SOPKOWSKI

# RESEARCH STUDY OF MAINTENANCE OF HIGHWAYS IN OKLAHOMA


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1968


PREPARED BY
OKLAHOMA HIGHWAY DEPARTM
RESEARCH & DEVELOPMENT DIVISION
IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATIO
FEDERAL HIGHWAY ADMINISTRATION
BUREAU OF PUBLIC ROADS

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PURPOSE

The purpose of this project is to develop proper consideration of maintenance cost in the design and construction process, to develop required maintenance standards, and to develop a method of estimating required maintenance funds on a long-range basis.

BACKGROUND AND SCOPE

The Oklahoma Department of Highways has divided the state into eight field divisions for control and supervision of maintenance and construction.

All highways on the State Highway System are divided into control sections varying in length from 0.5 to approximately 40.0 miles. Maintenance section numbers were used before 1953 and were subject to change from year to year. The present control section numbering system was established in 1953. Each control section is assigned a control section number and is divided into subsections by type and width of pavement and shoulders. Each subsection has a subsection number which shows its distance from the beginning of the control section.

Subsection numbers are used as referenced for the highway extents under study. Where possible, the subsections and the original construction projects were the same.

During the fiscal year July 1, 1964, to June 30, 1965, 11,766 miles of federal and state highways were being maintained. The types of construction and the miles of each were:

| Code | Type of Construction | Interstate Miles | Other 4-Lane Miles | 2-Lane Miles |
|---|---|---|---|---|
| 0001 | Unimproved | None | None | 1.0 |
| 0002 | Earth | None | None | 20.2 |
| 0010 | Graded and Drained | 60.0 | None | 34.9 |
| 1000 | Soil Surfaced | None | None | 53.7 |
| 2000 | Gravel Surfaced | None | None | 741.2 |
| 3000 | Asphalt Surfaced -1" thick | None | None | 4635.4 |
| 4000 | Asphalt Surfaced +1" thick | 0.2 | None | 1632.3 |
| 5000 | Asphalt Penetration | None | None | 18.3 |
| 6000 | Bituminous Concrete Surface | 219.5 | 139.5 | 2039.7 |
| 7000 | Portland Cement Concrete | 107.7 | 157.1 | 1871.8 |
| 8000 | Brick Surface | None | None | 7.1 |
| 9000 | Combination | None | None | 26.5 |
| | TOTAL | 387.4 | 296.6 | 11,082.1 |

Certain types of construction are more predominant in one division than in another.

The basic approach chosen to accomplish the purpose was to analyze maintenance cost records. Maintenance costs are recorded by class, operation, and category. The classes and operations are as follows:

| CLASS | OPERATION |
|---|---|
| 1. Roadway Surface | 1. Patching, sanding, spot sealing, etc.<br>2. Blading, scarifying, reshaping, etc.<br>3. Joints and cracks.<br>4. Mud-jacking.<br>5. Resurfacing.<br>6. Armor coating. |
| 2. Shoulders and Side Approaches | 7. Patching, blading, reshaping, etc.<br>8. Seeding, sodding, planting.<br>9. Stabilizing. |
| 3. Roadside | 10. Repairing cuts, fills, slopes, drainage.<br>11. Retaining walls, rip-rap, fences, etc.<br>12. Mowing.<br>13. Cutting brush, removing trash.<br>14. Heavy grading. |
| 4. Traffic Services | 15. Traffic lines.<br>16. Signs and markers.<br>17. Guardrails and guideposts.<br>18. Roadside parks<br>19. Watchmen, road magnet, pull traffic detour, etc. |
| 5. Emergency | 20. Snow and ice removal, snow fences, sanding, etc.<br>21. Disaster work, floods, remove debris, washouts. |
| 6. Structures Under 20 ft. | 22. Cleaning and repairing culverts.<br>23. Installing culverts. |
| 7. Structures Over 20 ft. | 24. Cleaning and repainting.<br>25. Repairing bridges and underpasses.<br>26. Bank protection, jetties, drift removal. |
| | 27. Maintenance General Expense. |

Each charge is further broken down to one or more of the categories:

1. Labor Expense
2. Material Expense
3. Equipment Rental
4. Other Expense

Cost records are kept separately for two major maintenance classifications--routine and special. Routine maintenance covers normal requirements and is performed by county (district) maintenance crews. Special maintenance covers extraordinary heavy maintenance work performed either by special division crews or by contract.

## SELECTION OF THE SAMPLE

Originally more than 200 subsections consisting of over 1500 miles of highways were chosen from across the state. These were chosen to vary by construction type, traffic volume, and age. Primary consideration in choosing the sample was given to availability of maintenance and construction records. Therefore, the sample was neither random nor representative.

One mile was randomly chosen from each subsection to be observed annually to determine the amount of routine and special maintenance required to bring the mile to its original constructed or reconstructed condition.

The sample that was analyzed in detail consisted of the following:

| Const. Code | Type of Construction | # of Subsections | Range as of 1964 Age | Range as of 1964 ADT |
|---|---|---|---|---|
| 2000 | Gravel Surfaced | 5 | 7-33 | 75-400 |
| 3000 | Asphalt Surfaced -1" thick | 18 | 0-17 | 75-2700 |
| 4000 | Asphalt Surfaced +1" thick | 12 | 3-33 | 475-3000 |
| 6000 | Bituminous Concrete Surface | 23 | 3-15 | 800-6400 |
| 7000 | Portland Cement Concrete | 20 | 1-38 | 475-7700 |

The sample was drawn from four divisions and the costs from the years 1957-1964 represented 530 years of maintenance operation.

## COLLECTION OF THE DATA

Detailed maintenance costs were compiled by operation and category for the years 1957 through 1964. Both routine and special maintenance costs were collected. Prior to 1957, costs were recorded only by operation; hence, category breakdowns were not available. Both construction and maintenance costs were updated to a 1964 basis by use of BPR cost trends. When a subsection had been reconstructed, its construction cost was taken as

$$C = \left[\frac{i_r}{2i_c} C_o + C_r\right] \frac{i_b}{i_r}$$

Where $C$ = Updated Construction Cost
$i_c$ = Composite Index for Year of Original Construction
$i_r$ = Composite Index for Year of Reconstruction
$C_o$ = Original Construction Cost of Roadway
$C_r$ = Actual Cost of Reconstruction
$i_b$ = Composite Index for Base Year (1964)

For the case where no reconstruction has occurred the equation is

$$C = \frac{i_b}{i_c} C_o$$

A search was made for factors that might affect maintenance costs. These were then codified and the associated data gathered. The final list of factors and their method of representation follows:

MAINTENANCE DESIGN CODING FACTORS

1. Surface Type

   1 = P. C. Concrete
   2 = Asphaltic Concrete
   3 = Rock Asphalt
   4 = Mixed Bituminous (oil mat)
   5 = Double Bituminous
   6 = Single Bituminous
   7 = Gravel
   8 = Soil

2. Surface Width - in feet

3. Surface Thickness - in inches

4. Surface Base Type

   1 = Old P. C. Concrete
   2 = Black Base
   3 = HMSA
   4 = SABC
   5 = Soil Cement
   6 = Soil Asphalt
   7 = Sand Cushion or Good Subgrade
   8 = Fair Subgrade
   9 = Poor Subgrade

5. Surface Base Width[1] - in inches

6. Surface Base Thickness[2] - in inches

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[1] A subgrade base or subbase width is represented as the width of the surface, as is a base or subbase with a homogeneous thickness throughout.

[2] In the case of a subgrade representation for base or subbase, the combined thickness of the subgrade represented as base or subbase will equal 2 feet.

