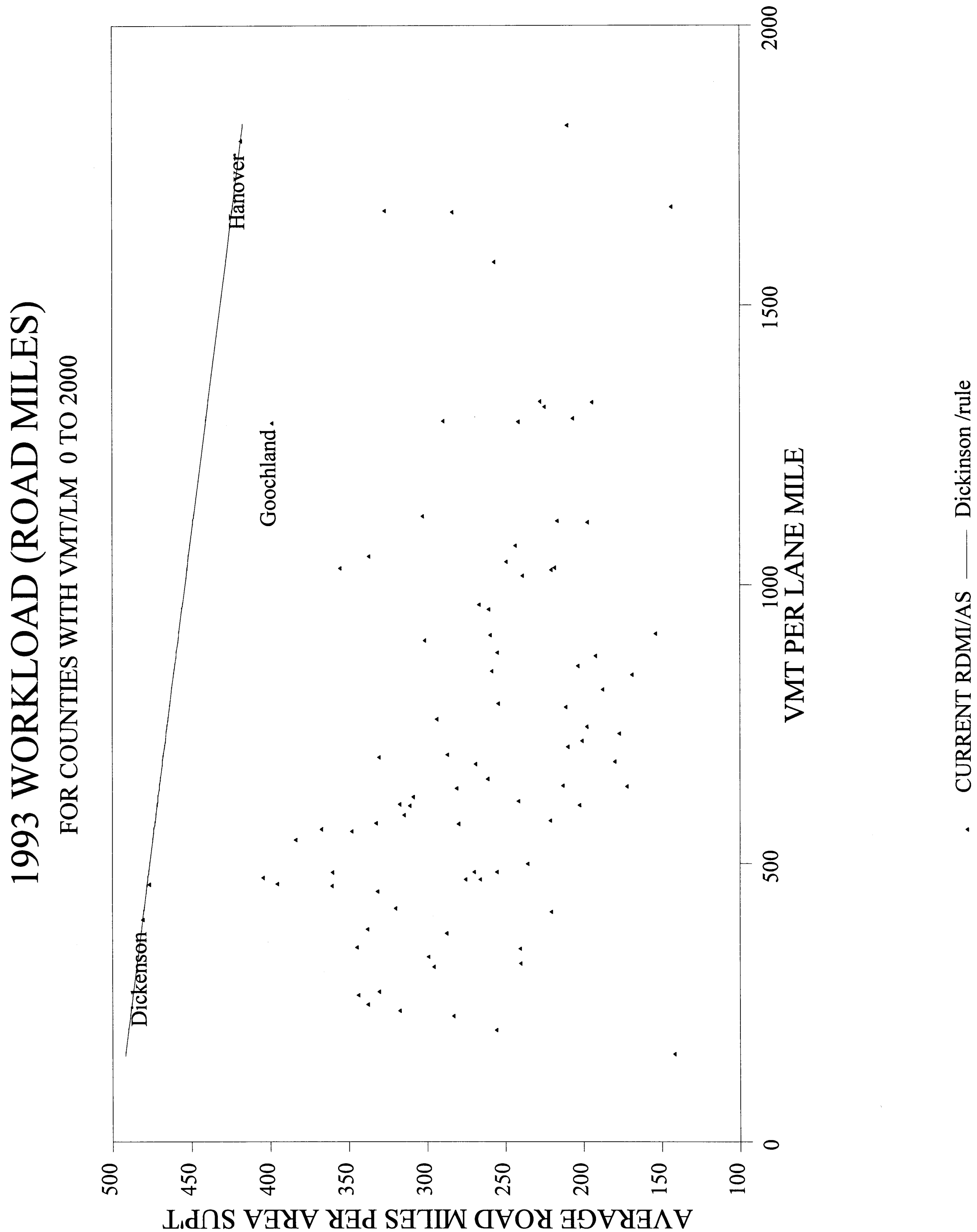


COUNTY DATA FOR 1993

	YEAR 1993 ROAD MILES	YEAR 1993 AREA SUP'T	ROAD MILES PER SUP'T	VMT TOTAL (TPD EST FOR SEC)	YEAR 1993 LANE MILES	UTILIZATIO VMT PER LANE MILE
Accomac County	662	2	330.82	968,311	1,403	690.19
Albemarle County	966	4	241.51	2,693,446	2,085	1292.11
Alleghany County	396	2	197.80	656,385	880	746.24
Amelia County	396	1	395.62	383,957	827	464.34
Amherst County	636	2	317.75	798,597	1,318	605.70
Appomattox County	477	1	476.80	457,740	989	462.76
Arlington County	53	1	53.29	2,773,730	244	11367.75
Augusta County	1,196	5	239.13	2,569,102	2,528	1016.41
Bath County	318	1	317.88	150,336	636	236.47
Bedford County	1,076	4	268.92	1,506,436	2,220	678.43
Bland County	308	2	153.95	599,542	657	911.99
Botetourt County	650	3	216.73	1,604,243	1,438	1115.31
Brunswick County	697	2	348.36	841,578	1,509	557.88
Buchanan County	532	3	177.33	807,980	1,101	733.95
Buckingham County	662	2	330.81	360,559	1,329	271.21
Campbell County	770	4	192.47	1,430,274	1,640	872.17
Caroline County	579	2	289.69	1,704,176	1,317	1294.31
Carroll County	945	3	314.91	1,155,161	1,968	586.94
Charles City County	180	1	180.05	245,942	360	682.98
Charlotte County	592	2	295.80	388,107	1,232	315.08
City of Chesapeake	47	1	46.71	1,299,550	205	6330.62
Chesterfield County	1,448	5	289.52	7,994,485	3,251	2458.75
City of Suffolk	620	3	206.79	1,771,299	1,364	1298.81
Clarke County	259	1	258.90	485,056	574	845.46
Craig County	240	1	240.22	154,675	480	321.94
Culpeper County	523	2	261.39	710,507	1,089	652.59
Cumberland County	344	1	344.30	183,396	694	264.37
Dickenson County	481	1	481.16	386,126	966	399.89
Dinwiddie County	662	3	220.57	1,484,943	1,445	1027.66
Essex County	309	1	309.02	431,794	697	619.41
Fairfax County	2,580	10	258.05	23,042,439	5,960	3866.04
Fauquier County	909	3	303.04	2,215,791	1,972	1123.54
Floyd County	676	2	338.01	334,778	1,352	247.61
Fluvanna County	338	1	338.48	259,378	677	383.15
Franklin County	1,120	4	279.93	1,312,913	2,297	571.56
Frederick County	684	3	227.83	2,030,523	1,528	1328.89
Giles County	405	2	202.71	538,828	891	604.46
Gloucester County	356	1	355.75	803,729	780	1029.97
Goochland County	399	1	399.00	1,116,646	865	1290.70
Grayson County	768	3	255.91	310,780	1,540	201.76
Greene County	210	1	210.22	310,214	437	709.73
Greensville County	337	1	337.43	777,478	740	1050.79
Halifax County	996	3	331.93	950,965	2,108	451.14
Hanover County	837	2	418.60	3,351,151	1,867	1795.35
Henrico County	188	4	46.95	4,567,847	777	5875.65
Henry County	782	3	260.59	1,605,707	1,679	956.31
Highland County	284	2	142.21	89,993	569	158.21
Isle of Wight County	509	2	254.40	848,430	1,077	787.51
James City County	288	2	143.96	1,082,434	645	1677.67
King & Queen County	345	1	345.11	253,773	723	350.99
King George County	244	1	243.52	569,977	532	1070.98
King William County	311	1	311.32	386,728	640	604.23

