# A Statistical Analysis Of Rural Road Costs

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● THIS PAPER describes and illustrates the application of a statistical technique to a problem of highway administration. The detailed findings of the investigation used as an illustration in this paper have been reported elsewhere (*1, 2*); hence methodology will receive primary emphasis here.

The particular relationship to be discussed is the effect of size of highway administrative unit on per-mile costs. This relationship is of interest for purposes of predicting the likely effect on per-mile costs of changes in the size of administrative units currently operating.

Several alternative methods exist for studying this cost-size relationship. It is not presumed that this enumeration is exhaustive. In the synthetic approach method, budgets of costs would be determined for hypothetical administrative units of various sizes. Costs should be based on a detailed specification of machinery and equipment, performance rates, labor and materials, and other physical data upon which costs depend. An attempt might be made to develop an optimum organization for each size of unit. Thus, comparisons would not be made, for example, between an efficient unit of one size and an inefficient unit of another size. Cost comparisons might also be made of units at average levels of efficiency. The principal advantage of the synthetic method is that, in a sense, it permits control of factors other than size which are likely to affect costs if the relationship of actual units is studied. On the other hand, the demands for technical planning data in this method are great. Considerable judgment needs to be exercised in developing the machinery, equipment, labor, and materials requirements for units of various sizes. A detailed study of several units in actual operation would be useful as a guide in this approach.

If the increase in size of certain administrative units has taken place recently, a comparative study of the costs before and after reorganization is a second method by which insights into the effect of size on costs might be gained. This method has the advantage of studying units in actual operation and thereby discovering problems involved in transition to larger units. However, if changes in size have not taken place recently, the adjustment of the previous costs to reflect price changes and technological developments might prove to be difficult. Further, one may wish to study a rather large sample of units that had undergone such a change in size. This may require waiting until more units have increased in size. If a study of the effect of size on costs is to be of maximum usefulness, it should form the basis for evaluating the desirability of the formation of larger units and not simply record what has happened historically.

As contrasted to the synthetic method and the study of units that have actually changed in size, knowledge may be gained of the cost-size relationship by relying on statistical control and studying a large number of units. In this statistical method, the dominant variables selected for observations are apt to be fewer than in an intensive study of a few units. Funds are usually not available to study operational procedures such as kind and size of equipment, and amount of use for a very large sample of units. Even with high-speed data-processing facilities, considerable cost may be incurred in obtaining the original data.

The remainder of this paper deals with the application of statistical methods to the study of local rural road costs in Illinois. Illinois has three systems of rural

TABLE 1
AVERAGE MILEAGES OF RURAL ROADS ADMINISTERED BY LOCAL ROAD UNITS IN ILLINOIS, 1953

| Type of surface | State Highway Districts[a] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9[b] | State |
| | (miles) | | | | | | | | | |
| Unimproved | 0.41 | 0.53 | 0.44 | 0.36 | 0.39 | 1.28 | 2.79 | 0.73 | 4.75 | 1.12 |
| Graded and drained earth | 2.69 | 3.03 | 6.21 | 6.11 | 6.11 | 6.61 | 14.29 | 7.05 | 10.40 | 6.84 |
| Soil surfaced, primarily oil | 0.01 | 2.40 | 0.31 | 0.01 | 16.29 | 11.72 | 5.02 | 12.04 | 0.47 | 5.69 |
| Gravel or stone | 36.74 | 30.44 | 40.61 | 36.45 | 34.30 | 26.73 | 34.89 | 22.89 | 47.15 | 33.76 |
| Bituminous (low type) (flex-base) | 5.60 | 1.20 | 0.59 | 0.19 | 0.89 | 0.40 | 0.09 | 0.03 | 0.05 | 0.88 |
| Bituminous (high type) (solid-base) | 0.01 | 0.01 | [c] | 0.03 | 0.03 | [c] | [c] | [c] | [c] | 0.01 |
| Concrete | 0.06 | 0.04 | 0.01 | 0.05 | 0.12 | 0.03 | 0.02 | 0.14 | 0.15 | 0.06 |
| Brick | [c] | 0.01 | 0.01 | 0.02 | 0.14 | 0.01 | [c] | 0.01 | 0.02 | 0.02 |
| Total | 45.52 | 37.66 | 48.18 | 43.22 | 58.27 | 46.78 | 57.10 | 42.89 | 62.99 | 48.38 |
| Number of local road units | 119 | 202 | 202 | 173 | 176 | 182 | 179 | 166 | 94 | 1,493 |