7. Subbase Type

   1 = 306 Special Subbase
   2 = 306 Subbase or Sand Cushion or Good Subgrade
   3 = Select Material or Fair Subgrade
   4 = Poor Subgrade

8. Subbase Width[1] - in feet

9. Subbase Thickness[2] - in inches

10. Shoulder Type - same rankings as 1.

11. Shoulder Surface Width - in feet

12. Shoulder Base Type - same rankings as 4.

13. Shoulder Base Width - in feet

14. Shoulder Base Thickness[2] - in inches

15. Shoulder Subbase Type - same rankings as 7.

16. Shoulder Subbase Width - in feet

17. Shoulder Subbase Thickness[2] - in inches

18. R/W Width - in feet

19. Median Width[3] - in feet

20. Construction Type Code - based on Department of Commerce codes for highway improvements.

21. ADT - based on 1964 traffic surveys

22. % Heavy Commercial - based on 1964 ATR & Vehicle Classification Surveys

23. Age = 1964 - (year that 1964 construction type code was acquired)

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[1] A subgrade base or subbase width is represented as the width of the surface, as is a base or subbase with a homogeneous thickness throughout.

[2] In the case of a subgrade representation for base or subbase, the combined thickness of the subgrade represented as base or subbase will equal 2 feet.

[3] Applicable to 4-lane only.

24. General Topography

    1 = Flat
    2 = Rolling
    3 = Hilly

25. Subgrade Soil Texture

    1 = Sand
    2 = Loam
    3 = Clay Loam
    4 = Clay

26. Geology Type (subgrade suitability)

    1 = Good
    2 = Fair
    3 = Poor

27. Construction Cost Per Mile - to nearest dollar (see page 3)

28. # of Signs and Markers - actual count on random mile as of 1964.

29. Linear Feet of Guard Rail - measured on random mile (1964)

30. # of Guide Posts & Delineators - counted on random mile (1964)

31. Wet-Dry Cycles - Total # for 10-year period (from weather map, Oklahoma Flexible Paving Research Project, Oklahoma Highway Department, 1962.)

32. Mean # of Days Below $32^{o}$ - mean # per year for 10-year period 1951-1960 (U.S. Weather Bureau Climatology Data)

33. Mean # of Days Above $90^{o}$ - mean # per year for 10-year period 1951-1960 (U.S. Weather Bureau Climatology Data)

34. Frost Penetration - Max. computed penetration for coldest wet period over a 10-year period (weather map, Oklahoma Flexible Paving Research Project, Oklahoma Highway Department, 1962)

Soils, geology, and topography information was obtained by actual survey of the random mile. Design factors were obtained from historical records. Where variation was encountered within a subsection weighted averages were used.

## ANALYSIS OF DATA

In order to develop a systematic method of estimating future maintenance costs, it was decided to use the method of multiple regression analysis. Initial analysis was made using both routine and total maintenance costs from Division Three as dependent variables. Although the equations developed in this manner had associated with them low errors of estimate and high degrees of multiple correlation, they would not adequately predict maintenance cost for subsections which were not included in the sample from which the equations were developed. In searching for an explanation for this, the following conclusions were drawn:

1. Due to a difference between accounting procedures for the interstate system and the state primary and secondary system, the analysis of the two should be done separately.

2. The analysis of routine and special maintenance costs should initially be done separately.

3. The sample size from Division III was too small.

Data from Division Two and Three were added to the sample. In making an analysis of the larger sample it was found that the resultant equation still had drawbacks. The factors which best explained the variance in maintenance cost in one division did not necessarily give the best explanation for another division or for two or three divisions in combination. In searching for an explanation, several things became clear:

1. Several subsections were included which had only one or two years of maintenance cost charged to them. In a subsection's early years, maintenance funds will be spent which cannot be clearly defined as maintenance costs. Examples of such costs are original signing and delineation of a project and work done on an uncompleted project to protect the earthwork before surfacing, sodding, seeding, etc. are complete.

2. Routine maintenance funds have been used in some cases to perform maintenance that might ordinarily fall under reconstruction or special maintenance.

3. Charges for material might be made to a certain subsection, when in reality part or all of the material was used on other subsections. The preceding problems are due primarily to accounting procedures and little can be done about them from a statistical analysis point of view. In short they support the view that an analysis of maintenance operations and expenditures by use of historical records is indeed difficult if not dubious. In addition, the mathematical relationships between the factors under consideration and maintenance cost were not necessarily linear. This fact had been suspected all along, but prior to the enlargement of the sample nothing had been done to discover the actual relationships. Several functional relationships were investigated for those factors for which it appeared the "fit" might be improved.

In order to develop an equation which would satisfactorily predict maintenance cost, the following additional steps were taken:

1. The subsections under study in Division Eight were added to the analysis. With this division added, the entire eastern half of the state was represented in the analysis. It is felt that the four eastern divisions form a natural grouping with similar climate, soils, geology, and topography.

2. An in depth study was made of maintenance costs as broken down into four categories and twenty-seven maintenance operations (see page 2).

## Mathematical Discussion

In general statistical analysis was made at the 5% level of significance. Using average routine maintenance cost per mile per year as the dependent variable, the following equations were developed.

Division 3, 17 observations

$$y = 72\ x_1 - 208\ x_2 + 583\ x_3 + 623\ x_4 - 16\ x_5 + 517$$

Where: $y$ = maintenance cost
$x_1$ = surface thickness
$x_2$ = surface base type
$x_3$ = general topography
$x_4$ = subgrade suitability
$x_5$ = mean number of days below $32^{o}$ F.

$R^2 = 0.85$ $s_{y.x}$ (standard error of estimate) = 212

Division 1, 17 observations

$$y = -191\ x_1 + 41\ x_2 - 14\ x_3 + 5177$$

Where: $y$ = maintenance cost
$x_1$ = surface width
$x_2$ = surface thickness
$x_3$ = average number of signs and markers per mile

$R^2 = 0.71$ $s_{y.x} = 142$

Division 2, 21 observations

No independent variables were significant at the 5% level.

In order to develop an equation for more than one division in combination, it was necessary to make the analyses at the 10% level.

Divisions 1 & 3, 34 observations

$$y = -104\ x_1 - 208\ x_2 + 289\ x_3 + 74\ x_4 + 0.13\ x_5 + 13\ x_6 - 802$$

Where: $y$ = maintenance cost
$x_1$ = surface width
$x_2$ = base width
$x_3$ = subbase width
$x_4$ = shoulder base thickness
$x_5$ = average daily traffic
$x_6$ = mean number of days above 90° F.

$R^2 = 0.58$ $s_{y.x} = 260$

Divisions 1, 2, & 3, 55 observations

$$y = -386\ x_1 + 376\ x_2 + 17\ x_3 + 608$$

Where: $y$ = maintenance cost
$x_1$ = surface subbase type
$x_2$ = shoulder subbase type
$x_3$ = age

$R^2 = 0.25$ $s_{y.x} = 295$

Transformations of independent variables were made as follows:

| Variable | Transformation | Linear Corr. Coefficient | Corr. Coefficient After Transformation |
|---|---|---|---|
| General Topography | $1.1x^2 - 15.8x + 784.7$ | .05 | .23 |
| Age | $-163.0x^2 + 646.9x + 189.6$ | .32 | .37 |
| Construction Type Code | $x^3$ | -.11 | .57 |

Using the transformed independent variables with the data from Divisions 1, 2, & 3, the following equation was developed.

$$y = 105.8\ x_1 + 3.6\ x_2 + 428.4$$

Where: $y$ = maintenance cost
$x_1$ = subgrade suitability
$x_2$ = construction type code

$R^2 = 0.38$ $s_{y.x} = 223$

With the addition of Division Eight, the sample consisted of 78 subsections. The previous analyses had been made with maintenance costs represented as average annual cost per mile. For the analysis of costs from Divisions One, Two, Three, and Eight, annual cost per mile (updated to a 1964 base) was used as the dependent variable. Maintenance costs prior to 1957 were not included. Age and ADT were converted to their

actual values for the years 1957 to 1964. As a result, 530 observations were available for analysis. The resultant equation was:

$$y = 11.7\ x_1 + 3.0\ x_2 + 19.1\ x_3 + 71.3\ x_4 - 118.3$$

Where: $y$ = maintenance cost
$x_1$ = age
$x_2$ = # guide posts and delineators
$x_3$ = # wet - dry cycles
$x_4$ = construction type code

$R^2 = 0.09$ $s_{y.x} = 591$

Analysis of Maintenance Cost Records

The updated yearly routine maintenance cost per mile was plotted for each subsection under study in Divisions One, Two, Three, and Eight - See Fig. 2, page 11. Starting with the 18th year of road life, the number of observations per year is too small to draw conclusions. Typically, the distribution of yearly routine maintenance cost is skewed to the right. A more idealized distribution curve is shown in Figure 1.