COUNTY DATA FOR 1993

	YEAR 1993 ROAD MILES	YEAR 1993 AREA SUP'T	ROAD MILES PER SUP'T	VMT TOTAL (TPD EST FOR SEC)	YEAR 1993 LANE MILES	UTILIZATIO VMT PER LANE MILE
Lancaster County	266	1	266.25	256,941	544	472.39
Lee County	662	3	220.80	556,534	1,345	413.85
Loudoun County	900	4	225.02	2,541,520	1,926	1319.29
Louisa County	634	3	211.33	1,017,632	1,302	781.53
Lunenburg County	567	2	283.39	257,279	1,134	226.81
Madison County	368	1	367.71	431,748	769	561.66
Mathews County	172	1	172.48	220,599	345	639.16
Mecklenburg County	886	4	221.44	1,068,347	1,853	576.62
Middlesex County	204	1	203.70	375,550	439	855.16
Montgomery County	514	2	257.25	1,817,272	1,152	1577.86
Nelson County	575	2	287.72	448,074	1,194	375.34
New Kent County	284	1	283.88	1,101,485	660	1668.03
City of Norfolk	26	1	25.79	2,557,820	150	17064.65
Northampton County	281	1	281.40	398,249	627	635.43
Northumberland County	361	1	361.05	339,846	739	459.84
Nottoway County	384	1	384.27	449,516	829	542.55
Orange County	427	2	213.35	560,629	877	639.51
Page County	361	1	360.75	366,804	758	483.75
Patrick County	722	3	240.63	502,473	1,444	348.03
Pittsylvania County	1,602	5	320.35	1,397,392	3,326	420.09
Powhatan County	294	1	293.80	464,863	612	759.26
Prince Edward County	472	2	235.96	512,676	1,027	499.40
Prince George County	389	2	194.52	1,183,677	892	1327.33
Prince William County	881	5	176.15	5,481,405	1,986	2760.51
Pulaski County	437	2	218.48	977,841	949	1030.83
Rappahannock County	276	1	275.55	279,852	593	472.29
Richmond County	242	1	241.54	312,852	511	612.71
Roanoke County	631	3	210.41	2,535,168	1,390	1823.86
Rockbridge County	780	3	259.86	1,543,213	1,697	909.59
Rockingham County	1,068	4	266.96	2,187,559	2,267	964.94
Russell County	666	2	332.77	795,631	1,391	571.82
Scott County	810	3	270.13	812,543	1,674	485.31
Shenandoah County	765	3	255.07	1,426,346	1,624	878.21
Smyth County	563	3	187.70	957,282	1,178	812.82
Southampton County	767	3	255.58	775,863	1,599	485.16
Spotsylvania County	654	2	327.14	2,396,060	1,434	1670.43
Stafford County	473	2	236.55	2,550,125	1,089	2341.09
Surry County	299	1	299.40	200,062	599	333.93
Sussex County	574	2	286.99	854,761	1,228	696.00
Tazewell County	603	3	201.07	932,681	1,295	720.27
Virginia Beach	24	1	23.91	1,653,500	131	12664.68
Warren County	249	1	249.35	569,423	546	1041.96
Washington County	904	3	301.45	1,716,238	1,906	900.43
Westmoreland County	405	1	404.88	384,051	809	474.93
Wise County	507	3	169.07	928,662	1,107	838.70
Wythe County	593	3	197.59	1,442,493	1,297	1112.42
York County	337	1	337.37	4,047,572	851	4755.75
AVERAGE			263.73			1280.21
TOTAL	55,446	220		138,346,044	119,197	


1993 WORKLOAD (ROAD MILES)
FOR COUNTIES WITH VMT/LM 0 TO 2000
Dickenson
Hanover
Goochland
AVERAGE ROAD MILES PER AREA SUP'T
500
450
400
350
300
250
200
150
100
0
500
1000
1500
2000
VMT PER LANE MILE
CURRENT RDMI/AS
Dickinson /rule