[a] See Fig. 1. Highway district 10 (Cook County) is omitted since interest is in rural roads. In the remaining highway districts, units which are coterminous with municipalities have also been omitted.
[b] Includes five local road units, each comprising an entire county.
[c] Less than 0.005 mile.

highways: (1) state primary system, (2) state-aid or county system, and (3) the local system. In terms of mileage, the primary system comprises 10 percent of the total rural highway mileage, the county system 18 percent, and the local system 72 percent (*3*). In 1953, the local system was administered by 1,515 local administrative units.[1] Approximately 30 percent of these units each had less than 40 miles to administer; 6 percent of the units each had less than 20 miles. In 1953 the average size of the road system administered by these units was 48 miles. In each of the following four counties the voters have acted under existing statutes to reorganize smaller administrative units into an administrative unit comprising the area of a county: Hardin, Massac, Pulaski, and Williamson. In Alexander County the entire area outside of Cairo is in one road district.

The rural roads under local control consist primarily of gravel roads (Table 1). Oil roads are important in State Highway Districts 5, 6, and 8 (Figure 1). Graded and drained earth roads comprise 25 percent of the total mileage in District 7. Adequacy of the present system may be better judged, however, by the number of farms located on each type of road. Classifying the roads upon which Illinois farms are located into two classes, (1) hard surface and gravel and (2) dirt or unimproved, 12 percent of the farms in Illinois were located on dirt or unimproved roads in 1949 (*4*). In 1939, 28 percent of the farms in Illinois were located on dirt or unimproved roads. However, the total number of farms decreased during this 10-year period about 8 percent. Accordingly, the need for at least some of these roads has diminished.

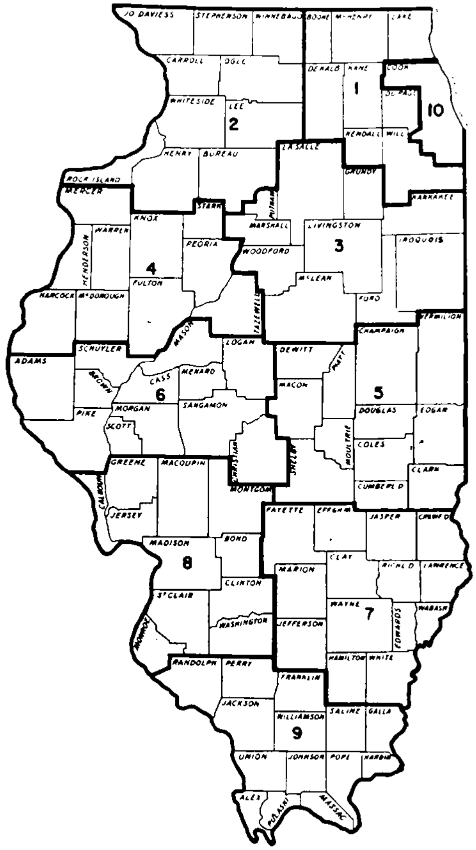


**Figure 1. The highway districts into which road administrative units were grouped. Because this study is concerned only with rural-road systems, District 10 (Cook County) is omitted from the analyses.**

## ANALYSIS OF DATA

Although the effect of size on costs might theoretically be studied best by division of costs into "fixed" and "variable," in an empirical study the cost classification is likely to be governed by the nature of the data available. The Division of Highways, State of Illinois, collects receipts and expenditures data from government units administering local roads. Costs reported for each of these units for the fiscal year 1953-54 were divided into three categories: maintenance, administration, and construction. Maintenance costs include all direct labor involved in maintenance operations, operating expenses, and the share of machinery and equipment overhead costs not charged to construction. Administration costs reported are composed chiefly of the commissioner's salary. Construction project descriptions and cost data were obtained from reports submitted to the

[1] Counties with the township form of government had 1,408 townships; counties with the commission form of government had 107 road districts.

Division of Highways in connection with the administration of the motor fuel tax funds. The Division of Highways also made available road mileage data collected in cooperation with the Bureau of Public Roads of the Department of Commerce. The miles of each type of road surface in each local road administrative unit as of December 31, 1953, were obtained. The average number of miles of each surface type per administrative unit is presented in Table 1.

