

CONTRACTOR ASSISTANCE IN HIGHWAY MAINTENANCE:

STATE-OF-THE-ART EVALUATION

by

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(The opinions, findings, and conclusions expressed in this report are those of the author and not necessarily those of the sponsoring agencies.)

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## ABSTRACT

The purpose of this study was to perform a state-of-the-art evaluation of contractor assistance in Virginia's highway maintenance.

The study revealed that expenditures for contractor assistance accounted for 2.79% of the total expenditure on ordinary maintenance, 60.17% of the expenditure on maintenance replacement, and 32.60% of the expenditure on incidental construction during FY78-79.

For ordinary maintenance, 47.48% of the expenditure for contractor assistance was for snow and ice control, 15.41% was for traffic services and operations, and 14.08% was for maintenance of bituminous surfaces. In the case of maintenance replacement, 54.56% of the expenditure for contractor assistance was for surface replacement and 36.17% was for major flood damage. For assistance on incidental construction, 75.44% of the expenditure went for surface and base work and 13.12% for roadway construction.

The basic procedure used in Virginia to determine whether or not to employ contractor assistance in performing highway maintenance work is as follows:

- (a) Determine the need for the work to be performed and how quickly the work must be done.
- (b) Determine if the proper men and equipment are available to do the work within the time required.
- (c) If either the proper or sufficient amount of equipment and personnel are not available, then employ the needed contractor assistance.

The development of formal procedures for comparing costs of performing maintenance activities with state forces and costs with contractor assistance is recommended.

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## SUMMARY OF FINDINGS

Expenditure Data

1. During fiscal 1978-79, contractor assistance as represented by the combined costs for hired equipment and contract maintenance accounted for 2.79% of the state's outlay for ordinary maintenance, 60.17% of its maintenance replacement expenditures, and 32.60% of its incidental construction expenditures.
2. Of the \$2,609,197 expended for contractor assistance in ordinary maintenance during FY78-79, 47.48% was expended for snow and ice control, 15.41% for traffic services and operations, and 14.08% for maintenance of bituminous surfaces.
3. Of the \$78,865,965 expended for contractor assistance in maintenance replacement during FY78-79, 54.56% was expended for surface replacement and 36.17% for major flood damage.
4. Of the \$8,533,359 expended for contractor assistance in incidental construction during FY78-79, 75.44% was expended for surface and base work and 13.12% for roadway construction.
5. The Department's greatest dependence upon contractor assistance for accomplishing a specific ordinary maintenance activity was in traffic services and operations. In that activity, 23.11% of the state expenditures went for contractor assistance.
6. In maintenance replacement the greatest expenditure for assistance, 85.74% of the total, was for surface replacement.
7. In incidental construction, the major expense for assistance, 59.80% of the total, was for general expense.

Questionnaire

1. The basic procedure used in Virginia to determine whether or not to employ contractor assistance in performing highway maintenance work is as follows:
  - (a) Determine the need for the work to be performed and how quickly the work must be done.
  - (b) Determine if the proper men and equipment are available to do the work within the time required.
  - (c) If either the proper or sufficient amount of equipment and personnel are not available, then employ the needed contractor assistance.
2. The use of contractor assistance in highway maintenance will increase in most parts of the state because of the present

restrictions on state force manpower and the increasing maintenance requirements of the aging roadway system.

3. The advantages of contractor assistance in highway maintenance include (a) the ability to have specialized work accomplished in an expeditious manner, (b) the ability to handle additional work loads without increasing the number of state personnel or equipment, and (c) the ability to make state work available to small contractors.
4. The disadvantages of contractor assistance in highway maintenance include (a) the increased coordination required to perform specific work, (b) the high cost, (c) the additional supervision that is not included in the state force manpower allocations, (d) the great amount of time expended in keeping the required records, and (e) the time lag in getting work under way.

## RECOMMENDATIONS

1. There is a need to develop formal procedures for comparing the costs of performing maintenance activities with state forces and the cost of performing them with contractor assistance.
2. The percentage of the expenditure for a given activity going for contractor assistance should be computed each year and monitored by management to (a) identify changes in the Department's dependence upon contractor assistance, and (b) aid in decisions concerning the increased or decreased use of contractor assistance.
3. There is a need for the Department to review its procedures for hiring equipment and contracting maintenance in an attempt to eliminate unnecessary time delays and reduce paperwork. This review should include the suggestions offered by the assistant district engineers for maintenance for inclusion in this report.

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## CONTRACTOR ASSISTANCE IN HIGHWAY MAINTENANCE:

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## INTRODUCTION

The basic objectives of Virginia's highway maintenance program as described in the Maintenance Division Policy Manual (1) are:

To maintain and operate the highway system in a manner such that (1) comfort, convenience and safety are afforded the public, (2) the investment in roads, bridges and appurtenances is preserved or enhanced, (3) the aesthetics and the compatibility of the highway system with the environment are preserved or enhanced, and (4) the necessary expenditure of resources is accomplished with continuing emphasis on economy.

Traditionally, these objectives have been satisfied by state forces supplemented with private contractor forces performing the necessary maintenance. State forces have been sufficient in number to accomplish most of the routine maintenance activities and most emergency operations. These activities are characteristically diverse, subject to variations, and, on occasion, hurried; thus they have not lent themselves to competitive bidding. Contractor assistance, which includes hired equipment and contract maintenance, has been employed to supplement state forces in emergencies and to perform specialized operations and maintenance projects of such large scope as to make performance by state forces impracticable. These activities include bridge repair, surface treatment, slurry seal, and asphalt overlay. The use of contractor forces in this manner has made it possible for the Department to achieve its maintenance objectives without increasing the number of state forces.

## PURPOSE AND SCOPE

At the request of Maintenance Engineer C. O. Leigh, this investigation was conducted to provide a state-of-the-art evaluation of contractor assistance in Virginia's highway maintenance. It included (1) a literature review of the subject area, (2) a documentation of Virginia's history in this area, and (3) an evaluation of the current status of state force and contractor assistance.