FIGURE 1.
IDEALIZED DISTRIBUTION OF YEARLY ROUTINE MAINTENANCE COSTS

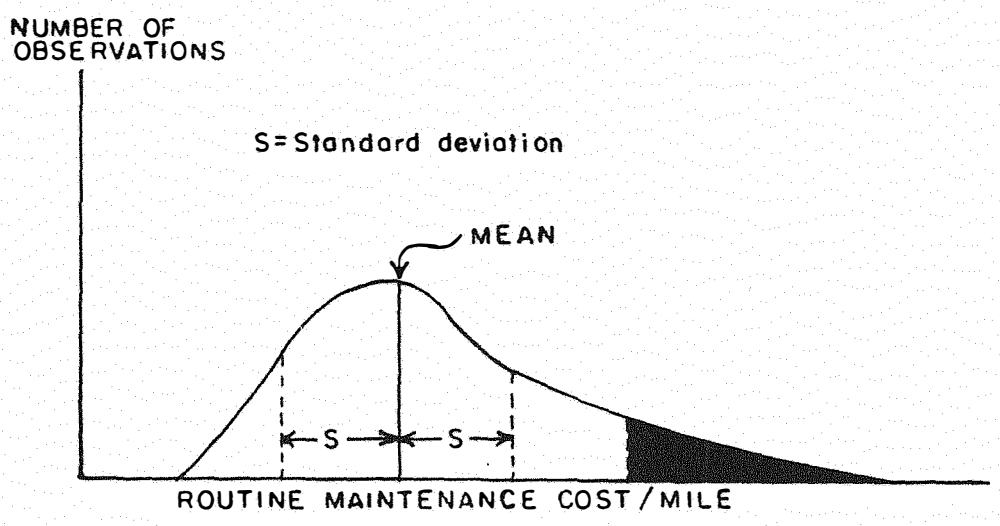
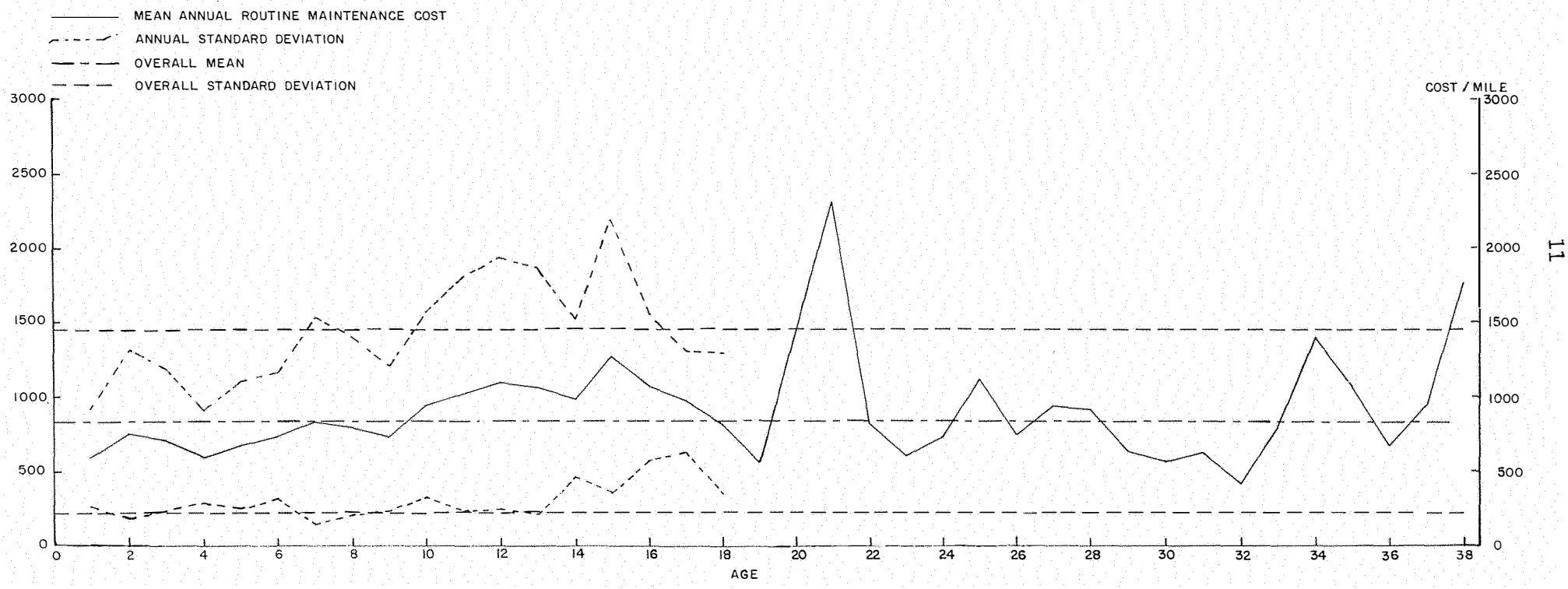


FIGURE 2.
UPDATED YEARLY ROUTINE MAINTENANCE COST/MILE



Those yearly charges which fell more than two standard deviations away from the overall mean (shaded area in Fig. 1, page 10) were investigated to determine what made them extraordinarily high. Table A shows the subsections involved and the specific charge(s) which caused them to be out of bounds.

Of the 530 years of routine maintenance cost data, 26 fell more than two standard deviations away from the mean. Fifteen individual subsections were involved, with four of the subsections accounting for 12 years of the extreme charges. The operations involved most often are: patching (12), resurfacing (7), and disaster work (5). The one time that maintenance general expense appears is probably due to miscoding. It is interesting to note that in Division One, four of five charges involve resurfacing. In Division Two, four of five charges involve patching. All six of the charges in Division Three involve patching. In Division Eight, four of ten charges involve disaster work.

Table B deals with special maintenance charges. Special maintenance is supposed to be charged to maintenance operations 5, 6, 7, 14, 19, and 21 only. During the eight chargeable periods from 1957 - 1964, 304 charges were made to subsections under study for special maintenance. The number of charges made to each operation and the percent of each are shown. 37% of the charges were made to operations that are not considered to be special maintenance. This points out the problem involved in defining routine and special maintenance.