The central problem in analysis is one of isolating, insofar as possible, the relationship between per-mile costs and mileage administered by the unit. Other factors that may be operative in causing differences in per-mile costs among units are differences in types of road administered, amounts of construction, physical characteristics of the soil, topography, snow fall, frost action, availability of local materials, wage rates, and taxable resources. There are other factors relating to operational efficiency which cannot be appraised from the secondary data utilized in this study. For example, units with the same mileage to administer and operating under similar conditions may have different costs due to differences in managerial ability of the administrative personnel.

To aid in minimizing the effect on costs of factors associated with location, such as physical characteristics of the soil, topography, and snow fall, the local road administrative units were first grouped into the state highway districts (Figure 1). The costs of administrative units in each highway district were then studied separately. Grouping into highway districts also reduced the effect of differences among units with respect to wage rates and cost of construction and maintenance materials.

Division of costs into maintenance, administration, and construction also aided in isolating the relationship between per-mile costs and mileage administered by the unit. By performing a separate analysis on construction costs, the cost differences among units due to different mileages of construction in 1953 were taken into account.

After grouping local administrative units into state highway districts and classifying costs, the multiple regression technique (*5*) was employed to estimate the relationships between per-mile costs and mileages administered by the units. In developing the mathematical model of the cost function it was necessary to take into account the fact that the accounting system had not allocated costs to each type of road maintained by the unit. Since administrative units have the eight types of roads (Table 1) in varying proportions and costs vary depending on the surface, consideration of the mileage of each type of road permitted a more accurate evaluation of the cost relationship than if an aggregate of simply "miles" had been employed. Furthermore, since a preliminary analysis indicated that taxable resources were related to per-mile costs, assessed valuation was included as a variable. Inclusion of assessed valuation tended to insure that the effect of mileage on costs was a net effect. That is, it aided in preventing distortion of the estimated per-mile cost relationships if the wealthier administrative units, which typically spent more on their roads, also consistently had either low or high mileages of roads to administer.

A maintenance cost function and an administration cost function for each highway district were determined by choosing constants $a$, $b_i$, and $c$ in such a fashion as to minimize

$$\sum_j (Y_j - a - \sum_i b_i X_{ij} - cZ_j)^2 \qquad (1)$$

in which

$Y_j$ = total maintenance or administration cost of the $j$th administrative unit;

$X_{ij}$ = number of miles of the $i$th type of road in the $j$th administrative unit ($i = 1, 2, 3, \dots 8$; see Table 1); and

$Z_j$ = assessed valuation of the $j$th administrative unit.

If the value of $a > o$, a downsloping average (per mile) maintenance or administration cost curve results. If $a=o$ then average maintenance or administration costs are estimated to be constant throughout the range of observations.

The following cost equations based on 177 local road administrative units ($j=177$) in Highway District 7 illustrate the procedure of estimating costs:

$$\begin{aligned} Y_m = -328 &+ \underset{(119.07)}{191.85}X_1 + \underset{(28.52)}{29.43}X_2 + \underset{(34.41)}{93.18}X_3 \\ &+ \underset{(16.74)}{71.39}X_4 + \underset{(470.53)}{278.16}X_5 - \underset{(11063)}{6930}X_6 \\ &- \underset{(1358)}{1010}X_7 - \underset{(12994)}{3865}X_8 + \underset{(0.051)}{0.481}Z \end{aligned} \tag{2}$$

$$\begin{aligned} Y_a = 273 &+ \underset{(24.224)}{67.845}X_1 + \underset{(5.819)}{0.869}X_2 + \underset{(7.019)}{24.292}X_3 \\ &+ \underset{(3.413)}{22.081}X_4 + \underset{(95.9)}{42.5}X_5 + \underset{(2246.9)}{2942.4}X_6 \\ &+ \underset{(276.8)}{319.6}X_7 + \underset{(2637.1)}{465.1}X_8 + \underset{(0.010)}{0.046}Z \end{aligned} \tag{3}$$

in which

$Y_m$ = maintenance cost, in dollars;
$Y_a$ = administration cost, in dollars;
$X_1$ = unimproved roads, in miles;
$X_2$ = graded and drained earth roads, in miles;
$X_3$ = soil surfaced, primarily oil roads, in miles;
$X_4$ = gravel or stone roads, in miles;
$X_5$ = bituminous (low type) roads, in miles;
$X_6$ = bituminous (high type) roads, in miles;
$X_7$ = concrete roads, in miles;
$X_8$ = brick roads, in miles; and
$Z$ = assessed valuation, in \$1,000.

The number in parenthesis immediately below each regression coefficient is the standard error of the regression coefficient.