## LITERATURE REVIEW

The performance of highway maintenance with other than state forces had its origin many years ago when a property owner could work off his assessed property tax on an already completed roadway rather than paying it in cash. Today the maintenance of a state's roadway system is more complex than it was years ago and thus requires a maintenance organization supported by a tax levied against the user. In most states, the maintenance organization can adequately perform routine maintenance activities and emergency operations, and contractor assistance is obtained only when highly specialized workmen or equipment are required, or when the scope of the work is beyond the capability of the state maintenance force.

Most state highway departments consider using contractor maintenance for those activities which (1) would require a seasonal or temporary staffing level above that needed throughout the year, or (2) require special skills and equipment not normally available and justified within the department.<sup>(2)</sup>

The types of maintenance activities reported in a 1972 AASHO survey <sup>(3)</sup> as being very compatible for contracting are as follows:

1. Resurfacing
2. Structure Cleaning & Painting
3. Structure Repair
4. Snow & Ice Control - Equipment Rental
5. Painting Surface Markings
6. Patching Holes
7. Mowing
8. Landscaping
9. Snow & Ice Control - Removal
10. Shoulder Repair
11. Highway Guardrail Repair & Replacement
12. Sign Repair
13. Weed Spraying
14. Catch Basin Cleaning
15. Litter Pickup
16. Slide Removal
17. Sweeping
18. Snow & Ice Control - Chemicals Purchased
19. Lighting

In making a decision as to what work, if any, should be contracted out, the answers to several simple questions may prove to be beneficial.

1. Will the use of a contract for a specific task during a peak period of maintenance activity eliminate the necessity of hiring labor on a short-term basis?

2. Is specialized equipment needed for the task at hand?
3. Does the job need specialized labor skills?
4. Is there a deadline or time limit for the tasks to be performed and, if so, can state personnel meet the deadline?
5. Can the job be done economically by contract?<sup>(4)</sup>

The answers to these questions should be available to the administrator before the decision on how to perform the work is made.

On the fifth question, the 1976 AASHTO Maintenance Manual states,

frequent competitive comparisons between the cost and benefits of state force and contract maintenance should become a general practice for maintenance managers. The comparison on trade-off studies should be used to determine when it is more economical to contract and may also serve as a basis to measure the cost effectiveness of state forces. <sup>(5)</sup>

This is perhaps the most difficult question to answer and thus the most often neglected question in the decision-making process.

#### CONTRACTOR ASSISTANCE IN VIRGINIA

The Virginia Department of Highways & Transportation had 52,217 miles of road under its jurisdiction as of December 31, 1978. Included were 907 miles on the interstate system, 7,874 miles on the primary system, and 43,436 miles on the secondary system. The Department's FY78-79 expenditures through the Maintenance Division were \$93,364,727 for ordinary maintenance; \$131,066,628 for maintenance replacement; and \$26,173,002 for incidental construction; for a grand total of \$250,604,357.

Contractor assistance on maintenance was in the form of hired equipment and maintenance contracts. "Hired equipment" is the term used to identify equipment and an operator rented from a contractor on an hourly basis. For hired equipment, the state expended \$1,990,280 in ordinary maintenance, \$4,210,098 in maintenance replacement, and \$1,421,350 in incidental construction during FY78-79, for a grand total of \$7,621,728. Thus, 2.13% of the ordinary maintenance expenditure, 3.21% of the maintenance replacement expenditure, and 5.43% of the incidental construction expenditure were for hired equipment.

"Maintenance contract" is the term used to identify a contract let by the state to a private contractor for the performance of specific maintenance tasks. For maintenance contracts the

state expended \$618,917 in ordinary maintenance, \$74,655,867 in maintenance replacement, and \$7,112,009 in incidental construction during FY78-79, for a grand total of \$82,386,793. Thus, 0.66% of the ordinary maintenance expenditure, 56.96% of the maintenance replacement expenditure, and 27.17% of the incidental construction expenditure were for maintenance contracts. The reader is referred to Appendix A for a detailed description of the principal types of formal maintenance contracts used in Virginia.

In combined hired equipment and contract maintenance expenditures, the state expended 2.79% of the ordinary maintenance expenditure, 60.17% of the maintenance replacement expenditure, and 32.60% of the incidental construction expenditure during FY78-79 on contractor assistance.

The remainder of this section describes the distribution of contractor assistance expenditures by general activity and roadway system.

#### Contractor Assistance in Ordinary Maintenance

Ordinary maintenance is the function of preserving each type of roadway, structure, and facility as near as possible in its condition as constructed. The ordinary maintenance activities include surface patching, shoulder maintenance, ditch cleaning, mowing, trash pickup, sign repair, snow removal, snow fence erection, pavement marking, weigh station operation, and many other similar items. A detailed list is included in Appendix B.

Contractor assistance expenditures for ordinary maintenance activities during FY78-79 on the interstate, the primary, and secondary systems are shown in Tables 1, 2, and 3 respectively. As can be seen in Table 1, of the \$629,733 expended for assistance on the interstate system, 44.67% was for traffic services and operations, 29.60% for snow and ice control, and 16.52% for maintenance of bituminous surfaces. The Department's dependence on contractor assistance in a given activity on the interstate system was greatest in the maintenance of bituminous surfaces, with 35.72% of the expenditure on that activity being for contract assistance. This was followed by maintenance of drawbridges and ferries at 23.96%, and traffic services and operations at 22.89%. The percentage of the expenditure for contractor assistance on a given activity should be computed each year and monitored by management, not only to identify changes in the Department's dependence on contractor assistance but also to aid in decisions on increasing or decreasing the assistance in given activities. Contractor assistance accounted for 4.38% of the total ordinary maintenance expenditures for the interstate system.

Of the \$633,450 expended for contractor assistance on the primary system, 44.49% was for snow and ice control, and 20.70% was for maintenance of bituminous surfaces. The Department's dependence on contractor assistance was greatest in traffic services and operations at 22.03%. Assistance accounted for 1.98% of the ordinary maintenance expenditure for the primary system.