# TABLE A.

## SUBSECTIONS WITH YEARLY ROUTINE MAINTENANCE CHARGES GREATER THAN TWO DEVIATIONS FROM MEAN ($840)

| Div. | Subsection Number | Year | Construction Type Code | MAJOR OPERATION(S) CHARGED | | | Total Cost/Mile |
|---|---|---|---|---|---|---|---|
| | | | | Oper. # | Operations | Cost/Mile | |
| 1 | 01-08-000 | 1957 | 4001 | 5 | Resurfacing. | 2131 | 3282 |
| | 51-20-000 | 1957 | 4001 | 1,5 | Patching and Resurfacing. | 1724 | 2719 |
| | 51-20-000* | 1961 | 4001 | 5 | Resurfacing. | 662 | 2008 |
| | 73-16-027 | 1957 | 3212 | 1,21 | Patching and Disaster Work. | 1605 | 2342 |
| | 73-27-000 | 1960 | 2010 | 5 | Resurfacing. | 1955 | 2452 |
| 2 | 07-24-000 | 1959 | 4221 | 1,2,5,6 | Patching, Reshaping, Resurfacing, Armor Coat. | 3683 | 4134 |
| | 45-04-186 | 1958 | 3212 | 1,6 | Patching and Armor Coating. | 3826 | 5252 |
| | 45-04-186* | 1960 | 3212 | 27 | Maintenance General Expense. | 845 | 2184 |
| | 48-16-019 | 1959 | 4252 | 1 | Patching. | 2438 | 2880 |
| | 64-02-000 | 1963 | 4232 | 1,7 | Patching - Roadway and Shoulders | 1707 | 2192 |
| 3 | 15-06-014 | 1957 | 4243 | 1 | Patching. | 2067 | 2885 |
| | 15-06-014* | 1962 | 4243 | 1 | Patching. | 2928 | 3527 |
| | 15-06-014** | 1963 | 4243 | 1,10 | Patching & Repair Slopes, Drainage | 3074 | 4009 |
| | 25-28-000 | 1962 | 3212 | 1 | Patching. | 2133 | 2479 |
| | 50-04-000 | 1964 | 6706 | 1,8,9,10 | Patching, Sodding, Stabilizing, Slopes | 4416 | 5689 |
| | 63-30-000 | 1959 | 4251 | 1,5 | Patching and Resurfacing. | 2138 | 2335 |
| 8 | 18-02-055 | 1961 | 6202 | 1 | Patching. | 1664 | 3702 |
| | 18-02-055** | 1962 | 6202 | 1 | Patching. | 1954 | 4053 |
| | 18-02-055** | 1963 | 6202 | 5 | Resurfacing. | 529 | 2242 |
| | 18-14-123 | 1957 | 6202 | 21 | Disaster Work. | 1437 | 2126 |
| | 18-14-123* | 1959 | 6202 | 1,2 | Patching, Blading & Reshaping. | 1849 | 2583 |
| | 18-14-123** | 1960 | 6202 | 21 | Disaster Work. | 4460 | 5003 |
| | 18-14-123** | 1961 | 6202 | 10 | Repair Slopes & Drainage | 848 | 2082 |
| | 72-06-180 | 1958 | 7011 | 1,21 | Patching & Disaster Work. | 1895 | 2727 |
| | 72-06-180** | 1959 | 7011 | 21 | Disaster Work. | 1849 | 2311 |
| | 72-06-180* | 1964 | 7011 | 13,22 | Trash Removal & Clean, Repair Culverts | 1867 | 2509 |

*A subsection repeats with an out of bound charge

**A subsection repeats with an out of bound charge in consecutive years

# TABLE B
## SPECIAL MAINTENANCE CHARGES BY OPERATION

| | OPERATION | DIVISION 1 | | DIVISION 2 | | DIVISION 3 | | DIVISION 4 | | OVERALL | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | # of Charges | % of Total | # of Charges | % of Total | # of Charges | % of Total | # of Charges | % of Total | # of Charges | % of Total |
| 1 | Patching, sanding, spot sealing, etc. | 10 | 20 | 34 | 27 | 7 | 17 | 17 | 19 | 68 | 22.4 |
| 2 | Blading, scarifying, reshaping, etc. | | | 5 | 4 | | | 5 | 5 | 10 | 3.3 |
| 3 | Joints and cracks. | | | 1 | 1 | | | 1 | 1 | 2 | 0.7 |
| 4 | Mud-jacking. | | | 3 | 2 | | | | | 3 | 1.0 |
| 5 | Resurfacing. | 21 | 42 | 20 | 16 | 14 | 34 | 23 | 25 | 78 | 25.7 |
| 6 | Armor Coating | 11 | 22 | 37 | 30 | 12 | 29 | 12 | 13 | 72 | 23.7 |
| 7 | Patching, blading, reshaping, etc. | 4 | 8 | 10 | 8 | 3 | 7 | 11 | 12 | 28 | 9.2 |
| 8 | Seeding, sodding, planting. | | | | | | | | | | |
| 9 | Stabilizing. | | | 1 | 1 | | | | | 1 | 0.3 |
| 10 | Repairing cuts, fills, slopes, drainage | 1 | 2 | 4 | 3 | 2 | 5 | 4 | 4 | 11 | 3.6 |
| 11 | Retaining walls, rip-rap, fences, etc. | | | | | | | | | | |
| 12 | Mowing. | | | | | | | 1 | 1 | 1 | 0.3 |
| 13 | Cutting brush, removing trash. | | | | | 1 | 2 | 2 | 2 | 3 | 1.0 |
| 14 | Heavy grading. | | | | | | | 2 | 2 | 2 | 0.7 |
| 15 | Traffic lines. | | | | | | | | | | |
| 16 | Signs and markers. | | | | | 1 | 2 | 2 | 2 | 3 | 1.0 |
| 17 | Guardrails and guideposts. | | | | | | | 4 | 4 | 4 | 1.3 |
| 18 | Roadside parks. | | | | | | | | | | |
| 19 | Watchmen, road magnet, pull traffic, detour. | | | 2 | 2 | | | | | 2 | 0.7 |
| 20 | Snow and ice removal, snow fences, sanding. | | | | | | | 2 | 2 | 2 | 0.7 |
| 21 | Disaster work, floods, remove debris, washouts. | 3 | 6 | 5 | 4 | | | 2 | 2 | 10 | 3.3 |
| 22 | Cleaning and repairing culverts. | | | | | | | 2 | 2 | 2 | 0.7 |
| 23 | Installing culverts. | | | | | 1 | 2 | 1 | 1 | 2 | 0.7 |
| 24 | Cleaning and repainting. | | | | | | | | | | |
| 25 | Repairing bridges and underpasses. | | | | | | | | | | |
| 26 | Bank protection, jetties, drift removal. | | | | | | | | | | |
| 27 | Maintenance General Expense | | | | | | | | | | |
| | OVERALL | 50 | | 122 | | 41 | | 91 | | 304 | |

A closer look at routine maintenance charges by operation shows:

1. Missing charges within categories. There are four categories within each operation -- labor, equipment, material, and other. In many cases no charge is made to one or more categories, when logically there should have been. (see Table C)

2. Distribution of charges by size. Tables D through D-4, pages 17-21 show the frequency of various sizes of charges for each maintenance operation. These are broken into eight classes:

   1 = no charge
   2 = insignificant charge: $\leq$ \$2
   3 = low charge with fairly normal distribution; standard deviation $\leq$ 2/3 mean; \$2 - \$30
   4 = medium charge with fairly normal distribution; \$30 - \$75
   5 = high charge with fairly normal distribution; $>$ \$75
   6 = low erratic charge; standard deviation $>$ 2/3 mean; \$2 - \$30
   7 = medium erratic charge; \$30 - \$75
   8 = high erratic charge; $>$ \$75

   Figure 3, page 22, combines classes 3 and 6, 4 and 7, and 5 and 8. 258 of 2025 charges or 12.74% have an average yearly cost of $\leq$ \$2.

3. Low or infrequent charges. Eleven of the maintenance operations had low, infrequent, or no charges made to them in the majority of subsections. Only 3.86% of the total cost was accounted for by these eleven operations.

   4. Mud-jacking.
   8. Seeding, sodding, planting.
   9. Stabilizing.
   11. Retaining walls, rip-rap, fences, etc.
   14. Heavy grading.
   18. Roadside parks.
   19. Watchmen, road magnet, pull traffic, detour, etc.
   22. Cleaning and repairing culverts.
   23. Installing culverts.
   24. Cleaning and repainting.
   26. Bank protection, jetties, drift removal.

4. Constant charges. Only two of the maintenance operations had relatively constant charges. (See Fig. 3, page 22)

   16. Signs and markers.
   27. Maintenance General Expense.

   The reason that these appear as constant charges is that the overhead account and the sign shop operations are distributed to the subsections on a pro rata basis.