THE NUMBER OF AREA SUPERINTENDENTS IN 1993 AS RECOMMENDED BY THE DICKENSON RULE

	YEAR 1993 ROAD MILES	YEAR 1993 AREA SUP'T	ROAD MILES PER SUP'T	VMT TOTAL (TPD EST FOR SEC)	YEAR 1993 LANE MILES	UTILIZATIO VMT PER LANE MILE	ROAD MILES PER SUP'T BASED ON RULE	NUMBER OF SUP'T BASED ON RULE	NUMBER OF SUP'T ROUNDED TO AN INTEGER	RECOMMEND NUMBER - EXISTING NUMBER	WORKLOAD IMPLIED BY HYPOTHETIC "RULE"	CHANGE IN WORKLOAD IMPLIED BY "RULE"
ABINGDON	1,467	6	245	2,673,520	3,084	867	460	3.2	3	-3	489	245
ACCOMAC	943	3	314	1,366,560	2,030	673	469	2.0	2	-1	472	157
AMELIA	1,347	4	337	1,090,752	2,790	391	482	2.8	3	-1	449	112
AMHERST	1,211	4	303	1,246,671	2,512	496	477	2.5	3	-1	404	101
APPOMATTOX	1,247	5	249	1,888,014	2,629	718	467	2.7	3	-2	416	166
ASHLAND	1,236	3	412	4,467,797	2,732	1,636	426	2.9	3	0	412	0
BEDFORD	1,076	4	269	1,506,436	2,220	678	469	2.3	3	-1	359	90
BOWLING GREEN	1,200	4	300	2,522,698	2,654	951	456	2.6	3	-1	400	100
CHARLOTTESVILLE	1,176	5	235	3,003,660	2,522	1,191	446	2.6	3	-2	392	157
CHATHAM	1,602	5	320	1,397,392	3,326	420	480	3.3	4	-1	400	80
CHESTERFIELD	1,741	6	290	8,459,348	3,864	2,189	401	4.3	5	-1	348	58
CHRISTIANSBURG	1,357	6	226	3,333,941	2,992	1,114	449	3.0	3	-3	452	226
CULPEPER	1,317	5	263	1,702,884	2,734	623	471	2.8	3	-2	439	176
DILLWYN	1,478	5	296	1,056,631	3,050	346	484	3.1	3	-2	493	197
EDINBURG	1,449	6	241	3,456,869	3,152	1,097	450	3.2	3	-3	483	241
FAIRFAX	2,634	11	239	25,816,169	6,204	4,161	313	8.4	9	-2	293	53
FRANKLIN	1,104	4	276	1,553,341	2,339	664	469	2.4	3	-1	368	92
FREDERICKSBURG	1,371	5	274	5,516,162	3,056	1,805	418	3.3	4	-1	343	69
HALIFAX	1,587	5	317	1,339,072	3,340	401	481	3.3	4	-1	397	79
HARRISONBURG	1,068	4	267	2,187,559	2,267	965	456	2.3	3	-1	356	89
HILLSVILLE	1,621	5	324	1,489,939	3,320	449	479	3.4	4	-1	405	81
JONESVILLE	1,473	6	245	1,369,077	3,019	453	479	3.1	3	-3	491	245
LEBENON	1,198	5	240	1,603,611	2,492	643	470	2.5	3	-2	399	160
LEESBURG	900	4	225	2,541,520	1,926	1,319	440	2.0	2	-2	450	225
LEXINGTON	1,493	6	249	2,349,934	3,212	732	466	3.2	3	-3	498	249
LOUISA	972	4	243	1,277,010	1,979	645	470	2.1	2	-2	486	243
LURAY	869	3	290	1,421,283	1,878	757	465	1.9	2	-1	435	145
MANASSAS	881	5	176	5,481,405	1,986	2,761	375	2.3	3	-2	294	117
MARTINSVILLE	1,504	6	251	2,108,180	3,123	675	469	3.2	3	-3	501	251
NORFOLK	96	3	32	5,510,870	486	11,346	100	1.0	1	-2	96	64
PETERSBURG	1,051	5	210	2,668,620	2,337	1,142	448	2.3	3	-2	350	140
ROCKY MOUNT	1,120	4	280	1,312,913	2,297	572	473	2.4	3	-1	373	93
SALEM	1,522	7	217	4,294,086	3,309	1,298	441	3.5	4	-3	380	163
SALUDA	1,077	4	269	1,653,651	2,288	723	467	2.3	3	-1	359	90
SANDSTON	652	6	109	5,915,274	1,798	3,290	352	1.9	2	-4	326	217
SOUTH HILL	1,582	6	264	1,909,925	3,361	568	474	3.3	4	-2	396	132
SUFFOLK	1,129	5	226	2,619,729	2,441	1,073	451	2.5	3	-2	376	151
TAZEWELL	911	5	182	1,532,223	1,952	785	464	2.0	2	-3	456	273
VERONA	1,480	7	211	2,659,095	3,096	859	461	3.2	3	-4	493	282
WARRENTON	1,185	4	296	2,495,643	2,565	973	455	2.6	3	-1	395	99
WARSAW	1,274	4	318	1,293,690	2,602	497	477	2.7	3	-1	425	106
WAVERLY	873	3	291	1,054,823	1,827	577	473	1.8	2	-1	437	146
WILLIAMSBURG	625	3	208	5,130,006	1,496	3,428	345	1.8	2	-1	313	104
WISE	988	4	247	1,314,788	2,073	634	471	2.1	2	-2	494	247
WYTHEVILLE	1,361	6	227	1,753,273	2,837	618	471	2.9	3	-3	454	227
TOTAL	55,446	220		138,346,044	119,197			125.1	138	-82		
AVERAGE			252			1,161					402	150

* The number based on the Rule is rounded up if .3 or greater and rounded down if .2 or less