To find the average variable maintenance or administration cost per composite mile, each of the regression coefficients corresponding to a road mileage variable ($X_1$ through $X_8$) is multiplied by the average percentage of that particular type of road in Highway District 7 (Table 1). For the maintenance cost equation: (191.85) (4.889%) + (29.43) (25.017%) + . . . −(3865) (0.003%) = \$68.26 is the average variable maintenance cost per composite mile. To determine the total fixed maintenance cost per composite mile the assessed valuation $Z$ is assumed to be at its mean value, \$4,030,000. Multiplying this value by the regression coefficient for $Z$ and adding the constant (−328), \$1,610 is the fixed maintenance cost.

An identical procedure is followed with Eq. 3 to obtain average variable administration costs and total fixed administration costs. For Highway District 7 these values are \$19.50 and \$458, respectively. The fixed maintenance cost of \$1,610 added to the administration costs of \$458 gives \$2,068. The variable maintenance cost of \$68.26 added to the administration costs per composite mile, \$19.50, totals \$87.76. The total cost per composite mile may then be computed for any mileage within the range of the observations. For example, the cost per mile of a 20-mi unit would be \$2,068 ÷ 20 + \$87.76 = \$191.16 (Table 2).

Construction costs were also estimated by the multiple regression procedure. As an example, the 106 projects in Highway District 7 involving the application of gravel to a surface of graded and shaped gravel or crushed stone, give the following equation:

$$Y_c = -4086 + \underset{(158)}{2413}X_1 + \underset{(72)}{116}X_2 + \underset{(176)}{1160}X_3 \tag{4}$$

in which

$Y_c$ = construction cost, in dollars;
$X_1$ = length of project, in miles;
$X_2$ = width of surface applied in feet; and
$X_3$ = depth of surface applied in inches.

TABLE 2

MAINTENANCE AND ADMINISTRATION COSTS PER MILE[a] OF LOCAL RURAL ROADS IN ILLINOIS, 1953

| Size of local road unit (miles) | State Highway District | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | State[b] |
| 10 | $722 | $341 | $375 | $383 | [c] | $547 | [c] | $300 | [c] | — |
| 20 | 540 | 295 | 353 | 287 | $325 | 351 | $191 | 236 | $199 | $303 |
| 30 | 480 | 280 | 346 | 254 | 296 | 285 | 157 | 215 | 147 | 269 |
| 40 | 450 | 272 | 342 | 238 | 282 | 252 | 140 | 205 | 120 | 253 |
| 50 | 431 | 267 | 340 | 228 | 273 | 233 | 129 | 198 | 105 | 243 |
| 60 | 419 | 264 | 338 | 222 | 268 | 220 | 122 | 194 | 96 | 236 |
| 70 | 410 | 263 | 337 | 217 | 264 | 210 | 117 | 191 | 88 | 231 |
| 80 | 404 | [c] | 337 | 214 | 261 | 203 | 113 | 188 | 82 | — |
| 90 | 399 | — | 336 | 212 | 259 | 198 | 111 | 187 | 79 | — |
| 100 | 395 | — | 335 | [c] | 256 | 194 | 108 | [c] | 74 | — |
| 110 | 391 | — | [c] | — | 255 | 190 | 107 | — | 72 | — |
| 120 | 389 | — | — | — | 253 | [c] | 105 | — | 69 | — |
| 130 | [c] | — | — | — | 253 | — | [c] | — | 68 | — |
| 150 | — | — | — | — | [c] | — | — | — | 65 | — |
| 200 | — | — | — | — | — | — | — | — | 59 | — |
| 300 | — | — | — | — | — | — | — | — | 54 | — |
| 400 | — | — | — | — | — | — | — | — | 51 | — |
| 500 | — | — | — | — | — | — | — | — | 49 | — |
| 600 | — | — | — | — | — | — | — | — | 49 | — |
| Number of local road units used to estimate maintenance and administration costs | 119 | 202 | 202 | 173 | 176 | 182 | 177[d] | 166 | 94 | 1,491 |

[a] A mile in each district is a composite of the eight types of road surfaces in the same average proportion as reported in that highway district (Table 1).

[b] Costs for each highway district weighted by the total number of miles in that district. State average costs computed only for mileages within the range of mileages of all districts.

[c] Average costs were not computed for local road units with fewer miles or more miles than any unit in that particular highway district.

[d] Two local road units had incomplete reports; total number of local road units in highway district 7 is 179.

