

COUNTY ROAD MAINTENANCE AND OPERATION COSTS

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This paper deals with the maintenance and operation costs of the county road system of Frederick County, a typical County in the State of Maryland. Similar conditions exist throughout the State, except in portions of Southern Maryland and the Eastern Shore of Maryland.

Frederick County is made up of a farming area of fertile rolling land through which flows the Monocacy River, one of the larger tributaries of the Potomac River, it being possibly the tributary that empties more silt into the Potomac River than any other. The County is divided into two valleys by the Catoctin Mountain Range, which rises north and south across the County. The rolling hills create an erosion problem which greatly affects our maintenance costs.

The area of Frederick County is 668.7 sq miles, with an average of 1.95 miles of road per sq mile of area. This well-established network of roads totaling in all 1308 miles, exclusive of the 85 miles of streets maintained by the incorporated towns and cities, is made up of 298 miles of State road, 16 miles of Frederick City Water Shed roads and 994 miles of County roads. The maintenance and operation costs of the County roads are being dealt with in this paper.

This 994 mile system of county roads gives the rural farming area access to the markets in the various cities and towns of the County. These roads do not carry an abundance of traffic, the travel for the entire system averages less than 100 vehicles per road section per day. The traffic, however, is essential, being made up of milk and produce trucks, mail delivery, school busses, farmers' and farm laborers' cars and cars of industrial workers who live in the rural areas. The majority of the travel is essential to the farming industry which is the economic backbone

of Frederick County.

The changeover to complete mechanization by the farmer and the overall use of the automobile and truck by all classes has occurred so rapidly that the need for all-weather roads has far surpassed the ability of the various counties to provide them. Schools have been rapidly consolidated, delivery trucks and milk trucks have threaded their way to the remote areas, with the result that every county in the State of Maryland and possibly throughout the Nation, has had thrust upon it the gigantic task of constructing and maintaining a county road system to cope with the mechanized travel. During the past few decades many counties, and Frederick is no exception, have dumped stone, gravel or any available granular material haphazardly on the roads, without thought of grading or correct drainage, in a desperate effort to keep the rural travel moving throughout the year. Many of these rough stone roads were surfaced with macadam by County officials who did not have the benefit of engineering advice, or failed to hear the pleas of the engineer to properly grade and drain the road before placing the finished macadam surfacing. So we come to the topic of the day - the maintenance cost of this typical County road system.

A county must decide first to what extent it should carry out its maintenance. Should the roads be maintained to the satisfaction of all, or should they be maintained adequately to meet the need of the travel on the various roads? We in Frederick County adhere to the latter. We recognize the fact that our road system is not completely maintained since we meet only the basic needs. Much must be left undone even though the traveling public is inconvenienced to a certain degree.

We in Frederick County maintain our road system as economically as possible

and yet try to give the traveling public adequate service. Improved roads and bridges are not allowed to deteriorate even though a limited budget is allowed for maintenance. The Frederick County road system has been under qualified

994 miles is classified into 274 miles of macadam road, 370 miles of stone-surfaced road and 350 miles of unimproved or dirt road. Of the macadam roads approximately 100 miles are obsolete, having been built without