Table 1

FY78-79 Expenditures for  
Ordinary Maintenance Activities on Interstate System

<u>ACTIVITY</u>	<u>TOTAL EXPENDITURES</u>	<u>PERCENT FOR CONTRACTOR ASSISTANCE</u>	<u>TOTAL FOR CONTRACTOR ASSISTANCE</u>	<u>PERCENT OF TOTAL FOR CONTRACTOR ASSISTANCE</u>
General Expense	\$ 814,041	1.43	\$ 11,654	1.85*
Bituminous Surface	291,219	35.72	104,028	16.52
Concrete Surface	147,573	0.09	129	0.02
Open-Hard Surface	9,042	0.66	60	0.01
Shoulder Maintenance	70,816	1.41	996	0.16
Ditches & Drainage	336,939	2.18	7,358	1.17
Roadside	2,421,585	0.07	1,708	0.27
Vegetation Control	896,934	0.17	1,500	0.24
Signs & Traffic Control	426,471	1.69	7,197	1.14
Traffic Services & Operations	1,228,971	22.89	281,333	44.67
Snow & Ice Control	4,145,899	4.50	186,381	29.60
Structures	62,438	-----	-----	-----
Drawbridges & Ferries	106,261	23.96	25,464	4.04
Weigh Stations	717,526	0.03	242	0.04
Tunnels	2,087,632	0.08	1,683	0.27
Supervision	627,810	-----	-----	-----
<b>TOTAL</b>	<b>\$14,391,157</b>	<b>4.38</b>	<b>\$629,733</b>	<b>100.00</b>

\*\$11,654 ÷ \$629,733 = 1.85.

Table 2

FY78-79 Expenditures for  
Ordinary Maintenance Activities on Primary System

<u>ACTIVITY</u>	<u>TOTAL EXPENDITURES</u>	<u>PERCENT FOR CONTRACTOR ASSISTANCE</u>	<u>TOTAL FOR CONTRACTOR ASSISTANCE</u>	<u>PERCENT OF TOTAL FOR CONTRACTOR ASSISTANCE</u>
General Expense	\$ 2,518,710	0.19	\$ 4,886	0.77
Bituminous Surface	2,539,121	5.17	131,146	20.70
Concrete Surface	93,874	-----	-----	-----
Non-Hard Surface	19,955	2.25	448	0.07
Shoulder Maintenance	1,998,187	1.75	35,033	5.53
Ditches & Drainage	2,035,866	2.79	56,879	8.98
Roadside	1,714,130	1.06	18,167	2.87
Vegetation Control	2,492,451	0.33	8,343	1.32
Signs & Traffic Control	2,146,989	0.15	3,160	0.50
Traffic Services & Operations	422,106	22.03	93,006	14.68
Snow & Ice Control	10,974,779	2.57	281,794	44.49
Structures	232,117	0.03	71	0.01
Drawbridges & Ferries	1,948,231	0.03	517	0.08
Weigh Stations	366,496	-----	-----	-----
Tunnels	90	-----	-----	-----
Supervision	2,432,763	-----	-----	-----
<b>TOTAL</b>	<b>\$31,935,865</b>	<b>1.98</b>	<b>\$633,450</b>	<b>100.00</b>

Table 3

FY78-79 Expenditures for  
Ordinary Maintenance Activities on Secondary System

<u>ACTIVITY</u>	<u>TOTAL EXPENDITURES</u>	<u>PERCENT FOR CONTRACTOR ASSISTANCE</u>	<u>TOTAL FOR CONTRACTOR ASSISTANCE</u>	<u>PERCENT OF TOTAL FOR CONTRACTOR ASSISTANCE</u>
General Expense	\$ 4,084,203	0.12	\$ 4,996	0.37
Bituminous Surface	8,109,126	1.82	147,833	10.98
Concrete Surface	3,217	-----	-----	-----
Non-Hard Surface	6,535,856	1.77	115,640	8.59
Shoulder Maintenance	992,316	1.27	12,604	0.94
Ditches & Drainage	7,118,365	2.07	147,398	10.95
Roadside	2,732,483	3.66	100,077	7.44
Vegetation Control	3,779,100	0.42	15,842	1.18
Signs & Traffic Control	1,638,126	0.02	372	0.03
Traffic Services & Operations	88,998	31.20	27,766	2.06
Snow & Ice Control	7,784,536	9.90	770,747	57.25
Structures	814,890	0.29	2,397	0.18
Drawbridges & Ferries	88,508	0.39	342	0.03
Weigh Stations	10	-----	-----	-----
Tunnels	8	-----	-----	-----
Supervision	3,267,966	-----	-----	-----
<b>TOTAL</b>	<b>\$47,037,708</b>	<b>2.86</b>	<b>\$1,346,014</b>	<b>100.00</b>

On the secondary system, \$1,346,014 were expended for contractor assistance in ordinary maintenance activities; 57.25% of this total went for snow and ice control, 10.98% for maintenance of bituminous surfaces, and 10.95% for ditches and drainage. The dependence was greatest in traffic services and operations at 31.20%. On this system, 2.86% of the ordinary maintenance expenditure went for assistance.

For all systems combined, \$2,609,197 were expended for contractor assistance in performing ordinary maintenance activities during FY78-79; 47.48% was for snow and ice control, 15.41% for traffic services and operations, and 14.08% for maintenance of bituminous surfaces. All of the expenditure for contractor assistance in snow and ice control was for hired equipment, 98.42% of the assistance expenditure for traffic services and operations was for maintenance contracts, and 57.20% of that for bituminous surface repair was for hired equipment. The Department's greatest dependence in ordinary maintenance activities was in traffic services and operations, at 23.11%.

Contractor assistance accounted for 2.79% of the ordinary maintenance expenditure for all three systems combined.

#### Contractor Assistance in Maintenance Replacement

Maintenance replacement is the function of restoring each type of roadway, structure, and facility as near as possible to its condition as constructed. Included is resurfacing, replacement of pipe lines, removal of major slides, replacement of large signs and signals, and similar items. A detailed list of maintenance replacement activities is included in Appendix B.

Expenditures for contractor assistance in maintenance replacement activities during FY78-79 on the interstate, primary, and secondary systems are shown in Tables 4, 5, and 6 respectively. Of the \$7,687,812 total for assistance on the interstate system, 84.06% was for surface replacement and 11.89% for structures. The Department's dependence on contractor assistance in a specific activity was greatest in surface replacement, at 92.50%. This was followed by structures at 65.77%; shoulders, turnouts and drainage at 31.35%; and major flood damage at 22.60%. Contractor assistance accounted for 72.20% of the maintenance replacement expenditure on the interstate system.