Attachment E

ESTIMATE OF YEAR 2000 LANE MILES, BY COUNTY

	INTERST LANE MILES 1989	PRIMARY LANE MILES 1989	SECONDAR LANE MILES 1989	FRONTA LANE MILES 1989	TOTAL LANE MILES 1989	TOTAL LANE MILES 1993	RATE OF CHANGE	EST LANE MILES 2000	USE LANE MILES 2000
Pittsylvania County		431.73	2862.14	9.72	3303.59	3326.45	0.00171805	3,366.46	3366.46
Powhatan County		124.38	472.48		596.86	612.26	0.00628818	639.21	639.21
Prince Edward County		224.90	809.02	5.84	1039.76	1026.58	-0.00320969	1,003.51	1026.58
Prince George County	66.88	189.70	536.17	21.74	814.49	891.77	0.02166478	1,027.01	1027.01
Prince William County	128.76	232.06	1498.80	9.94	1869.56	1985.65	0.01461612	2,188.81	2188.81
Pulaski County	70.16	106.80	717.04	42.80	936.80	948.60	0.00310985	969.25	969.25
Rappahannock County		151.79	435.82	0.40	588.01	592.54	0.00191126	600.47	600.47
Richmond County		94.18	412.88	0.18	507.24	510.60	0.00164512	516.48	516.48
Roanoke County	106.77	196.12	1033.22	14.00	1350.11	1390.00	0.00717446	1,459.81	1459.81
Rockbridge Co(+Cl For)	191.88	280.51	1211.90	12.40	1696.69	1696.61	-0.00001179	1,696.47	1696.61
Rockingham County	108.40	389.85	1734.20	8.68	2241.13	2267.03	0.00285616	2,312.36	2312.36
Russell County		285.62	1136.11		1421.73	1391.39	-0.00545138	1,338.30	1391.39
Scott County		271.32	1373.92	6.90	1652.14	1674.28	0.00330590	1,713.03	1713.03
Shenandoah Co(+ Wood	138.72	213.25	1285.64	3.82	1641.43	1624.15	-0.00265985	1,593.91	1624.15
Smyth County(+ Marion)	93.44	181.25	888.96	10.94	1174.59	1177.73	0.00066654	1,183.23	1183.23
Southampton County		235.25	1339.08	2.42	1576.75	1599.19	0.00350803	1,638.46	1638.46
Spotsylvania County	93.42	193.77	1010.90	16.04	1314.13	1434.40	0.02096173	1,644.87	1644.87
Stafford County	95.53	163.78	767.92	2.00	1029.23	1089.29	0.01378421	1,194.40	1194.40
Suffolk		337.60	975.66	5.74	1319.00	1363.79	0.00821057	1,442.17	1442.17
Surry County		97.64	500.74		598.38	599.12	0.00030879	600.42	600.42
Sussex County	70.40	220.87	912.60	21.76	1225.63	1228.11	0.00050484	1,232.45	1232.45
Tazewell County		351.46	919.70	1.82	1272.98	1294.90	0.00423199	1,333.26	1333.26
Virginia Beach	11.72	101.78	0.00		113.50	130.56	0.03266697	160.42	130.56
Warren County	58.64	87.01	390.56	3.92	540.13	546.49	0.00290948	557.62	557.62
Washington County	143.48	257.97	1473.38	26.16	1900.99	1906.03	0.00066106	1,914.85	1914.85
Westmoreland County		135.32	663.36		798.68	808.65	0.00308230	826.10	826.10
Wise County		310.88	784.28	2.30	1097.46	1107.26	0.00221267	1,124.41	1124.41
Wythe Co (+ Wytheville)	198.98	149.81	911.37	56.86	1317.02	1296.72	-0.00391372	1,261.20	1296.72
York County	196.55	138.53	446.36	18.78	800.22	851.16	0.01496193	940.31	940.31
TOTAL	4876.15	20528.45	90835.55	657.44	116897.59	119197.22	0.00482316	123,222	123198.96

ESTIMATE OF YEAR 2000 LANE MILES, BY COUNTY

	INTERST LANE MILES 1989	PRIMARY LANE MILES 1989	SECONDAR LANE MILES 1989	FRONTA LANE MILES 1989	TOTAL LANE MILES 1989	TOTAL LANE MILES 1993	RATE OF CHANGE	EST LANE MILES 2000	USE LANE MILES 2000
Giles County		226.69	653.40	0.78	880.87	891.42	0.00295876	909.88	909.88
Gloucester County		180.32	571.16	1.78	753.26	780.34	0.00867571	827.73	827.73
Goochland County	111.96	161.41	558.44	15.86	847.67	865.15	0.00505115	895.74	895.74
Grayson County		222.09	1312.88	1.44	1536.41	1540.35	0.00063947	1,547.24	1547.24
Greene County		70.93	360.26	0.80	431.99	437.09	0.00291702	446.01	446.01
Greensville County	68.56	80.51	569.76	19.52	738.35	739.90	0.00052372	742.61	742.61
Halifax County		396.58	1693.70	0.12	2090.40	2107.90	0.00207553	2,138.53	2138.53
Hanover County	202.04	241.68	1368.58	6.62	1818.92	1866.57	0.00638203	1,949.96	1949.96
Henrico County	287.35	347.43	0.00	18.56	653.34	777.42	0.03990121	994.56	777.42
Henry County		292.89	1317.70	3.06	1613.65	1679.06	0.00973908	1,793.53	1793.53
Highland County		142.40	426.46		568.86	568.82	-0.00001758	568.75	568.82
Isle of Wight		223.27	822.68	9.00	1054.95	1077.36	0.00520021	1,116.58	1116.58
James City County	34.80	158.70	410.37	7.02	610.89	645.20	0.01329433	705.24	705.24
King & Queen County		132.30	587.20		719.50	723.02	0.00121712	729.18	729.18
King George County		189.98	321.78	0.18	511.94	532.20	0.00951710	567.66	567.66
King William County		111.50	526.46		637.96	640.03	0.00080856	643.65	643.65
Lancaster County		119.18	410.18	1.06	530.42	543.92	0.00620496	567.55	567.55
Lee County		226.67	1102.14		1328.81	1344.78	0.00296889	1,372.73	1372.73
Loudoun County		319.73	1508.26	3.86	1831.85	1926.43	0.01227400	2,091.95	2091.95
Louisa County	66.20	240.23	971.38	9.70	1287.51	1302.11	0.00280314	1,327.66	1327.66
Lunenburg County		127.14	1006.36	0.32	1133.82	1134.32	0.00011020	1,135.20	1135.20
Madison County		158.96	607.02	0.96	766.94	768.70	0.00057239	771.78	771.78
Mathews County		67.65	277.05		344.70	345.14	0.00031871	345.91	345.91
Mecklenburg Co(+S.Hill)	78.08	352.62	1415.48	5.36	1851.54	1852.76	0.00016462	1,854.90	1854.90
Middlesex County		125.48	307.56	0.38	433.42	439.16	0.00326760	449.21	449.21
Montgomery Co(+ Christi	107.53	183.38	827.68	9.32	1127.91	1151.73	0.00517048	1,193.42	1193.42
Nelson County		260.52	931.36	0.20	1192.08	1193.78	0.00035601	1,196.76	1196.76
New Kent County	80.28	187.88	384.85	1.60	654.61	660.35	0.00217309	670.40	670.40
Norfolk	123.17	0.00	0.00	14.32	137.49	149.89	0.02068183	171.59	171.59
Northampton County		160.10	461.60	1.40	623.10	626.74	0.00145196	633.11	633.11
Northumberland County		99.68	620.90		720.58	739.06	0.00625118	771.40	771.40
Nottoway County		225.61	609.94	4.42	839.97	828.53	-0.00345190	808.51	828.53
Orange County		203.91	698.54		902.45	876.65	-0.00735755	831.50	831.50
Page County		140.56	605.14	0.72	746.42	758.25	0.00390043	778.95	778.95
Patrick County		191.36	1253.04		1444.40	1443.76	-0.00011082	1,442.64	1443.76