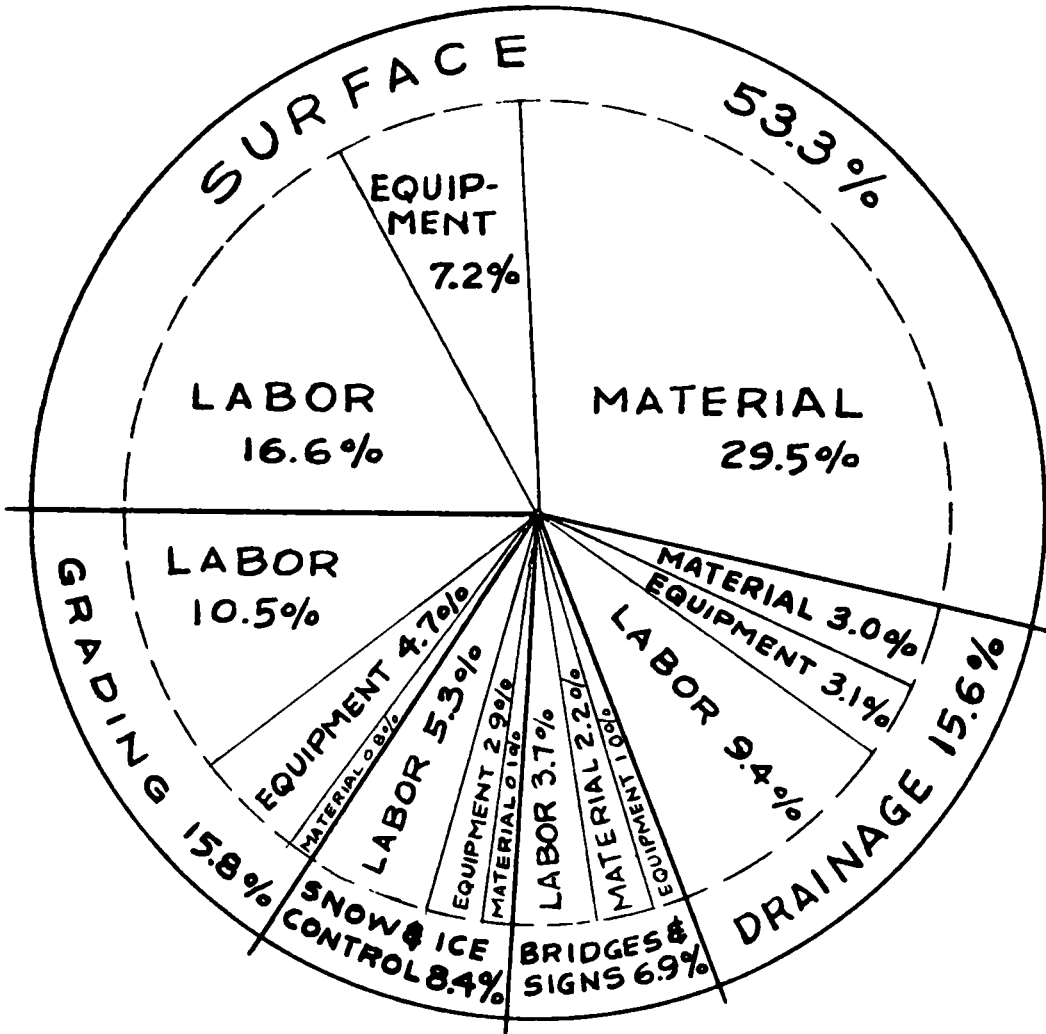


Chart 1. The Maintenance Dollar - Maintenance and Operation Costs of Frederick County, Maryland, County Road System, 1949

engineering supervision for the past ten years with the result that present road construction and maintenance has been in keeping with good engineering principles.

Frederick County's road system of

engineering, and of the stone roads only approximately 65 miles have been properly graded and drained before the stone surface was applied. On the dirt or unimproved roads a sprinkling of stone has been added at many places.

Frederick County is fortunate in having two commercial limestone quarries well located within the County. Some gravel in small quantities is obtained from deposits along the tributaries of the Monocacy and Potomac Rivers. The soil of the County is diversified - a large portion is clay studded with limestone and flint - a section is of red shale formation and the remainder is of a brown shale and chestnut soil, with shale and sandstone rock formations. The soil throughout the County contains many boulders and small stones, which creates a maintenance problem in maintaining the unimproved roads. The loose stones can be gathered together and used as a base on some roads where the soil conditions are bad. This was done to a great extent years ago when labor costs justified the hand knapping of these stones. At present portable crushers are used in the winter months to crush stone ridges and stone piles that have accumulated for generations in clearing the land. These crushers are located far remote from commercial stone plants, and they provide work for the maintenance men when the weather is not fit for regular maintenance work. This helps to keep our organization intact and gainfully employed. The crushed stones are stock piles for future use.

In the year 1948 a total of \$151,979.18 was spent to maintain the 994 mile County road system, or an average cost of \$152.90 per mile.

Maintenance costs are kept for the three types of roads, namely, dirt, stone and macadam. The cost on each of these various types of roads is broken down into surface repairs, drainage, grading, (that is, scraping and shaping the surface and shoulders) bridge repairs and snow removal. Chart 1 shows how the maintenance dollar is spent and proportioned over the various types of operations.