Of the \$23,672,026 expended for contract assistance on the primary system, 74.68% was for surface replacement and 12.03% for major flood damage. The greatest dependence was in surface replacement, at 94.11%. This was followed by structures at 75.24%, general expense at 50.36%, major flood damage at 38.56%, and roadside at 25.86%. Contractor assistance accounted for 67.23% of the maintenance replacement expenditure on the primary system.

On the secondary system, \$47,506,127 were expended for contractor assistance in maintenance replacement activities; 53.98%

Table 4

FY78-79 Expenditures for  
Maintenance Replacement Activities on Interstate System

<u>ACTIVITY</u>	<u>TOTAL EXPENDITURES</u>	<u>PERCENT FOR CONTRACTOR ASSISTANCE</u>	<u>TOTAL FOR CONTRACTOR ASSISTANCE</u>	<u>PERCENT OF TOTAL FOR CONTRACTOR ASSISTANCE</u>
General Expense	\$ 194,399	17.31	\$ 33,656	0.44
Surface Replacement	6,985,894	92.50	6,462,283	84.06
Shoulders, Turnouts & Drainage	226,028	31.35	70,860	0.92
Roadside	938,073	17.75	166,516	2.17
Signs	684,949	-----	-----	-----
Structures	1,390,172	65.77	914,348	11.89
Weigh Stations	44,952	1.21	546	-----
Major Flood Damage	175,257	22.60	39,603	0.52
Supervision	7,816	-----	-----	-----
<b>TOTAL</b>	<b>\$10,647,540</b>	<b>72.20</b>	<b>\$7,687,812</b>	<b>100.00</b>

Table 5

FY78-79 Expenditures for  
Maintenance Replacement Activities on Primary System

<u>ACTIVITY</u>	<u>TOTAL EXPENDITURES</u>	<u>PERCENT FOR CONTRACTOR ASSISTANCE</u>	<u>TOTAL FOR CONTRACTOR ASSISTANCE</u>	<u>PERCENT OF TOTAL FOR CONTRACTOR ASSISTANCE</u>
General Expense	\$ 1,074,070	50.36	\$ 540,895	2.28
Surface Replacement	18,780,307	94.11	17,674,835	74.68
Shoulders, Turnouts & Drainage	1,188,175	4.97	59,098	0.25
Roadside	1,255,792	25.86	324,798	1.37
Signs	2,534,543	-----	252	-----
Structures	2,955,021	75.24	2,223,361	9.39
Weigh Stations	16,849	-----	-----	-----
Major Flood Damage	7,387,045	38.56	2,848,787	12.03
Supervision	18,491	-----	-----	-----
 TOTAL	 \$35,210,293	 67.23	 \$23,672,026	 100.00

Table 6

FY78-79 Expenditures for  
Maintenance Replacement Activities on Secondary System

<u>ACTIVITY</u>	<u>TOTAL EXPENDITURES</u>	<u>PERCENT FOR CONTRACTOR ASSISTANCE</u>	<u>TOTAL FOR CONTRACTOR ASSISTANCE</u>	<u>PERCENT OF TOTAL FOR CONTRACTOR ASSISTANCE</u>
General Expense	\$ 3,605,585	76.97	\$ 2,775,152	5.84
Surface Replacement	24,415,837	77.36	18,888,756	39.76
Shoulders, Turnouts & Drainage	991,986	6.26	62,109	0.13
Roadside	260,298	31.80	82,763	0.17
Signs	779,707	0.85	6,665	0.01
Structures	774,851	6.95	53,862	0.11
Weigh Stations	-----	-----	-----	-----
Major Flood Damage	54,221,227	47.28	25,636,820	53.98
Supervision	159,305	-----	-----	-----
<b>TOTAL</b>	<b>\$85,208,796</b>	<b>55.75</b>	<b>\$47,506,127</b>	<b>100.00</b>

of the total went for major flood damage and 39.78% for surface replacement. The greatest dependence was in surface replacement, at 77.36%. This was followed by general expense at 76.97%, major flood damage at 47.28%, and roadside at 31.80%. Contractor assistance accounted for 55.75% of the maintenance replacement expenditure on the secondary system.

For all systems combined, \$78,865,965 were expended for contractor assistance in maintenance replacement activities during FY78-79; with 54.56% going for surface replacement and 36.17% for major flood damage. Maintenance contracts accounted for 99.80% of the assistance in surface replacement and 87.12% of that in major flood damage. The greatest dependence was in surface replacement, at 85.74%. This was followed by general expense at 68.73% and structures at 62.33%.

Contractor assistance accounted for 60.17% of the maintenance replacement expenditure for all three systems combined.

#### Contractor Assistance in Incidental Construction

Incidental construction is any operation which changes the type, width, length, location, or gradient of a road, facility, or structure. It includes acquisition of right-of-way, earthwork, surface and base work, drainage, grading the roadside and similar activities. A detailed list of incidental construction activities is included in Appendix B.

There were no contractor assistance expenditures for incidental construction activities on the interstate system during FY78-79. The expenditures for the primary system are shown in Table 7 and those for the secondary system in Table 8. Of the \$278,399 expended for contractor assistance on the primary system, 93.55% was for traffic and pedestrian services. The Department's dependence on contractor assistance was greatest in surface and base work, at 80.97%. This was followed by traffic and pedestrian services at 26.64%. Contractor assistance accounted for 26.73% of the incidental construction expenditure for the primary system.

On the secondary system, \$8,254,960 were expended for contractor assistance in incidental construction; 77.78% of the total for surface and base work and 13.56% for roadway construction. The greatest dependence was in general expense, at 60.01%. This was followed by surface and base work at 49.45% and roadway construction at 22.38%. Contractor assistance accounted for 33.35% of the incidental construction expenditure on the secondary system.

For the combined primary and secondary system, \$8,533,359 were expended for contractor assistance in incidental construction activities during FY78-79. Of this amount, 75.44% was for surface and base work and 13.12% for roadway construction. The Department's greatest dependence was in general expense, at 59.80%. This was followed by surface and base work at 49.50%.