# TABLE C

## PERCENTAGE BREAKDOWN OF ROUTINE MAINTENANCE CHARGES BY CATEGORY AND OPERATION

| OPERATION | OTHER | | | MATERIAL | | | EQUIPMENT | | | LABOR | | | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | I | II | III | I | II | III | I | II | III | II | III |
| | % of Operation Charges | % of Total # of Charges | % of Total Routine Cost | % of Operation Charges | % of Total # of Charges | % of Total Routine Cost | % of Operation Charges | % of Total # of Charges | % of Total Routine Cost | % of Operation Charges | % of Total # of Charges | % of Total Routine Cost | % of Total # of Charges | % of Total Routine Cost |
| 1. Patching, sanding, spot sealing, etc. | 8 | 7.62 | .10 | 57 | 50.99 | 8.06 | 90 | 79.85 | 6.02 | 92 | 81.85 | 10.71 | 81.30 | 24.91 |
| 2. Blading, scarifying, reshaping, etc. | 1 | .54 | | 10 | 3.08 | .11 | 83 | 24.31 | 2.39 | 80 | 23.41 | 1.85 | 29.03 | 4.36 |
| 3. Joints and cracks. | 2 | .90 | | 45 | 14.33 | .34 | 83 | 26.31 | .37 | 81 | 25.58 | 1.34 | 31.57 | 2.06 |
| 4. Mud-jacking. | 19 | .72 | | 64 | 2.35 | .02 | 79 | 2.90 | .05 | 69 | 2.54 | .13 | 3.62 | .21 |
| 5. Resurfacing. | 7 | 2.17 | .03 | 24 | 7.07 | 1.31 | 77 | 22.32 | 1.26 | 83 | 24.13 | 1.56 | 28.85 | 4.18 |
| 6. Armor coating. | 10 | 1.27 | | 29 | 3.62 | .59 | 71 | 8.71 | .34 | 71 | 8.71 | .42 | 12.15 | 1.36 |
| 7. Patching, blading, reshaping, etc. | 3 | 2.17 | | 11 | 6.89 | .66 | 91 | 55.71 | 2.10 | 95 | 57.89 | 2.48 | 60.79 | 5.26 |
| 8. Seeding, sodding, planting. | | | | 29 | 1.45 | .14 | 77 | 3.81 | .10 | 77 | 3.81 | .12 | 4.90 | .37 |
| 9. Stabilizing. | 3 | .54 | | 8 | 1.45 | .02 | 89 | 15.42 | .36 | 89 | 15.42 | .54 | 17.24 | .93 |
| 10. Repairing cuts, fills, slopes, drainage. | 7 | 5.08 | .04 | 12 | 9.07 | .23 | 91 | 66.06 | 2.52 | 94 | 67.87 | 3.72 | 71.86 | 6.52 |
| 11. Retaining walls, rip-rap, fences, etc. | 2 | .36 | | 22 | 2.90 | .01 | 74 | 9.43 | .07 | 75 | 9.61 | .18 | 12.70 | .28 |
| 12. Mowing. | | .18 | | | .90 | | 40 | 37.38 | 1.15 | 99 | 92.55 | 7.62 | 93.10 | 8.78 |
| 13. Cutting brush, removing trash. | 1 | .90 | .01 | 4 | 3.44 | .02 | 93 | 77.67 | .93 | 98 | 81.85 | 4.75 | 82.75 | 5.73 |
| 14. Heavy grading. | | | | 14 | .36 | | 57 | 1.45 | .06 | 92 | 2.35 | .04 | 2.54 | .11 |
| 15. Traffic lines. | 35 | 15.60 | .05 | 97 | 42.10 | 2.40 | 94 | 41.19 | .41 | 94 | 41.19 | .86 | 43.37 | 3.74 |
| 16. Signs and markers. | 26 | 26.86 | .01 | 98 | 99.63 | 4.87 | 61 | 61.88 | .25 | 64 | 64.97 | 1.53 | 100.00 | 6.67 |
| 17. Guardrails and guideposts. | | .36 | | 34 | 20.14 | .10 | 85 | 50.63 | .33 | 89 | 52.99 | 1.47 | 59.16 | 1.92 |
| 18. Roadside parks. | 10 | .90 | | 22 | 1.99 | .01 | 85 | 7.44 | .08 | 93 | 8.16 | .20 | 8.71 | .30 |
| 19. Watchmen, road magnet, pull traffic detour, etc. | | | | 29 | 1.63 | .08 | 79 | 4.35 | .07 | 69 | 3.81 | .16 | 5.44 | .32 |
| 20. Snow and ice removal, snow fences, sanding, etc. | 2 | 1.63 | | 14 | 8.16 | .06 | 90 | 51.72 | .48 | 92 | 52.99 | 1.01 | 57.35 | 1.57 |
| 21. Disaster work, floods, remove debris, washouts. | 4 | 1.08 | .01 | 30 | 7.62 | 1.70 | 76 | 19.05 | 1.13 | 89 | 22.32 | 2.18 | 25.04 | 5.05 |
| 22. Cleaning and repairing culverts. | 2 | .72 | .03 | 19 | 5.08 | .04 | 78 | 20.32 | .21 | 83 | 21.41 | .42 | 25.77 | .71 |
| 23. Installing culverts. | 2 | .36 | | 30 | 3.81 | .05 | 71 | 8.89 | .09 | 72 | 9.07 | .17 | 12.52 | .32 |
| 24. Cleaning and repainting. | | | | 12 | 1.99 | | 81 | 13.24 | .04 | 88 | 14.51 | .18 | 16.33 | .23 |
| 25. Repairing bridges and underpasses. | 4 | .90 | | 63 | 12.15 | .33 | 73 | 13.97 | .14 | 75 | 14.33 | .49 | 19.05 | .98 |
| 26. Bank protection, jetties, drift removal. | | | | 9 | .72 | | 75 | 5.62 | .01 | 85 | 6.35 | .06 | 7.44 | .08 |
| 27. Maintenance General Expense | 39 | 39.92 | .36 | 100 | 100.00 | 1.72 | 100 | 100.00 | 1.90 | 100 | 100.00 | 8.92 | 100.00 | 12.91 |

This table represents 530 years of routine maintenance charges. Type I shows the percent of the times a given operation was charged that a given category charge was made. Type II shows the percent of the times any charge was made that a given category or operation charge was made. Type III shows the percent of the total routine maintenance cost that was charged to a given category or operation.

# TABLE D

## FREQUENCY OF ROUTINE MAINTENANCE CHARGES FOR EACH OPERATION, BY SIZE OF CHARGE, DIVISIONS 1,2,3,AND8.

### Construction Type Code 2000 Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | | 2 | 5 | | 4 | 1 | 4 | 2 | | 1 | 1 | | 4 | 3 | | | 5 | 3 | 2 | 1 | | 3 | 2 | 1 | 4 | | |
| Insignificant | | | 2 | | | 1 | | | | | | | | 1 | | | 1 | | 2 | 3 | 3 | 1 | | 2 | 1 | 1 | | |
| Low Normal | | | | | | | 1 | | | | | | | | | 5 | | | | | | | | | | | 1 | |
| Medium Normal | | 5 | | | | | | | | | | | | | | | | | | | | | | | | | 4 | 5 |
| High Normal | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Low Erratic | 1 | | | | 1 | | 2 | 1 | 2 | 3 | 4 | 3 | 2 | | 2 | | 4 | | | | 1 | 4 | 2 | 1 | 2 | | | |
| Medium Erratic | 2 | | 1 | | 2 | | 1 | | 1 | 1 | | 1 | 3 | | | | | | | | | | | | 1 | | | |
| High Erratic | 2 | | | | 2 | | | | | 1 | | | | | | | | | | | | | | | | | | |

### Construction Type Code 3000 Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | 3 | 13 | 17 | 3 | 10 | 1 | 14 | 14 | | 9 | | | 14 | 3 | | 4 | 15 | 14 | 4 | 7 | 5 | 10 | 11 | 11 | 13 | | |
| Insignificant | 1 | 7 | 3 | 1 | 3 | 3 | 2 | 2 | | 2 | 3 | 1 | 1 | 2 | | | | 2 | 3 | 3 | 3 | 6 | 3 | 5 | 2 | 4 | | |
| Low Normal | | | | | | | | | | | | | 1 | | | | 1 | | | 1 | | | | | | | | |
| Medium Normal | | | | | | | | 1 | | | | 11 | 5 | | 1 | 17 | | | | | | | | | | | | |
| High Normal | 2 | 2 | | | | | 2 | | | 2 | | 3 | 1 | | | 1 | | | | | | | | | | | 15 | 16 |
| Low Erratic | 1 | 6 | 2 | | 10 | 3 | 9 | 1 | 3 | 6 | 6 | 2 | 7 | 2 | 7 | | 10 | 1 | 1 | 10 | 4 | 7 | 5 | 2 | 3 | 1 | | |
| Medium Erratic | 4 | | | | 1 | 2 | 1 | 1 | | 7 | | 1 | 3 | | 7 | | 3 | | | | 3 | | | | 1 | | | |
| High Erratic | 10 | | | | 1 | | 3 | | | 1 | | | | | | | | | | | 1 | | | | 1 | | 3 | 2 |