DRAINAGE OF ROADS

Let us first consider drainage on the stone and dirt roads. Equipment plays

a very important role in keeping the maintenance costs at a low level. Table 1 indicates that a large part of the maintenance cost of each operation is equipment. The rising cost of labor as well as the shortage of labor during the war years made it necessary for the County to make use of labor-saving machinery of all kinds. Too much emphasis cannot be placed on the conveyor-type loader that removes debris and silt deposits from the road ditches and deposits it on trucks. It is still necessary, however, to use a blade machine to remove the silt from the ditches and windrow it along the shoulder. The maintenance of ditches and drainage pipes presents the major problem to our maintenance organization. Much stress must be placed on the importance of soil conservation measures as a direct factor in road maintenance. Where strip farming and contour plowing is practiced, along with sodded water ways, diversion ditches and permanent pasture on the steep slopes, a decided decrease is noted in the maintenance costs of roads. The silting of ditches and pipes not only creates a large maintenance cost item in drainage, but also results in a large cost item of surface maintenance to stone and dirt roads when the drainage facilities fail to function and washing of road surfaces results. Road engineers throughout the Nation should lend their support in urging the expansion of soil conservation practices.

The drainage facilities of the stone and dirt roads are periodically cleared in the early spring and again in the fall by use of motor patrol graders and a small group of men. In the spring the clearing of ditches and pipes is done in conjunction with the grading of the road surface. Where excess silt deposit and debris from bushes and trees is abundant it is necessary to remove the material by windrowing it on the road surface with motor patrol graders and loading it on trucks with a conveyor-type loader. Pipe inlets and outlets must be maintained by hand labor. In the fall the leaves from trees in the wooded areas cause an added drainage problem since they become deposited in the ditches and

culvert inlets and outlets. Mowing of the road shoulders and the cutting of bushes is considered a drainage item, and is done periodically.

distributor with hand hose attachment, 5-ton three-wheel road rollers and the necessary stones and chips. The macadam roads are surface-treated

TABLE 1
DRAINAGE

	Macadam Roads		Stone Roads		Dirt Roads	
Labor	\$4,809.51	55.8%	\$3,575.89	68.3%	\$5,930.39	60.6%
Material	\$ 966.62	11.3%	\$ 853.36	16.3%	\$2,773.99	28.3%
Equipment	\$2,838.25	32.9%	\$ 804.95	15.4%	\$1,084.66	11.1%
TOTALS	\$8,614.38	100.0%	\$5,234.20	100.0%	\$9,789.04	100.0%
Cost per Mile	\$31.44		\$14.95		\$26.45	

The maintenance of drainage facilities of the macadam roads is a matter of periodic hand work when the need arises. Silt deposits from the adjoining fields following the heavy rains that are numerous during the summer months make it necessary to clear and remove silt from the drainage ditches frequently, using grading and loading equipment. The extent of this siltation depends upon the degree and type of cultivation in the adjacent fields. Table 1 shows the cost per mile for drainage on the various types of roads and the breakdown of the cost into percentages of labor, equipment and material used.

every four to six years, depending upon the need. From 1/4 to 1/3 gal of cut-back asphalt or light emulsion per sq yd is used, covered with from 20 to 25 lb of limestone chips per sq yd. The cost of this treatment varies from .08 to .12 per sq yd, depending upon the distance necessary to haul the stone chips.

Stone and dirt road surface repairs constitute the adding of stone to fill the holes and replace that which is worn or washed away. The surfaces are bladed periodically and some rolling is done where the volume and type of travel warrant it. Some calcium chloride is

TABLE 2
SURFACING

	Macadam Roads		Stone Roads		Dirt Roads	
Labor	\$11,588.39	24.5%	\$ 4,641.65	24.3%	\$ 8,938.51	61.8%
Material	\$29,933.24	63.3%	\$12,549.57	65.6%	\$ 2,387.95	16.5%
Equipment	\$ 5,791.72	12.2%	\$ 1,937.10	10.1%	\$ 3,141.58	21.7%
TOTALS	\$47,313.35	100.0%	\$19,128.32	100.0%	\$14,468.04	100.0%
Cost per Mile	\$172.67		\$54.65		\$39.10	

SURFACE REPAIRS

Road surface repair is the largest of all the maintenance operations. This covers the spring and fall patching of the macadam roads, which is done by using a cut-back asphalt from an 800-gal tank

used on the more important stone-stabilized roads, an application of 2 lb per sq yd is used. The type of traffic and the volume of traffic govern to a great extent the surface maintenance needs on the unimproved roads. Table 2 shows the cost per mile of surface maintenance on the various types of road and the percentage breakdown of costs.