Table 7

FY78-79 Expenditures for  
Incidental Construction Activities on Primary System

<u>ACTIVITY</u>	<u>TOTAL EXPENDITURES</u>	<u>PERCENT FOR CONTRACTOR ASSISTANCE</u>	<u>TOTAL FOR CONTRACTOR ASSISTANCE</u>	<u>PERCENT OF TOTAL FOR CONTRACTOR ASSISTANCE</u>
General Expense	\$ 2,521	-----	-----	-----
Right-of-Way	395	-----	-----	-----
Roadway Construction	749	-----	-----	-----
Surface & Base	21,140	80.97	17,117	6.15
Shoulders & Entrances	6,844	-----	-----	-----
Drainage Structures	39	-----	-----	-----
Drainage & Small Drainage Structures	16,063	2.12	340	0.12
Traffic & Pedestrian Services	977,661	26.64	260,440	93.55
Roadside Development	15,900	3.16	502	0.18
Supervision	20	-----	-----	-----
TOTAL	\$1,041,332	26.73	\$278,399	100.00

Table 8

FY78-79 Expenditures for  
Incidental Construction Activities on Secondary System

<u>ACTIVITY</u>	<u>TOTAL EXPENDITURES</u>	<u>PERCENT FOR CONTRACTOR ASSISTANCE</u>	<u>TOTAL FOR CONTRACTOR ASSISTANCE</u>	<u>PERCENT OF TOTAL FOR CONTRACTOR ASSISTANCE</u>
General Expense	\$ 705,492	60.01	\$ 423,390	5.10
Right-of-Way	565,978	0.69	3,923	0.05
Roadway Construction	5,001,791	22.38	1,119,531	13.56
Surface & Base	12,984,278	49.45	6,420,528	77.78
Shoulders & Entrances	472,513	5.79	27,378	0.33
Drainage Structures	1,196,373	5.72	68,402	0.83
Drainage & Small Drainage Structures	1,964,673	7.30	143,483	1.74
Traffic & Pedestrian Services	897,207	5.07	45,501	0.55
Roadside Development	576,881	0.49	2,824	0.03
Toll Free Ferries & Docks	388,529	-----	-----	-----
TOTAL	\$24,753,715	33.35	\$8,254,960	100.00

Contractor assistance accounted for 32.60% of the incidental construction expenditure for the primary and secondary systems combined.

### QUESTIONNAIRE ON CONTRACTOR ASSISTANCE

This section of the report includes a summary of the responses by the assistant district engineers for maintenance to a questionnaire on contractor assistance in Virginia's highway maintenance. The questionnaire contained three sections: hired equipment, contract maintenance, and contractor assistance. In those instances where similar responses were received, the responses were combined.

#### Hired Equipment

1. What are the principal operations in ordinary maintenance, maintenance replacement, and incidental construction in which hired equipment is utilized?

The principal operations cited were as follows:

#### Ordinary Maintenance

Snow removal, transporting materials, paving operations, shoulder machining, ditching, bituminous patching, guardrail repair, brush cutting, and emergency work.

#### Maintenance Replacement

Surface treatment, bituminous overlays, pavement restoration, repair of slides and washouts, emergency storm damage, major cleaning of outfall ditches, bridge work, concrete repair, and center-line marking.

#### Incidental Construction

Clearing and grubbing, grading, placing base material, repair and/or replacement of substructure and superstructure on bridges, riprap and incidental concrete, erecting guardrail, excavation, paving and surface treatment, installation of large pipe, and soil cement stabilization.

2. What are (a) advantages and (b) disadvantages for your district in utilizing hired equipment?

Advantages

- (a) Makes available specialized equipment which is not practical for the Department to purchase because of small amount of time it would be used.
- (b) Makes additional equipment available for emergency operations such as snow removal and floods.
- (c) Reduces overhead cost required to prepare plans and execute contracts for needed work.
- (d) Makes state work available to small contractors who would not bid on contract projects.
- (e) Releases state equipment and personnel to perform other needed activities.

Disadvantages

- (a) Requires coordination to perform the specified work.
- (b) High cost of renting some equipment.
- (c) Requires supervision not included in the state force manpower allocation.
- (d) Availability of the contractors' hired equipment and manpower varies depending upon the contractors' work schedule.

3. Do you feel that your district will increase or decrease use of hired equipment in the future? Why?
- (a) The use of hired equipment will increase due to the present restrictions on manpower and the increasing maintenance requirements on the aging roadway system.
  - (b) The use of hired equipment will remain relatively constant with variations caused by the number and type of emergency situations.
4. Do you have any suggestions on how to improve the utilization of hired equipment?
- (a) In cooperation with the contracting industry, the Department should catalog available equipment and identify a range of rental rates. This would help the Department's engineers know who to contact for certain types of equipment.
  - (b) The Department's procedures for contracting emergency standby equipment should be more flexible.

- (c) When using hired equipment, each step in the operation schedule should be carefully planned to eliminate lost time and motion.

### Contract Maintenance

1. What are the principal operations in ordinary maintenance, maintenance replacement and incidental construction performed by contract maintenance in your district?

The principal operations cited were as follows:

#### Ordinary Maintenance

Snow removal, bridge maintenance, guardrail repair, bituminous patching, trash collection at rest areas, headquarters and waysides, and sign and highway lighting maintenance.

#### Maintenance Replacement

Plant mix, slurry seals, surface treatment, cold-mix, reconditioning hard surface roads, major concrete pavement and joint repair, sidewalk, curb and gutter repair, bridge repairs, centerline and edgeline painting, school and railroad crossing messages painting, bridge painting, roadway signing, and storm damage repairs.

#### Incidental Construction

Plant mix, guardrail, grubbing, earthwork, and widening projects.

2. What are (a) advantages and (b) disadvantages for your district in using contract maintenance?

#### Advantages

- (a) Ability to have specialized work accomplished in an expeditious manner.
- (b) Ability to handle additional work loads without increasing state personnel or equipment.

#### Disadvantages

- (a) Time lag to get contract under way.
- (b) High cost to perform many tasks by contract.
- (c) The records required are voluminous and time consuming.