### Construction Type Code 4000 Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | 1 | 2 | 12 | 1 | 4 | 1 | 12 | 4 | | 3 | | | 11 | | | | 7 | 9 | 1 | 3 | | 4 | 8 | 7 | 6 | | |
| Insignificant | | 1 | 4 | | | 1 | 1 | | 3 | 1 | 6 | | | 1 | | | | 3 | 2 | 1 | | 6 | 5 | 3 | 3 | 5 | | |
| Low Normal | | | | | | | | | | | | 1 | | | | | | 1 | | | 1 | | | | | | | |
| Medium Normal | | | | | | | | | | | | 7 | 4 | | 1 | 12 | 1 | | | | | | | | | | | |
| High Normal | 6 | | | | | | | | | 1 | | 1 | 2 | | | | | | | | | | | | | | 12 | 10 |
| Low Erratic | | 9 | 5 | | 4 | 4 | 6 | | 5 | 3 | 3 | 2 | 3 | | 5 | | 10 | 1 | | 10 | 4 | 6 | 3 | 1 | 2 | 1 | | |
| Medium Erratic | | | 1 | | 3 | 2 | 2 | | | 5 | | | 3 | | 5 | | 1 | | 1 | | 1 | | | | | | | |
| High Erratic | 6 | 1 | | | 4 | 1 | 2 | | | 2 | | 1 | | | 1 | | | | | | 3 | | | | | | | 2 |

### Construction Type Code 6000 Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | 8 | 1 | 19 | 5 | 6 | | 16 | 8 | 1 | 12 | | | 18 | | | | 17 | 16 | | 9 | 6 | 11 | 14 | 11 | 11 | | |
| Insignificant | | 7 | 5 | 2 | 3 | 5 | | 1 | 4 | | 6 | | 1 | 2 | | | | 1 | 3 | 4 | 2 | 3 | 7 | 2 | 3 | 8 | | |
| Low Normal | | | | | | | 1 | | | | | 1 | | | | | 3 | | | | | | | | | | | |
| Medium Normal | 1 | | 2 | | | | | | | 1 | | 7 | 7 | | 2 | 19 | | 1 | | 1 | | | | | | | | |
| High Normal | 1 | | 1 | | | | | | | | 1 | 5 | | | 1 | 2 | | | | | | | | | | | 21 | 20 |
| Low Erratic | 2 | 4 | 7 | | 10 | 4 | 14 | 2 | 8 | 9 | 2 | 1 | 6 | 1 | 9 | | 14 | 2 | 2 | 13 | 6 | 12 | 3 | 5 | 5 | 2 | | |
| Medium Erratic | 3 | 1 | 4 | | 1 | 4 | 6 | 1 | | 7 | | 4 | 6 | | 8 | | 3 | | | 2 | 2 | | | | 2 | | | |
| High Erratic | 14 | 1 | 1 | | 2 | 2 | | 1 | 1 | 3 | | 3 | 1 | | 1 | | 1 | | | 1 | 2 | | | | | | | 1 |

### Construction Type Code 7000 Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | 4 | 1 | 7 | 7 | 16 | 1 | 12 | 9 | | 10 | | | 16 | 1 | | | 12 | 12 | 2 | 4 | 4 | 10 | 9 | 5 | 13 | | |
| Insignificant | | 4 | 2 | 4 | 4 | 2 | | | 1 | | 6 | | | 1 | | | | 5 | 3 | | 4 | 7 | 5 | 4 | 5 | 6 | | |
| Low Normal | | | | | | | | | | | | | 1 | | | | 2 | | | 2 | | | | | | | | |
| Medium Normal | 2 | | 1 | | | | | | | | | 4 | 3 | | 1 | 15 | | | | 1 | | | | | | | | |
| High Normal | 1 | | | | | | 3 | | | 3 | | 11 | 5 | | | | | | | | | | | | | | 16 | 17 |
| Low Erratic | 1 | 11 | 6 | 7 | 8 | 1 | 5 | 7 | 7 | 5 | 3 | | 4 | 1 | 7 | 1 | 16 | 2 | 2 | 11 | 3 | 7 | 4 | 6 | 5 | | 2 | |
| Medium Erratic | 8 | | 6 | 1 | | | 5 | | 2 | 8 | | 1 | 2 | 1 | 9 | 2 | 1 | | 2 | 3 | 2 | | | | 3 | | | |
| High Erratic | 7 | | 3 | | | | 5 | | | 3 | | 3 | 4 | | 1 | 1 | | | | | 6 | 1 | | | 1 | | 1 | 2 |

### Construction Type Code Overall Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | 16 | 19 | 60 | 16 | 40 | 4 | 58 | 37 | 1 | 35 | 1 | | 63 | 7 | | 4 | 56 | 54 | 9 | 24 | 15 | 38 | 44 | 35 | 47 | | |
| Insignificant | 1 | 19 | 16 | 7 | 10 | 12 | 3 | 3 | 8 | 3 | 21 | 1 | 2 | 7 | | | 1 | 11 | 13 | 11 | 12 | 23 | 20 | 16 | 14 | 24 | | |
| Low Normal | | | | | | | 1 | | | | | 2 | 2 | | | | 6 | 1 | | 3 | 1 | | | | | | | |
| Medium Normal | 3 | | 3 | | | | 1 | | 1 | 1 | | 29 | 19 | | 5 | 68 | 1 | 1 | | 2 | | | | | | | 1 | |
| High Normal | 10 | 7 | 1 | | | | 5 | | | 6 | 1 | 20 | 8 | | 1 | 3 | | | | | | | | | | | 68 | 68 |
| Low Erratic | 5 | 30 | 20 | 7 | 33 | 12 | 36 | 11 | 25 | 26 | 18 | 8 | 22 | 4 | 30 | 1 | 54 | 6 | 5 | 44 | 18 | 36 | 17 | 15 | 17 | 4 | 2 | |
| Medium Erratic | 17 | 1 | 12 | 1 | 7 | 8 | 15 | 2 | 3 | 28 | | 7 | 17 | 1 | 29 | 2 | 8 | | 3 | 5 | 8 | | | | 7 | | | |
| High Erratic | 39 | 2 | 4 | | 9 | 3 | 10 | 1 | 1 | 10 | | 7 | 5 | | 3 | 1 | 1 | | | 1 | 12 | 1 | | | 2 | | 4 | 7 |

# TABLE D—I

## FREQUENCY OF ROUTINE MAINTENANCE CHARGES FOR EACH OPERATION, BY SIZE OF CHARGE, DIVISION I.

### Construction Type Code 2000 Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | | | 2 | | 2 | | 1 | | | | | | 2 | 2 | | | 2 | 1 | 1 | | | 2 | 2 | | 1 | | |
| Insignificant | | | 1 | | | | | | | | | | | | | | 1 | | 1 | 1 | 2 | 1 | | | 1 | 1 | | |
| Low Normal | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | |
| Medium Normal | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | |
| High Normal | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 2 |
| Low Erratic | | | | | | | | 1 | 1 | | 2 | 1 | 1 | | | | 1 | | | | | 1 | | | 1 | | | |
| Medium Erratic | 1 | | 1 | | 1 | | 1 | | 1 | 1 | | 1 | 1 | | | | | | | | | | | | | | | |
| High Erratic | 1 | | | | 1 | | | | | 1 | | | | | | | | | | | | | | | | | | |

### Construction Type Code 3000 Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | | 2 | 4 | | 4 | | 4 | 4 | | 2 | | | 3 | | | 2 | 3 | 3 | 1 | 2 | | 3 | 2 | 3 | 3 | | |
| Insignificant | 1 | 1 | 1 | | 2 | | | | | 1 | 1 | | | 1 | | | | | | 1 | 1 | 1 | 1 | 2 | | 1 | | |
| Low Normal | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Medium Normal | | | | | | | | | | | | 3 | 1 | | 1 | 3 | | | | | | | | | | | | |
| High Normal | | | | | | | | | | 1 | | | 1 | | | 1 | | | | | | | | | | | 4 | 3 |
| Low Erratic | | 3 | 1 | | 2 | | 4 | | | 1 | 1 | 1 | 2 | | 2 | | 1 | 1 | 1 | 2 | | 3 | | | | | | |
| Medium Erratic | 1 | | | | | | | | | 1 | | | | | 1 | | 1 | | | | | | | | | | | |
| High Erratic | 2 | | | | | | | | | | | | | | | | | | | | 1 | | | | 1 | | | 1 |