GRADING COSTS

Grading or the shaping of road surfaces and shoulders is done largely with motor patrol graders accompanied by trucks and men to remove the loose stones that roll to the surface. The unimproved or dirt roads become rutted, especially in the spring and fall

create a continuous maintenance operation of floor repair and replacement. Painting and repairing of walls is also a continuous maintenance operation. The growing tendency toward larger trucks and heavier loads being carried to and from the farms is being looked upon with much concern since most of the bridges are only of H-10 capacity.

TABLE 3

GRADING

	Macadam Roads		Stone Roads		Dirt Roads	
Labor	\$1,024.98	74.5%	\$6,753.38	68.9%	\$ 8,140.87	62.8%
Material	\$ 246.97	17.9%	\$ 735.82	7.5%	\$ 144.75	1.1%
Equipment	\$ 104.62	7.6%	\$2,306.45	23.6%	\$4,675.75	36.1%
TOTALS	\$1,376.57	100.0%	\$9,795.65	100.0%	\$12,961.37	100.0%
Cost per Mile	\$5.02		\$27.98		\$35.03	

seasons when freezing and thawing occurs. The grading operation levels and closes the ruts and reshapes the roads. Stone roads likewise may be affected by frost action and need periodic reshaping.

The edges and shoulders on the macadam roads are bladed when needed. Table 3 shows the cost of grading per mile for the various types of roads and the percentage breakdown of cost.

Even though the bridges are well posted as to their capacity, they too frequently are overloaded and will without doubt create a reconstruction problem in the future.

Snow removal is a variable maintenance operation in Frederick County. The amount of snowfall has been light in the past few years, yet it is necessary to be prepared for the heavy snows that we occasionally have. About 20,000 ft

TABLE 4

MAINTENANCE COSTS FOR TOTAL OPERATION

	Macadam Roads		Stone Roads		Dirt Roads		Bridges		Snow	
Labor	\$17,422.88	30.4%	\$14,970.92	43.8%	\$23,009.77	61.8%	\$ 5,643.76	53.5%	\$ 8,063.95	63.4%
Material	\$31,146.83	54.3%	\$14,173.75	41.4%	\$ 5,306.69	14.2%	\$ 3,410.59	32.3%	\$ 141.91	1.1%
Equipment	\$ 8,734.59	15.3%	\$ 5,048.50	14.8%	\$ 8,901.99	24.0%	\$ 1,489.39	14.2%	\$ 4,513.66	35.5%
TOTAL	\$57,304.30	100.0%	\$34,193.17	100.0%	\$37,218.45	100.0%	\$10,543.74	100.0%	\$12,719.52	100.0%
Cost per Mile	\$209.13		\$97.69		\$100.59		\$10.60		\$12.80	

BRIDGE MAINTENANCE AND SNOW AND ICE CONTROL

Although there are nearly 350 bridges on the County road system, varying from small steel-beam bridges to large truss bridges, the average cost of \$10.60 is not excessive. Practically all of the bridges have plank decks which

of snow fence is erected along the primary County roads. All trucks, motor patrols and tractors are equipped with snow plows for immediate use if needed.

Ice control costs usually exceed the actual snow removal costs. Table 4 shows the cost per mile as well as the breakdown percentages of the costs.

In summarizing, it has been shown that the total maintenance cost of the County Road System is broken down into: 45.5 percent labor, 35.6 percent material and 18.9 percent equipment costs.

The total costs per mile including the average bridge and snow removal costs are - macadam, \$232.54 - stone, \$121.09 - dirt, \$123.99.

The maintenance cost per mile of stone road and unimproved or dirt is about the same, while that of macadam is slightly less than double the costs of the unimproved road. So we recognize the fact that as we gradually construct

more new roads and our road system becomes more highly developed our road maintenance costs will increase rapidly. As our maintenance costs increase our construction program will become smaller and smaller, since there will be less money left for construction work after the maintenance budget has been fulfilled. In order to meet the public demand for a county road system in keeping with present-day travel, there must be an increase in the funds made available for county road construction and maintenance, and this increase cannot justly be derived from local property tax.