- (d) Requires seasonal demand for inspectors.
3. Do you feel that your district will increase or decrease use of contract maintenance in the future? Why?
- (a) Increase due to the difficulties in retaining qualified personnel.
- (b) Increase due to the increase in the number of specialized operations required as the roadway system ages.
- (c) Increase if personnel levels are reduced further.
4. Do you have any suggestions on how to improve the use of contract maintenance?
- (a) Initiate a program to inform the contractors of the contract maintenance programs.
- (b) Streamline procedures and reduce time required to advertise bituminous surface schedule work. Residencies are required to submit requests of roads to be resurfaced prior to completing the previous year's schedule.
- (c) Each district, in cooperation with the Maintenance Division, should be allowed to prepare the proposals for all contract maintenance.

#### Contractor Assistance

1. Please describe the basic philosophy or procedure used in your district in determining whether or not to employ (a) hired equipment and (b) contract maintenance in performing highway maintenance work.

#### Hired Equipment

- (a) Determine the need for the work to be performed and how quickly the work must be done.
- (b) Determine if proper men and equipment are available to do the work within the time required.
- (c) If either the proper or sufficient amount of equipment and personnel are not available, then hire the needed equipment and personnel.

#### Contract Maintenance

- (a) This item is essentially the same as for hired equipment.

- (b) It is not practical to attempt to do plant mix, seal schedules, major guardrail schedules, or major bridge repairs with state forces.

2. Please include any additional comments concerning the Department's dependence on contractor assistance in maintaining Virginia's highways.

- (a) Assistance from the contractors is definitely needed to carry out an adequate maintenance program on Virginia's highways. The Department cannot afford to own the large and specialized equipment that is available through contractors. Generally, the contracting industry has operators who have more expertise and are more efficient than the Department's. Contractors provide an invaluable service during emergency situations and play a vital role in restoring our highways to normal.

- (b) In some parts of the state contractor assistance is not the most efficient method of performing highway maintenance, because many contractors are not maintenance oriented and are not willing to perform maintenance work at a price providing a reasonable profit.





## REFERENCES

1. Virginia Department of Highways and Transportation, Maintenance Division Policy Manual, Richmond, Virginia, January 1978, p.1.
2. "Contract Maintenance - Do You Use It?" Better Roads, Park Ridge, Illinois, November 1971, pp. 22-24.
3. American Association of State Highway and Transportation Officials, "Summary of Contract Maintenance As Currently Practiced by Member Organizations," Washington, D.C., 1973.
4. Stone, Arthur H., "Formulating A Practical Maintenance Policy - Contract vs. Use of Own Personnel," Proceedings, Thirty-third Annual Meeting of the International Bridge, Tunnel, and Turnpike Association, Bal Harbour, Florida, October 31 - November 3, 1965.
5. American Association of State Highway and Transportation Officials, Maintenance Manual, Washington, D.C. 1976, pp. 22-23.



## APPENDIX A

## TYPES OF MAINTENANCE CONTRACTS USED IN VIRGINIA

This appendix contains information on the principal types of maintenance activities performed under contract in Virginia. This information includes (1) the bid prices by calendar year, (2) the types of work performed, and (3) a description of the work performed.

Table A-1 contains the bid prices by calendar year for the principal maintenance activities performed under contract. Bituminous surface work (Plant Mix, Surface Treatment, Slurry Seal, and Cold Mix) make up the largest percentage of the bid prices. This percentage was highest at 89.31% in 1974 and decreased gradually to 66.60% in 1978. Maintenance restoration accounted for 22.86% of the contract bid prices in 1977 and 16.30% in 1978. On an overall basis, the bid prices increased from a low of \$14,902,592 in 1975 to a high of \$65,879,282 in 1978.

The principal types of maintenance activities performed by contract maintenance in Virginia are as follows:

1. Bituminous Plant Mix

Consists of furnishing and applying a single or multiple course of bituminous concrete in accordance with the requirements of the Road and Bridge Specifications and the Special Provisions.

2. Bituminous Surface Treatment

Consists of the application of a single or multiple courses of bituminous surface treatment in accordance with the requirements of the Road and Bridge Specifications and the Special Provisions.

3. Emulsified Asphalt Slurry Seal

Consists of furnishing and applying an emulsified asphalt slurry seal in accordance with the Road and Bridge Specifications and the Special Provisions.

4. Cold Mix Bituminous Treatment

Consists of furnishing and constructing one or more pavement courses of cold mix treatment on existing roadway surface and choking with a cover material in accordance with the Special Provisions and in reasonably close conformity with the lines, grades, thickness or typical cross sections shown on the plans or established by the Engineer.

Table A-1. Virginia Contract Maintenance Bid Prices by Calendar Year

TYPE	1978	% OF TOTAL	1977	% OF TOTAL	1976	% OF TOTAL	1975	% OF TOTAL	1974	% OF TOTAL
Plant Mix	23,554,939	35.76	23,828,384	40.87	13,912,706	44.11	5,946,089	39.90	15,485,531	50.90
Surface Treatment	14,739,510	22.37	12,896,191	22.11	9,513,503	30.17	5,480,697	36.78	10,618,852	34.90
Slurry Seal	3,442,355	5.23	2,579,450	4.42	1,531,685	4.86	1,073,865	7.21	1,069,278	3.51
Cold Mix	2,133,713	3.24								
Maintenance Restoration	10,738,586	16.30	13,332,460	22.86						
Bridge Repairs	2,728,602	4.14	1,530,355	2.62	1,177,816	3.73	1,112,380	7.46	1,096,792	3.60
Sidewalk, Curb & Gutter	2,608,033	3.96	1,242,511	2.13	825,848	2.62	388,193	2.60	950,058	3.12
Pavement Marking	2,630,392	3.99								
Guardrail	924,553	1.40	193,040	0.33	163,001	0.52	93,490	0.63	156,706	0.51
Painting Bridge Structural Steel	433,513	0.66	869,467	1.49	1,200,400	3.81	8,480	0.06	182,981	0.60
Miscellaneous	1,945,086	2.95	1,847,646	3.17	3,210,267	10.18	799,398	5.36	870,556	2.86
TOTAL	65,879,282	100.00	58,319,504	100.00	31,535,226	100.00	14,902,592	100.00	39,430,754	100.00

## 5. Maintenance Restoration

Consists of scarifying the existing pavement and base to a minimum depth of 6 inches, the addition of aggregate material or hydraulic cement, the replacing of pipe culverts, the manipulating and compacting of base stone, the reshaping and cleaning of adjacent ditches, and the priming and the application of a bituminous pavement using bituminous seal coats or bituminous plant mix, in accordance with the Special Provisions, applicable sections of the Specifications, and the lines, grades, and details established by the Engineer.