Attachment E

ESTIMATE OF YEAR 2000 LANE MILES, BY COUNTY

	INTERST LANE MILES 1989	PRIMARY LANE MILES 1989	SECONDAR LANE MILES 1989	FRONTA LANE MILES 1989	TOTAL LANE MILES 1989	TOTAL LANE MILES 1993	RATE OF CHANGE	EST LANE MILES 2000	USE LANE MILES 2000
Accomack County		289.42	1147.20		1436.62	1402.96	-0.00599803	1,344.06	1402.96
Albemarle County	124.80	367.47	1529.10	7.30	2028.67	2084.54	0.00670052	2,182.31	2182.31
Alleghany County	163.96	155.70	533.14	23.50	876.30	879.59	0.00093509	885.35	885.35
Amelia County		114.52	707.94	1.08	823.54	826.88	0.00100982	832.72	832.72
Amherst County		229.63	1080.58	2.60	1312.81	1318.47	0.00107321	1,328.38	1328.38
Appomattox County		138.28	849.02		987.30	989.16	0.00047010	992.42	992.42
Arlington County	67.58	161.71	0.00	8.36	237.65	244.00	0.00650615	255.11	255.11
Augusta County	177.76	361.06	1930.04	12.48	2481.34	2527.63	0.00457840	2,608.64	2608.64
Bath County		149.60	484.98		634.58	635.76	0.00046401	637.83	637.83
Bedford County		372.09	1811.34	0.56	2183.99	2220.46	0.00410613	2,284.28	2284.28
Bland County	81.56	156.46	415.56	4.22	657.80	657.40	-0.00015211	656.70	657.40
Botetourt County	107.44	251.40	1031.40	28.56	1418.80	1438.38	0.00340313	1,472.65	1472.65
Brunswick County	83.08	249.43	1169.96	3.76	1506.23	1508.52	0.00037951	1,512.53	1512.53
Buchanan County		183.23	908.16		1091.39	1100.87	0.00215284	1,117.46	1117.46
Buckingham County		199.76	1129.86	0.12	1329.74	1329.44	-0.00005641	1,328.92	1329.44
Campbell County		320.72	1287.14	9.38	1617.24	1639.90	0.00345448	1,679.56	1679.56
Caroline County	93.24	275.62	929.77	4.00	1302.63	1316.67	0.00266582	1,341.24	1341.24
Carroll County	103.58	207.21	1647.66		1958.45	1968.11	0.00122707	1,985.01	1985.01
Charles City County		90.00	267.82		357.82	360.10	0.00158289	364.09	364.09
Charlotte County		275.28	952.38	1.92	1229.58	1231.78	0.00044651	1,235.63	1235.63
Chesapeake	105.87	61.81	0.00		167.68	205.28	0.04579111	271.08	271.08
Chesterfield County	163.91	437.51	2339.47	3.06	2943.95	3251.44	0.02364260	3,789.55	3789.55
Clarke County		149.40	420.10	4.04	573.54	573.72	0.00007844	574.04	574.04
Craig County		119.32	360.42		479.74	480.44	0.00036425	481.67	481.67
Culpeper County		190.97	870.64	5.20	1066.81	1088.75	0.00503789	1,127.15	1127.15
Cumberland County		106.48	585.14		691.62	693.72	0.00075679	697.40	697.40
Dickenson County		159.40	789.16		948.56	965.57	0.00440413	995.34	995.34
Dinwiddie County	118.28	249.20	1060.66	7.08	1435.22	1444.97	0.00168689	1,462.03	1462.03
Essex County		157.02	530.14		687.16	697.11	0.00356830	714.52	714.52
Fairfax Co (+ Vienna)	361.15	551.01	4628.22	51.98	5592.36	5960.21	0.01542941	6,603.95	6603.95
Fauquier County	87.72	316.54	1531.20	24.96	1960.42	1972.16	0.00148822	1,992.71	1992.71
Floyd County		109.60	1240.84		1350.44	1352.02	0.00029216	1,354.79	1354.79
Fluvanna County		102.28	575.24		677.52	676.96	-0.00020681	675.98	676.96
Franklin County		245.83	2013.59	3.86	2263.28	2297.06	0.00367644	2,356.18	2356.18
Frederick County	102.52	299.02	1074.16	5.90	1481.60	1527.99	0.00759004	1,609.17	1609.17