### Construction Type Code 4000 Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | | | 2 | | | | 2 | | | | | | 1 | | | | 1 | 1 | | 1 | | | | | 2 | | |
| Insignificant | | | 1 | | | | 1 | | 1 | | 2 | | | 1 | | | | 1 | | | | 1 | 2 | 2 | 2 | | | |
| Low Normal | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | |
| Medium Normal | | | | | | | | | | | | 1 | 1 | | | 2 | | | | | | | | | | | | |
| High Normal | 2 | | | | | | | | | 1 | | | 1 | | | | | | | | | | | | | | 2 | 1 |
| Low Erratic | | 2 | 1 | | | 1 | 1 | | 1 | | | | | | | | 2 | | | 2 | 1 | 1 | | | | | |
| Medium Erratic | | | | | | 1 | | | | 1 | | | | | 1 | | | | 1 | | | | | | | | | |
| High Erratic | | | | | 2 | | | | | | | | | | 1 | | | | | | | | | | | | | 1 |

### Construction Type Code 6000 Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | | | 4 | 1 | 2 | | 3 | 2 | | 3 | | | 4 | | | | 4 | 2 | | 2 | 1 | 3 | 2 | 3 | 3 | | |
| Insignificant | | 3 | 1 | 1 | 1 | | | | 1 | | 1 | | | 1 | | | | | 2 | 2 | 1 | | 2 | 1 | | 1 | | |
| Low Normal | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | |
| Medium Normal | | | | | | | | | | | | 2 | 1 | | 1 | 5 | | | | | | | | | | | | |
| High Normal | | | 1 | | | | | | | 1 | | 1 | | | 1 | | | | | | | | | | | | 5 | 5 |
| Low Erratic | 1 | 2 | 3 | | 2 | 3 | 5 | 1 | 2 | | 1 | | 2 | | | | 2 | 1 | 1 | 2 | 1 | 4 | | 2 | 2 | 1 | | |
| Medium Erratic | 1 | | | | 1 | | | 1 | | 2 | | | 1 | | 2 | | 1 | | | | 1 | | | | | | | |
| High Erratic | 3 | | | | | | | | | 2 | | 2 | 1 | | 1 | | 1 | | | 1 | | | | | | | | |

### Construction Type Code 7000 Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | | | 1 | | 4 | | 2 | 2 | | 1 | | | 3 | | | | 3 | 2 | 1 | 1 | 1 | 1 | 2 | | 2 | | |
| Insignificant | | | 1 | | 1 | | | | | | 3 | | | 1 | | | | 1 | 1 | | 1 | | 1 | | 1 | 2 | | |
| Low Normal | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | |
| Medium Normal | | | | | | | | | | | | | 1 | | | 4 | | | | | | | | | | | | |
| High Normal | | | | | | | 1 | | | 2 | | 4 | 3 | | | | | | | | | | | | | | 4 | 4 |
| Low Erratic | | 4 | | 3 | 3 | | 2 | 2 | 2 | | | | | | | | 3 | | | 2 | 1 | 3 | 2 | 2 | 2 | | | |
| Medium Erratic | 4 | | | | | | 1 | | | 2 | | | | | 3 | | | | 1 | 1 | 1 | | | | 1 | | | |
| High Erratic | | | 3 | | | | | | | | | | | | 1 | | | | | | | | | | | | | |

### Construction Type Code Overall Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | | 2 | 13 | 1 | 12 | | 12 | 8 | | 6 | | | 13 | 2 | | 2 | 13 | 9 | 3 | 6 | 2 | 9 | 8 | 6 | 11 | | |
| Insignificant | 1 | 4 | 5 | 1 | 4 | | 1 | | 2 | 1 | 7 | | | 4 | | | 1 | 2 | 4 | 4 | 5 | 3 | 6 | 5 | 4 | 5 | | |
| Low Normal | | | | | | | | | | | | 1 | | | | | 2 | | | | | | | | | | | |
| Medium Normal | | | | | | | 1 | | | 1 | | 6 | 4 | | 2 | 16 | | | | | | | | | | | | |
| High Normal | 2 | 2 | 1 | | | | 1 | | | 4 | | 5 | 5 | | 1 | 1 | | | | | | | | | | | 17 | 15 |
| Low Erratic | 1 | 11 | 5 | 3 | 7 | 4 | 12 | 4 | 6 | 1 | 4 | 2 | 5 | | 2 | | 9 | 2 | 2 | 8 | 3 | 12 | 2 | 4 | 5 | 1 | | |
| Medium Erratic | 7 | | 1 | | 2 | 1 | 2 | 1 | 1 | 7 | | 1 | 2 | | 7 | | 2 | | 2 | 1 | 2 | | | | 1 | | | |
| High Erratic | 6 | | 3 | | 3 | | | | | 3 | | 2 | 1 | | 3 | | 1 | | | 1 | 1 | | | | 1 | | | 2 |

# TABLE D-2

## FREQUENCY OF ROUTINE MAINTENANCE CHARGES FOR EACH OPERATION, BY SIZE OF CHARGE, DIVISION 2

### Construction Type Code 2000 Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | | | 1 | | 1 | | 1 | 1 | | | 1 | | 1 | | | | 1 | 1 | 1 | 1 | | | | | 1 | | |
| Insignificant | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Low Normal | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Medium Normal | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | |
| High Normal | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Low Erratic | | | | | | | 1 | | | 1 | 1 | | | | 1 | | 1 | | | | | 1 | 1 | 1 | 1 | | 1 | 1 |
| Medium Erratic | 1 | | | | 1 | | | | | | | | 1 | | | | | | | | | | | | | | | |
| High Erratic | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

### Construction Type Code 3000 Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | | | 3 | 1 | 1 | | 2 | 1 | | 1 | | | 2 | | | | 1 | 2 | | 1 | | | 2 | 2 | 2 | | |
| Insignificant | | 2 | 2 | | 1 | | 1 | | | | | | | | | | | 2 | 1 | 1 | 1 | 2 | 1 | | | 1 | | |
| Low Normal | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | |
| Medium Normal | | | | | | | | | | | | 3 | 2 | | | 3 | | | | | | | | | | | | |
| High Normal | 1 | | | | | | 2 | | | 1 | | | | | | | | | | | | | | | | | 2 | 3 |
| Low Erratic | | 1 | 1 | | 1 | 2 | | | 2 | | 2 | | | 1 | 1 | | | | | 2 | 1 | 1 | 2 | 1 | 1 | | | |
| Medium Erratic | 1 | | | | | | | 1 | | 2 | | | 1 | | 2 | | 2 | | | | | | | | | | | |
| High Erratic | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |

### Construction Type Code 4000 Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | | | 4 | 1 | 2 | | 4 | 1 | | | | | 4 | | | | 2 | 4 | 1 | 1 | | 1 | 4 | 3 | 1 | | |
| Insignificant | | | | | | | | | 2 | | 3 | | | | | | | 1 | | 1 | | 1 | 2 | | 1 | 3 | | |
| Low Normal | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Medium Normal | | | | | | | | | | | | 2 | 2 | | | 4 | 1 | | | | | | | | | | | |
| High Normal | | | | | | | | | | | | 1 | 1 | | | | | | | | | | | | | | 4 | 3 |
| Low Erratic | | 3 | 3 | | 2 | 1 | 1 | | 1 | 2 | 1 | 1 | | | 3 | | 2 | 1 | | 2 | 1 | 3 | 1 | | | | | |
| Medium Erratic | | | 1 | | 1 | 1 | 2 | | | 2 | | | 1 | | 1 | | 1 | | | | 1 | | | | | | | |
| High Erratic | 4 | 1 | | | | | 1 | | | | | | | | | | | | | | 1 | | | | | | | 1 |