At the average width (13.17 ft) and average depth of surface (3.10 in.) for this group of projects, the total fixed costs are (116) (13.17) + (1160) (3.10) - 4068 = \$1,038. Using the coefficient of $X_1$, \$2,413, as the variable cost per mile of road constructed, the total cost per mile for mileages within the range of data may be estimated by dividing total fixed cost by the mileage and adding \$2,413 (Table 3).

The cost equations had the following multiple correlation coefficients; all are statistically significant at the one percent level of probability:

| Highway Dist. | Cost Equations Maint. | Adm. | Const. |
|---|---|---|---|
| 1 | 0.93 | 0.74 | 0.80 |
| 2 | 0.90 | 0.71 | 0.71 |
| 3 | 0.79 | 0.60 | 0.70 |
| 4 | 0.61 | 0.66 | 0.81 |
| 5 | 0.84 | 0.66 | 0.98 |
| 6 | 0.91 | 0.73 | 0.79 |
| 7 | 0.76 | 0.66 | 0.84 |
| 8 | 0.81 | 0.74 | 0.93 |
| 9 | 0.92 | 0.78 | 0.79 |

In essence, the multiple regression technique is an averaging process which summarizes the effects of, in this case, mileage on road costs after taking into account other variables. The technique also yields a measure of the degree of confidence which might be placed in the estimated cost relationship. When the multiple correlation coefficient is squared, the resulting figure is the percent of variation in total cost among road units that is "explained" by the variables considered. For example, in Highway District 1, 86 percent ($0.93^2$) of the unit-to-unit variability in maintenance costs was accounted for by mileage and assessed valuation. On the other hand, only 55 percent ($0.74^2$) of the variability in administration costs among units in District 1 was accounted for by these same variables.

The existence of "unexplained" variation means that increasing size of administrative unit is not likely to be the only avenue for lowering per-mile costs. The multiple regression technique may furnish a starting point for a more detailed comparative analysis which might indicate other factors operative in affecting costs. The cost functions could be used to determine for a given unit an "average" cost adjusted for such factors as mileage of each type of road and assessed valuation. This average cost may be determined by substituting the actual mileages and assessed valuation of the unit considered in the cost function and solving for the adjusted average cost for this unit. For example, suppose a unit in Highway District 7 has 15 miles of oil roads $X_3$, 20 miles of gravel or stone roads $X_4$, and has an assessed valuation, $Z$, of \$5,000,000. The adjusted average maintenance cost for this unit would be: (93.8) (15) + (71.39) (20) + (0.481) (5,000) −328 = \$4,902.50.

If this particular unit had a maintenance cost substantially above or below this adjusted average, further study of this road unit might be useful. The analysis could be extended to determine a group of road units that appear to be successful in terms of having actual costs less than their respective adjusted averages. The important point here is that the multiple regression analysis may be a useful preliminary tool in determination of detailed factors causing cost variation among units. Computation of adjusted average costs was not performed in the study discussed here.

## RESULTS

Although per-mile maintenance and administration costs were estimated separately, the results (Table 2) show only the relation of the sum of per-mile maintenance and administration cost to mileage. Maintenance costs were generally about four times as large as administration costs irrespective of the mileage of the administrative unit. For the state average, maintenance costs comprised 82 percent of the total of maintenance and administration costs for units administering 20 miles, and 85 percent for units of 70 miles.

The pattern of decreasing per-mile costs with increased mileages administered by the unit is evident in each state highway district. However, the per-mile costs decrease at a decreasing rate; the cost reductions are greatest in the increases from the lower mileages.

TABLE 3
CONSTRUCTION COSTS PER MILE OF GRAVEL APPLIED TO GRADED AND SHAPED GRAVEL OR CRUSHED STONE USING DAY LABOR IN ILLINOIS, 1953[a]