ESTIMATE OF YEAR 2000 ROAD MILES, BY COUNTY

	INTERST ROAD MILES 1989	PRIMARY ROAD MILES 1989	SECONDAR ROAD MILES 1989	FRONTA ROAD MILES 1989	TOTAL ROAD MILES 1989	TOTAL ROAD MILES 1993	RATE OF CHANGE	EST ROAD MILES 2000	USE ROAD MILES 2000
Pittsylvania County		157.98	1,431.07	4.86	1593.91	1,601.76	0.00122521	1,615.50	1,615.50
Powhatan County		49.97	236.13		286.10	293.80	0.00655208	307.28	307.28
Prince Edward County		70.06	404.51	2.92	477.49	471.91	-0.00295607	462.15	471.91
Prince George County	25.62	76.59	267.14	10.87	380.22	389.04	0.00566780	404.48	404.48
Prince William County	25.58	88.92	714.12	4.97	833.59	880.75	0.01338632	963.28	963.28
Pulaski County	17.54	34.26	358.52	21.40	431.72	436.96	0.00299799	446.13	446.13
Rappahannock County		57.44	217.91	0.20	275.55	275.55	0.00000000	275.55	275.55
Richmond County		33.33	206.44	0.09	239.86	241.54	0.00173884	244.48	244.48
Roanoke County	23.61	67.12	515.67	7.00	613.40	631.22	0.00705776	662.41	662.41
Rockbridge Co(+Cl For)	47.97	116.69	605.95	6.20	776.81	779.59	0.00089149	784.46	784.46
Rockingham County	27.10	162.89	867.10	4.34	1061.43	1,067.82	0.00149604	1,079.00	1,079.00
Russell County		112.08	566.48		678.56	665.53	-0.00489460	642.73	665.53
Scott County		110.83	686.64	3.45	800.92	810.40	0.00292448	826.99	826.99
Shenandoah Co(+ Wood	35.11	94.01	642.82	1.91	773.85	765.21	-0.00282275	750.09	765.21
Smyth County(+ Marion)	23.36	88.54	443.30	5.47	560.67	563.11	0.00108327	567.38	567.38
Southampton County		95.31	669.36	1.21	765.88	766.74	0.00028041	768.25	768.25
Spotsylvania County	15.57	67.23	505.13	8.02	595.95	654.28	0.02228786	756.36	756.36
Stafford County	15.74	44.66	382.30	1.00	443.70	473.09	0.01553087	524.52	524.52
Suffolk	5.63	119.27	487.52	2.87	615.29	620.37	0.00204717	629.26	629.26
Surry County		48.68	250.37		299.05	299.40	0.00029225	300.01	300.01
Sussex County	17.51	88.04	456.30	10.88	572.73	573.97	0.00054010	576.14	576.14
Tazewell County		131.53	460.10	0.91	592.54	603.21	0.00442217	621.88	621.88
Virginia Beach	2.92	12.19	0.00		15.11	23.91	0.09201171	39.31	39.31
Warren County	14.66	35.49	195.28	1.96	247.39	249.35	0.00196511	252.78	252.78
Washington County	35.97	114.48	735.69	13.08	899.22	904.36	0.00142089	913.36	913.36
Westmoreland County		66.99	331.78		398.77	404.88	0.00377272	415.57	415.57
Wise County		110.57	394.14	1.36	506.07	507.22	0.00056682	509.23	509.23
Wythe Co (+ Wytheville)	45.64	72.33	455.71	28.43	602.11	592.78	-0.00393485	576.45	592.78
York County	47.60	44.24	222.32	9.39	323.55	337.37	0.01024098	361.56	361.56
TOTAL	1,105.95	7,945.32	45,250.00	329.02	54301.27	55,446.37	0.00516310		57,016

ESTIMATE OF YEAR 2000 ROAD MILES, BY COUNTY

	INTERST ROAD MILES 1989	PRIMARY ROAD MILES 1989	SECONDAR ROAD MILES 1989	FRONTA ROAD MILES 1989	TOTAL ROAD MILES 1989	TOTAL ROAD MILES 1993	RATE OF CHANGE	EST ROAD MILES 2000	USE ROAD MILES 2000
Giles County		75.67	326.39	0.39	402.45	405.42	0.00183143	410.62	410.62
Gloucester County		55.74	285.58		341.32	355.75	0.01014055	381.00	381.00
Goochland County	27.99	75.12	279.22	7.93	390.26	399.00	0.00547619	414.29	414.29
Grayson County		108.32	656.44	0.72	765.48	767.73	0.00073268	771.67	771.67
Greene County		27.14	180.13	0.40	207.67	210.22	0.00303254	214.68	214.68
Greensville County	17.14	25.64	284.34	9.76	336.88	337.43	0.00040749	338.39	338.39
Halifax County		148.09	846.85	0.06	995.00	995.79	0.00019833	997.17	997.17
Hanover County	24.93	89.08	681.77	3.34	799.12	837.20	0.01137124	903.84	903.84
Henrico County	71.10	107.56	0.00	9.28	187.94	187.78	-0.00021302	187.50	187.78
Henry County		100.71	658.06	1.53	760.30	781.76	0.00686272	819.32	819.32
Highland County		71.20	213.23		284.43	284.41	-0.00001758	284.38	284.41
Isle of Wight		81.98	411.26	4.50	497.74	508.79	0.00542955	528.13	528.13
James City County	8.70	54.87	204.42	3.51	271.50	287.91	0.01424924	316.63	316.63
King & Queen County		51.99	293.60		345.59	345.11	-0.00034772	344.27	345.11
King George County		75.41	160.74	0.09	236.24	243.52	0.00747372	256.26	256.26
King William County		46.97	263.38		310.35	311.32	0.00077894	313.02	313.02
Lancaster County		57.27	205.09	0.53	262.89	266.25	0.00315493	272.13	272.13
Lee County		105.22	551.07		656.29	662.41	0.00230975	673.12	673.12
Loudoun County		122.78	744.62	1.93	869.33	900.08	0.00854091	953.89	953.89
Louisa County	16.55	119.49	485.80	4.85	626.69	633.99	0.00287859	646.77	646.77
Lunenburg County		63.19	503.18	0.16	566.53	566.78	0.00011027	567.22	567.22
Madison County		62.84	303.51	0.48	366.83	367.71	0.00059830	369.25	369.25
Mathews County		33.65	138.61		172.26	172.48	0.00031888	172.87	172.87
Mecklenburg Co(+S.Hill)	19.52	156.89	707.44	2.68	886.53	885.74	-0.00022298	884.36	885.74
Middlesex County		46.86	153.78	0.19	200.83	203.70	0.00352234	208.72	208.72
Montgomery Co(+ Christi	25.61	61.82	413.68	4.66	505.77	514.49	0.00423721	529.75	529.75
Nelson County		108.80	465.68	0.10	574.58	575.43	0.00036929	576.92	576.92
New Kent County	20.07	67.68	192.46	0.80	281.01	283.88	0.00252748	288.90	288.90
Norfolk	23.25	0.00	0.00	7.16	30.41	25.79	-0.04478480	17.71	25.79
Northampton County		48.76	229.72	0.70	279.18	281.40	0.00197228	285.28	285.28
Northumberland County		44.49	310.45		354.94	361.05	0.00423072	371.74	371.74
Nottoway County		82.46	304.97	2.21	389.64	384.27	-0.00349364	374.87	384.27
Orange County		88.60	349.27		437.87	426.70	-0.00654441	407.15	426.70
Page County		53.14	302.57	0.36	356.07	360.75	0.00324324	368.94	368.94
Patrick County		95.68	626.52		722.20	721.88	-0.00011082	721.32	721.88