## 6. Bridge Repairs - examples

### a. Repair of Bridge Decks With Latex Modified Portland Cement Concrete.

Consists of repairing existing bridge decks by removing loose, deteriorated, or contaminated concrete and re-surfacing with an approved type latex modified portland cement concrete overlayment course, together with other work necessary to restore structural integrity to the deck, in accordance with the Special Provisions and in reasonably close conformity with the dimensions, lines, and grades shown on the plans or established by the Engineer.

### b. Bridge Substructure Repair.

Consists of repairing existing piles and girders of a specified bridge in accordance with the Special Provisions and in reasonably close conformity with the lines and details shown on the plans or established by the Engineer.

## 7. Sidewalk, Curb, and Gutter

Consists of the repair and replacement of undermined and deteriorated sidewalks, curb and gutter, and entrances in accordance with the Special Provisions and in reasonably close conformity with lines, grades, and limits established by the Engineer.

## 8. Pavement Marking

Consists of furnishing and installing retroreflectorized plastic pavement marking materials in accordance with the Special Provisions and the Federal Manual on Uniform Traffic Control Devices or as directed by the Engineer. Pavement markings include pavement line markings, school zone markings, railroad crossing markings, crosswalk markings, elongated arrows, and messages.

## 9. Guardrail Maintenance - yearly contract

Consists of replacing and installing guardrail and median barriers in reasonably close conformity with the existing lines and grades or as directed by the Engineer. The duration of the contract is for approximately one year for the areas specified. The contractor is given five days' notice as to when and where the repairs are needed. There is a minimum of 200 linear feet per repair call in the designated area.

## 10. Guardrail Replacement

Consists of installing, removing and/or resetting guardrail in accordance with the Special Provisions and in reasonably close conformity with the dimensions, lines, and grades shown on the plans and standards or established by the Engineer.

## 11. Cleaning and Painting Bridge Structural Steel

Consists of the preparation and painting of ferrous metal surfaces on designated existing structures in accordance with the Special Provisions. Surfaces to be painted include but are not limited to structural steel, bearing devices and anchors, expansion joints, drainage systems, utility lines, and attachments.

Cleaning and painting structural steel includes (1) the preparation and painting of metal surfaces, (2) the protection of pedestrian and vehicular traffic, public and private property, and waterways, and (3) furnishing all materials, labor, tools, equipment, and incidentals necessary to complete the work.

## 12. Pavement Repairs - examples

## a. Repair of Portland Cement Concrete Pavement and Joints

Consists of cleaning and sealing joints and repairing defective pavements in accordance with the Special Provisions and at locations directed by the Engineer.

## b. Bituminous Patching

Consists of furnishing all materials, labor, and equipment necessary for spot overlays on the roads specified and any other locations as designated by the Engineer.

## c. Rehabilitation of Pavement

Consists of furnishing all labor and equipment necessary to reshape and prepare subgrade; place, shape and roll 4" 21-A stone; prime and seal roads specified and any other locations as designated by the Engineer.

13. Asphaltic Pavement Planing

Consists of planing the existing asphaltic surface in accordance with the Special Provisions and in reasonably close conformity with the lines, grades, and profiles shown on the plans or established by the Engineer. The planed and finished surface shall be free from gouges, grooves, ridges, sooting, oil film and other imperfections of workmanship and shall have a mosaic appearance suitable as a riding surface.

14. Sealing Pavement Shoulder Joints

Consists of sawing and sealing joints between the pavement and the shoulder in accordance with the Special Provisions and at locations as directed by the Engineer.

15. Undersealing Portland Cement Concrete Pavement

Consists of furnishing and pumping hot asphalt cement under portland cement concrete pavement in accordance with the Special Provisions or as directed by the Engineer.

16. Fencing Repairs and New Installation

Consists of replacing, adjusting, and repairing existing fencing and appurtenances and/or the installation of new fencing and appurtenances in accordance with the Special Provisions, standard specifications, Road Designs and Standards, or as directed by the Engineer, in reasonably close conformity with existing lines or grades and/or new lines and grades established by the Engineer.

17. Grooving Concrete Pavement

Consists of longitudinal grooving of portland cement concrete pavements, including bridge approach slabs and bridge decks, in accordance with the Special Provisions or as directed by the Engineer.

18. Coating Bituminous Pavements with Coal Tar Pitch Emulsions

Consists of furnishing and applying a coal tar pitch emulsion as a protective coating for bituminous concrete pavements on parking areas in accordance with the Special Provisions and in reasonably close conformity with the lines shown on the plans or established by the Engineer.

19. Hot Mix Bituminous Treatment

Consists of furnishing and constructing one or more pavement courses of hot mix bituminous treatment on existing roadway surface in accordance with the Special Provisions and in reasonably close conformity with the lines, grades, and thickness as established by the Engineer and specified in the Road and Bridge Specifications.





## APPENDIX B

## LIST OF MAINTENANCE ACTIVITIES

The following is a list of ordinary maintenance, maintenance replacement, and incidental construction activities.

Ordinary Maintenance Activities

Ordinary maintenance is the function of preserving each type of roadway, structure, and facility as near as possible in its condition as constructed.