| | State Highway District | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | State[b] |
| Number of projects | 71 | 48 | 117 | 98 | 32 | 40 | 106 | 48 | 21 | 581 |
| Average width (feet) | 17.48 | 15.27 | 15.01 | 13.41 | 14.72 | 14.10 | 13.17 | 13.12 | 12.95 | 14.42 |
| Average depth (inches) | 5.68 | 5.23 | 4.67 | 4.19 | 4.06 | 3.95 | 3.10 | 3.77 | 3.95 | 4.29 |
| Average length (miles) | 1.38 | 1.73 | 2.54 | 1.51 | 1.75 | 1.37 | 1.73 | 1.65 | 1.40 | 1.77 |
| | | | | | *Cost Per Mile* | | | | | |
| Length of project (miles) | | | | | | | | | | |
| 0.5 | $4,356 | $4,280 | $5,044 | $4,780 | $6,010 | $5,098 | $4,490 | $3,714 | $6,760 | $4,759 |
| 1.0 | 3,700 | 3,643 | 3,349 | 3,486 | 4,033 | 3,831 | 3,452 | 3,198 | 5,834 | 3,606 |
| 1.5 | 3,481 | 3,431 | 2,784 | 3,054 | 3,374 | 3,409 | 3,105 | 3,025 | 5,525 | 3,221 |
| 2.0 | 3,372 | 3,325 | 2,502 | 2,839 | 3,045 | 3,198 | 2,933 | 2,939 | 5,370 | 3,029 |
| 2.5 | 3,306 | 3,261 | 2,332 | 2,709 | 2,847 | 3,072 | 2,828 | 2,888 | 5,278 | 2,914 |
| 3.0 | 3,262 | 3,219 | 2,219 | 2,623 | 2,715 | 2,987 | 2,759 | 2,853 | 5,216 | 2,837 |
| 3.5 | 3,231 | 3,189 | 2,139 | 2,561 | 2,621 | c | 2,710 | 2,828 | c | — |
| 4.0 | c | 3,166 | 2,078 | 2,515 | 2,551 | — | 2,673 | 2,810 | — | — |
| 4.5 | — | 3,148 | 2,031 | c | 2,496 | — | 2,644 | 2,796 | — | — |
| 5.0 | — | 3,134 | 1,993 | — | 2,452 | — | c | c | — | — |
| 5.5 | — | 3,122 | 1,962 | — | 2,416 | — | — | — | — | — |
| 6.0 | — | c | 1,937 | — | 2,386 | — | — | — | — | — |
| 6.5 | — | — | 1,915 | — | 2,360 | — | — | — | — | — |
| 7.0 | — | — | 1,896 | — | 2,339 | — | — | — | — | — |
| 7.5 | — | — | 1,880 | — | 2,320 | — | — | — | — | — |
| 8.0 | — | — | 1,866 | — | 2,303 | — | — | — | — | — |
| 8.5 | — | — | 1,854 | — | 2,289 | — | — | — | — | — |
| 9.0 | — | — | 1,843 | — | c | — | — | — | — | — |
| 9.5 | — | — | 1,833 | — | — | — | — | — | — | — |
| 10.0 | — | — | 1,824 | — | — | — | — | — | — | — |

[a] Construction performed with equipment and personnel of local road administrative unit with necessary additional labor hired by the day.

[b] Costs for each highway district weighted by the number of projects in that district. State average costs computed only for mileages within the range of all highway districts.

[c] Average costs were not computed for projects smaller or larger than any project in that particular highway district.

The construction costs per mile (Table 3) are for the most common type of construction — gravel applied on graded and shaped gravel or crushed stone. The costs presented assume construction of different mileages at the average width and thickness shown for the particular state highway district considered or, in the right hand column, for the state.

## APPLICATION OF FINDINGS

That per-mile costs should decrease with larger units is, of course, not surprising. The magnitude of the per-mile cost decrease is, however, the factor that needs to be weighed carefully against such factors as "home rule" in considering the desirability of enlarged local administrative units. The costs reported here are suggestive of the amount of expected savings from a system of larger units.

The evidence is rather compelling in regard to the cost reductions up to 60 or 70 miles; approximately 20 percent of the local road units have over 60 miles of roads. A comparison of the costs (using state average figures from Tables 2 and 3) of one 60-mi unit, two 30-mi units, and three 20-mi units will suggest the amount of savings from a system of larger units. Assuming that 5 percent of the total mileage is new construction of gravel applied to a previous gravel surface, costs are as follows:

| | One 60-mi unit | Two 30-mi unit | Three 20-mi unit |
|---|---|---|---|
| Maintenance and administration costs (60 miles) | $14,160 | $16,140 | $18,180 |
| Construction costs (3 miles) | 8,511 | 9,663 | 10,818 |
| Total | $22,671 | $25,803 | $28,998 |

The expected cost saving by consolidating two 30-mi units into one 60-mi unit is about 12 percent; by consolidating three 20-mi units, about 22 percent.

The five county-wide administrative units are all located in Highway District 9. However, only one of these units has over 400 miles. Of the total of 94 units in Highway District 9, only 11 have over 100 miles of roads to administer. Consequently, it is not believed that adequate experience is present for drawing inferences regarding the magnitude of cost reductions resulting from consolidation into county units.

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