Attachment E

ESTIMATE OF YEAR 2000 ROAD MILES, BY COUNTY

	INTERST ROAD MILES 1989	PRIMARY ROAD MILES 1989	SECONDAR ROAD MILES 1989	FRONTA ROAD MILES 1989	TOTAL ROAD MILES 1989	TOTAL ROAD MILES 1993	RATE OF CHANGE	EST ROAD MILES 2000	USE ROAD MILES 2000
Accomack County		104.98	573.60		678.58	661.64	-0.00640076	632.00	662.64
Albemarle County	31.20	146.52	761.21	3.71	942.64	966.02	0.00605060	1,006.93	1,006.93
Alleghany County	40.99	74.88	266.24	11.75	393.86	395.59	0.00109330	398.62	398.62
Amelia County		39.44	353.97	0.54	393.95	395.62	0.00105531	398.54	398.54
Amherst County		90.71	540.29	1.30	632.30	635.50	0.00125885	641.10	641.10
Appomattox County		51.14	424.51		475.65	476.80	0.00060298	478.81	478.81
Arlington County	10.96	38.15	0.00	4.18	53.29	53.29	0.00000000	53.29	53.29
Augusta County	44.29	161.45	964.32	6.24	1176.30	1,195.63	0.00404180	1,229.46	1,229.46
Bath County		74.80	242.49		317.29	317.88	0.00046401	318.91	318.91
Bedford County		152.80	905.80	0.28	1058.88	1,075.67	0.00390222	1,105.05	1,105.05
Bland County	20.39	77.66	207.78	2.11	307.94	307.90	-0.00003248	307.83	307.90
Botetourt County	26.86	84.73	515.91	14.28	641.78	650.20	0.00323747	664.94	664.94
Brunswick County	20.77	87.66	584.98	1.88	695.29	696.71	0.00050954	699.20	699.20
Buchanan County		73.14	454.08		527.22	531.99	0.00224158	540.34	540.34
Buckingham County		96.34	564.93	0.06	661.33	661.61	0.00010580	662.10	662.10
Campbell County		114.25	642.93	4.69	761.87	769.86	0.00259463	783.84	783.84
Caroline County	15.54	95.87	464.85	2.00	578.26	579.38	0.00048328	581.34	581.34
Carroll County	24.29	92.71	823.55		940.55	944.74	0.00110877	952.07	952.07
Charles City County		45.00	133.91		178.91	180.05	0.00158289	182.05	182.05
Charlotte County		113.44	476.19	0.96	590.59	591.59	0.00042259	593.34	593.34
Chesapeake	29.55	19.91	0.00		49.46	46.71	-0.01471848	41.90	46.71
Chesterfield County	21.55	122.24	1,160.20	1.53	1305.52	1,447.58	0.02453405	1,696.19	1,696.19
Clarke County		46.85	210.05	2.02	258.92	258.90	-0.00001931	258.86	258.90
Craig County		59.66	180.21		239.87	240.22	0.00036425	240.83	240.83
Culpeper County		74.08	435.32	2.60	512.00	522.78	0.00515513	541.65	541.65
Cumberland County		50.54	292.57		343.11	344.30	0.00086407	346.38	346.38
Dickenson County		79.70	393.93		473.63	481.16	0.00391242	494.34	494.34
Dinwiddie County	34.35	88.63	530.33	3.54	656.85	661.71	0.00183615	670.22	670.22
Essex County		43.55	265.10	0.89	309.54	309.02	-0.00042068	308.11	309.02
Fairfax Co (+ Vienna)	56.09	153.01	2,220.56	25.99	2455.65	2,580.46	0.01209184	2,798.88	2,798.88
Fauquier County	21.93	103.50	765.36	12.48	903.27	909.11	0.00160597	919.33	919.33
Floyd County		54.80	620.42		675.22	676.01	0.00029216	677.39	677.39
Fluvanna County		51.14	287.62		338.76	338.48	-0.00020681	337.99	338.48
Franklin County		94.82	1,006.08	1.93	1102.83	1,119.72	0.00377103	1,149.28	1,149.28
Frederick County	25.20	100.39	537.08	2.95	665.62	683.50	0.00653987	714.79	714.79