## General Expense

- Engineering
- Inclement Weather
- Expendable Equipment
- Payments to Towns
- Employee Education
- Servicing Equipment
- Administrative Overhead

## Bituminous Surface Repair

- Spot Sealing or Skin Patching
- Premix Patching
- Spot Reconditioning
- Seal Cracks on Bituminous Surfaces
- Treat Bleeding Pavements
- Other Bituminous Surface Maintenance

## Concrete Surface Repair

- Patch with Concrete
- Concrete Joints
- Grouting, Undersealing or Pavement Jacking
- Other Repairs to Concrete Pavement

## Non-Hard Surface Roads

- Patching Non-Hard Surface Roads
- Machining Non-Hard Surface Roads
- Applying Dust Palliatives
- Other Non-Hard Surface Maintenance

## Shoulder Maintenance Repair

- Machine Non-Hard Surface Shoulders
- Repair Non-Hard Surface Shoulder With Soil or Aggregate
- Wedge Non-Hard Surface Shoulder With Bituminous Mixes
- Repair Hard Surfaced Shoulders
- Seal Cracks on Bituminous Shoulders
- Other Shoulder Care

## Ditches and Drainage

- Clean and Reshape Ditches by Machine - Hauling
- Clean and Reshape Ditches by Machine - No Hauling
- Hand Cleaning of Ditches
- Clean and Repair Minor Drainage Structures
- Other Drainage Care

## Roadside

- Erosion Repair and Removal of Minor Slides
- Cleaning Right-of-Way
- Dead Animal and Litter Patrol
- Reseeding, Mulching, Sodding, and Resoiling
- Picnic Areas, Waysides, and Rest Areas
- Roadside Structures
- Fences

## Vegetation Control

- Tractor Mowing
- Hand Mowing
- Brush Cutting
- Spraying Brush, Weeds or Grass
- Trimming and Removing Trees

## Signs and Traffic Control

- Signs
- Traffic Signals
- Railroad Protection Devices
- Reversible Lanes

## Traffic Services and Operations

- Repair or Reset Guardrail
- Clean and/or Paint Guardrail
- Historical Markers
- Traffic Counts
- Highway Lighting
- Holiday Safety Service Patrol

## Snow and Ice Control

- Snow Removal Expendable Equipment
- Standby and Patrol for Snow and Ice Control by
  - State Forces and Equipment
- Standby Time for Snow and Ice Control by Hired Equipment
- Snow Fence
- Other Snow and Ice Control Support
- Snow Removal and Ice Control by State Forces
- Snow Removal and Ice Control by Hired Equipment
- Availability Fee
- Snow Removal Supervision

## Structures

- Repairing Substructures
- Repairing Superstructures
- Minor Repairs to Large Pipe Lines
- Minor Repairs to Box Culverts
- Waterproof Bridge Decks
- Underwater Substructure Investigations

## Drawbridges and Ferries

- Operation of Drawbridges
- Repair Toll Fee Ferries
- Operation of Toll Free Ferries
- Repair Toll Ferries
- Operation of Toll Ferries

## Weigh Stations

- Maintenance of Weighing Stations
- Operation of Permanent Weighing Stations

## Tunnels

- Maintenance of Tunnels
- Operation of Tunnels

## Supervision

Maintenance Replacement Activities

Maintenance replacement is the function of restoring each type of roadway, structure, and facility as near as possible to its condition as constructed.

## General Expense

- Engineering
- Inclement Weather
- Expendable Equipment

## Surface Replacement

- Recondition Non-Hard-Surface Roads
- Recondition Hard-Surface Roads
- Light Bituminous Retreatments
- Heavy Bituminous Retreatments
- Application of Plant Mix
- Repair and/or Replacement of Portland Cement Concrete Pavement Joints
- Portland Cement Concrete Pavement Slab Repairs
- Linseed Oil Treatments

## Shoulders, Turnouts, and Drainage

Reconditioning  
 Bituminous Retreatments  
 Drainage Structures

## Roadside

Major Cut and Fill Washouts and Slides  
 Roadside Structures  
 Major Waysides and Rest Areas  
 Replacement of Right-of-Way Fences  
 Reseeding Mulching, Sodding, and Resoiling  
 Replacement of Guardrail  
 Replacement of Existing Shrubs, Trees, etc.

## Signs

Signs  
 Traffic Signals  
 Highway Lighting  
 Paint Guide Lines  
 Paint Pavement Messages  
 Nonproductive Time

## Structures

Repairing Substructures  
 Repairing Superstructures  
 Waterproofing Bridge Decks  
 Major Repairs to Ferries  
 Repairs and Replacement of Pipe Lines 48" in Diameter  
 or Larger, Including Multi-Plate Pipe

## Weigh Stations

Weighing Stations

## Major Flood Damage Repairs

Roadway Repairs  
 Structure Repairs  
 Toll Free Ferries and Docks  
 Removal of Debris  
 Auxiliary Police Assistance

## Supervision

Incidental Construction

Incidental construction is any operation which changes the type, width, length, location, or gradient of a road, facility, of structure.

## General Expense

- Engineering
- Inclement Weather
- Expendable Equipment

## Right-of-Way

- Engineering
- Land
- Damages
- Buildings
- Fences
- Right-of-Way Markers

## Roadway Construction

- Clearing and Grubbing
- Earthwork, Excavation, Compaction, Including Shoulders  
and Slopes
- Borrow
- Subgrade
- Superelevation of Curves

## Surface and Base

- Admixtures
- Addition of Surface or Base Material
- New Surface or Base Materials
- Straight Bituminous Treatments
- Penetration Treatment or Mixed-in-Place Treatments
- Plant Mix Treatments

## Shoulders and Entrances

- Widening and/or grading
- Stabilizing
- Bituminous Treatments

## Drainage Structures

- Excavation, Cofferdams, Pumping, and Backfilling
- Substructure Including Footings
- Superstructure
- Protective Devices
- Riprap
- Large Pipe Lines Including Large Multi-Plate Pipes
- Box Culverts

## Drainage and Small Drainage Structures

## Structures

- Pipe Culverts Across Roadway
- Pipe Culverts Across Entrances
- Box Culverts and Cattle Passes
- Concrete Curb and Gutter
- Paved or Rubble Masonary Gutters
- Riprap
- Retaining Walls
- Sub-drain, Tile Drains, Channels, etc.

## Traffic and Pedestrian Services

- Guardrail and Guide Posts
- Route Markers, Section Markers, and Signs
- Highway Lighting and Traffic Signals
- Permanent Traffic Lane Stripes
- Sidewalks
- Snow Fences
- Intersection Reconstruction and Channelization
- Civil Defense Signs and Markers
- Ice Detection Devices

## Roadside Development

- Grading, Sloping, and Obliteration of Scars
- Soiling, Seeding and Sodding
- Planting, or Replanting Trees, Shrubs, Care of Existing Vegetation, etc.
- Drainage Channels
- Waysides and Turnouts
- Tree Wells and Walls
- Rustic guard

## Toll Free Ferries and Docks

- Ferries
- Docks, Slips, and Wharves
- Stationary Equipment

## Supervision