Attachment F

RECOMMENDED NUMBER OF AREA SUPERINTENDENTS IN THE YEAR 2000, BY RESIDENCY

	YEAR 2000 ROAD MILES	YEAR 1993 AREA SUP'T	ROAD MILES PER SUP'T	VMT TOTAL (TPD EST FOR 2000)	YEAR 2000 LANE MILES	UTILIZATIO VMT PER LANE MILE	ROAD MILES PER SUP'T BASED ON RULE	NUMBER OF SUP'T BASED ON RULE	NUMBER OF SUP'T ROUNDED TO INTEGER	RECOMMEND NUMBER - EXISTING NUMBER	WORKLOAD IMPLIED BY HYPOTHETIC "RULE"	CHANGE IN WORKLOAD IMPLIED BY "RULE"
ABINGDON	1,481	6	247	2,890,000	3,098	933	457	3.2	3	-3	494	247
ACCOMAC	948	3	316	1,488,000	2,036	731	466	2.0	2	-1	474	158
AMELIA	1,350	4	338	1,279,000	2,796	457	478	2.8	3	-1	450	113
AMHERST	1,218	4	305	1,455,000	2,525	576	473	2.6	3	-1	406	102
APPOMATTOX	1,263	5	253	2,306,000	2,672	863	460	2.7	3	-2	421	168
ASHLAND	1,318	3	439	4,574,000	2,846	1,607	427	3.1	3	0	439	0
BEDFORD	1,105	4	276	1,643,000	2,284	719	467	2.4	3	-1	368	92
BOWLING GREEN	1,203	4	301	2,537,000	2,699	940	457	2.6	3	-1	401	100
CHARLOTTESVILLE	1,222	5	244	3,595,000	2,628	1,368	438	2.8	3	-2	407	163
CHATHAM	1,615	5	323	1,761,000	3,366	523	476	3.4	4	-1	404	81
CHESTERFIELD	2,003	6	334	9,709,590	4,429	2,192	401	5.0	5	-1	401	67
CHRISTIANSBURG	1,386	6	231	3,263,000	3,073	1,062	451	3.1	3	-3	462	231
CULPEPER	1,338	5	268	1,996,000	2,730	731	466	2.9	3	-2	446	178
DILLWYN	1,480	5	296	1,228,000	3,053	402	481	3.1	3	-2	493	197
EDINBURG	1,480	6	247	4,159,000	3,233	1,286	441	3.4	4	-2	370	123
FAIRFAX	2,852	11	259	30,319,000	6,859	4,420	301	9.5	10	-1	285	26
FRANKLIN	1,107	4	277	1,313,000	2,381	551	474	2.3	3	-1	369	92
FREDERICKSBURG	1,537	5	307	5,999,000	3,407	1,761	420	3.7	4	-1	384	77
HALIFAX	1,591	5	318	1,538,000	3,374	456	479	3.3	4	-1	398	80
HARRISONBURG	1,079	4	270	2,408,000	2,312	1,041	452	2.4	3	-1	360	90
HILLSVILLE	1,629	5	326	1,512,000	3,340	453	479	3.4	4	-1	407	81
JONESVILLE	1,500	6	250	1,315,000	3,086	426	480	3.1	3	-3	500	250
LEBENON	1,206	5	241	1,782,000	2,509	710	467	2.6	3	-2	402	161
LEESBURG	954	4	238	2,541,000	2,092	1,215	445	2.1	2	-2	477	238
LEXINGTON	1,502	6	250	2,849,000	3,220	885	459	3.3	4	-2	375	125
LOUISA	985	4	246	1,521,000	2,005	759	465	2.1	2	-2	493	246
LURAY	881	3	294	1,737,000	1,911	909	458	1.9	2	-1	440	147
MANASSAS	963	5	193	6,402,000	2,189	2,925	368	2.6	3	-2	321	128
MARTINSVILLE	1,541	6	257	2,141,000	3,237	661	469	3.3	4	-2	385	128
NORFOLK	112	3	37	5,373,000	573	9,373	100	1.1	1	-2	112	75
PETERSBURG	1,075	5	215	3,172,000	2,489	1,274	442	2.4	3	-2	358	143
ROCKY MOUNT	1,149	4	287	1,344,000	2,356	570	473	2.4	3	-1	383	96
SALEM	1,568	7	224	4,743,000	3,414	1,389	437	3.6	4	-3	392	168
SALUDA	1,108	4	277	2,448,000	2,352	1,041	452	2.4	3	-1	369	92
SANDSTON	659	6	110	9,586,410	1,812	5,291	262	2.5	3	-3	220	110
SOUTH HILL	1,585	6	264	2,124,000	3,367	631	471	3.4	4	-2	396	132
SUFFOLK	1,157	5	231	2,515,000	2,559	983	455	2.5	3	-2	386	154
TAZEWELL	930	5	186	1,817,000	1,991	913	458	2.0	2	-3	465	279
VERONA	1,514	7	216	2,807,000	3,177	883	459	3.3	4	-3	378	162
WARRENTON	1,195	4	299	3,044,000	2,593	1,174	446	2.7	3	-1	398	100
WARSAW	1,304	4	326	1,175,000	2,682	438	479	2.7	3	-1	435	109
WAVERLY	876	3	292	1,316,000	1,833	718	467	1.9	2	-1	438	146
WILLIAMSBURG	678	3	226	6,395,000	1,646	3,886	325	2.1	2	-1	339	113
WISE	1,004	4	251	1,592,000	2,120	751	465	2.2	2	-2	502	251
WYTHEVILLE	1,364	6	227	1,855,000	2,844	652	470	2.9	3	-3	455	227
TOTAL	57,016	220		158,567,000	123,199			130.9	144	-76		
AVERAGE			259			1,287					396	137