### Construction Type Code 6000 Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | 4 | | 6 | 1 | 2 | | 6 | 2 | 1 | 4 | | | 6 | | | | 4 | 5 | | 2 | 2 | 2 | 3 | 3 | 2 | | |
| Insignificant | | 1 | 2 | | 1 | 2 | | | 1 | | 2 | | | | | | | 1 | | 1 | 1 | 1 | 3 | 1 | 1 | 4 | | |
| Low Normal | | | | | | | 1 | | | | | 1 | | | | | 1 | | | | | | | | | | | |
| Medium Normal | 1 | | 2 | | | | | | | | | 1 | 4 | | 1 | 6 | | | | | | | | | | | | |
| High Normal | 1 | | | | | | | | | | | 1 | | | | | | | | | | | | | | | 6 | 6 |
| Low Erratic | 1 | 1 | 1 | | 4 | | 3 | | 3 | 4 | | 1 | | | 3 | | 5 | 1 | 1 | 4 | 2 | 3 | 1 | 2 | 2 | | | |
| Medium Erratic | 1 | | 1 | | | 1 | 2 | | | 1 | | 1 | 2 | | 2 | | | | | 1 | 1 | | | | | | | |
| High Erratic | 2 | | | | | 1 | | | | | | 1 | | | | | | | | | | | | | | | | |

### Construction Type Code 7000 Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | 2 | | 3 | 1 | 4 | | 4 | 1 | | 2 | | | 4 | 1 | | | 4 | 5 | | 2 | 1 | 2 | 2 | 2 | 3 | | |
| Insignificant | | | | 1 | 1 | | | | 1 | | 2 | | | | | | | 1 | | | 2 | 2 | 2 | 2 | 2 | 2 | | |
| Low Normal | | | | | | | | | | | | | | | | | 1 | | | 1 | | | | | | | | |
| Medium Normal | 2 | | 1 | | | | | | | | | 2 | 2 | | 1 | 4 | | | | | | | | | | | 4 | 5 |
| High Normal | | | | | | | 2 | | | 1 | | 2 | 2 | | | | | | | | | | | | | | 1 | |
| Low Erratic | 1 | 3 | | 1 | 3 | 1 | 1 | 1 | 2 | 2 | 1 | | | | 3 | 1 | 3 | | | 3 | 1 | 2 | 1 | 1 | | | | |
| Medium Erratic | | | 4 | | | | 1 | | 1 | 2 | | | 1 | 1 | | | 1 | | | 1 | | | | | 1 | | | |
| High Erratic | 2 | | | | | | 1 | | | | | 1 | | | | | | | | | | | | | | | | |

### Construction Type Code Overall Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | 6 | | 17 | 4 | 10 | | 17 | 6 | 1 | 7 | 1 | | 17 | 1 | | | 12 | 17 | 2 | 7 | 3 | 5 | 11 | 10 | 9 | | |
| Insignificant | | 3 | 5 | 1 | 3 | 2 | 1 | | 4 | | 7 | | | | | | | 5 | 1 | 3 | 4 | 6 | 8 | 3 | 4 | 10 | | |
| Low Normal | | | | | | | 1 | | | | | 1 | | | | | 3 | | | | | | | | | | | |
| Medium Normal | 3 | | 3 | | | | | | | | | 8 | 10 | | 2 | 18 | 1 | | | | | | | | | | | |
| High Normal | 2 | 1 | | | | | 4 | | | 2 | | 4 | 3 | | | | | | | | | | | | | | 17 | 18 |
| Low Erratic | 2 | 8 | 5 | 1 | 10 | 4 | 6 | 1 | 8 | 9 | 5 | 2 | | 1 | 11 | 1 | 11 | 2 | 1 | 12 | 5 | 10 | 6 | 5 | 4 | | 1 | |
| Medium Erratic | 3 | | 6 | | 2 | 2 | 5 | 1 | 1 | 7 | | 1 | 6 | 1 | 5 | | 4 | | | 2 | 2 | | | | 1 | | | |
| High Erratic | 9 | 1 | | | | 1 | 2 | | | | | 2 | | | | | | | | | 1 | | | | | | 1 | 1 |

# TABLE D-3

## FREQUENCY OF ROUTINE MAINTENANCE CHARGES FOR EACH OPERATION, BY SIZE OF CHARGE, DIVISION 3

### Construction Type Code 2000 Series

| | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size of Charge* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | | 1 | 1 | | | | 1 | 1 | | 1 | | | 1 | | | | 1 | | | | | | | | 1 | | |
| Insignificant | | | | | | 1 | | | | | | | | | | | | | 1 | 1 | 1 | | | 1 | | | | |
| Low Normal | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | 1 | |
| Medium Normal | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| High Normal | | | | | | | 1 | | | 1 | | 1 | 1 | | 1 | | 1 | | | | | 1 | 1 | | | | | |
| Low Erratic | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | |
| Medium Erratic | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| High Erratic | 1 | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | |

### Construction Type Code 3000 Series

| | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size of Charge* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | 2 | 4 | 4 | | 2 | | 4 | 2 | | 3 | | | 3 | | | | 4 | 3 | 1 | 3 | 1 | 3 | 3 | 3 | 2 | | |
| Insignificant | | | | | | 1 | | | | 1 | 1 | | | | | | | | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | | |
| Low Normal | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | |
| Medium Normal | | | | | | | | | 1 | | | 4 | | | | 4 | | | | | | | | | | | | |
| High Normal | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | 3 |
| Low Erratic | | 2 | | | 4 | | 1 | | 1 | 2 | | | 3 | 1 | 3 | | 4 | | | 2 | | 1 | | | | 1 | | |
| Medium Erratic | | | | | | 1 | 1 | | | 1 | | | | | 1 | | | | | | | | | | | | | |
| High Erratic | 3 | | | | | | 2 | | | | | | | | | | | | | | | | | | | | 1 | 1 |

### Construction Type Code 4000 Series

| | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size of Charge* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | 1 | | 3 | | | | 3 | 2 | | | | | 3 | | | | 2 | 1 | | 1 | | 1 | 1 | 1 | | | |
| Insignificant | | | 2 | | | 1 | | | | | 1 | | | | | | | | 2 | | | 1 | | 1 | | 2 | | |
| Low Normal | | | | | | | | | | | | | | | | | | 1 | | | 1 | | | | | | | |
| Medium Normal | | | | | | | | | | | | 3 | 1 | | | 3 | | | | | | | | | | | | |
| High Normal | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | 3 |
| Low Erratic | | 2 | 1 | | 1 | 2 | 2 | | 1 | 1 | 2 | | 1 | | 1 | | 3 | | | 3 | 1 | 2 | 2 | 1 | 2 | 1 | | |
| Medium Erratic | | | | | | | | | | | | | 1 | | 2 | | | | | | | | | | | | | |
| High Erratic | | | | | 2 | | 1 | | | 2 | | | | | | | | | | | | | | | | | | |

### Construction Type Code 6000 Series

| | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size of Charge* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | 1 | 1 | 3 | 1 | | | 3 | 1 | | 2 | | | 3 | | | | 4 | 4 | | 4 | 1 | 1 | 3 | 2 | 3 | | |
| Insignificant | | 2 | 1 | 1 | | 2 | | | 1 | | 2 | | 1 | | | | | | | 1 | | | 1 | | 2 | | | |
| Low Normal | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | |
| Medium Normal | | | | | | | | | | | | 2 | | | | 4 | | | | | | | | | | | | |
| High Normal | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | 4 |
| Low Erratic | | 1 | | | 3 | 1 | 1 | | 1 | | | | 2 | 1 | 3 | | 1 | | | 2 | | 3 | 2 | 1 | | 1 | | |
| Medium Erratic | | | 1 | | | | 3 | | | 4 | | 2 | 1 | | 1 | | 2 | | | 1 | | | | | | | | |
| High Erratic | 4 | | 1 | | | 1 | | 1 | 1 | | | | | | | | | | | | | | | | | | | |

### Construction Type Code 7000 Series

| | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size of Charge* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | 1 | 1 | | 1 | 2 | | | 2 | | 2 | | | 3 | | | | 1 | 3 | | 1 | | 2 | 1 | | 3 | | |
| Insignificant | | 2 | 1 | 1 | 2 | 1 | | | | | | | | | | | | 1 | | | 1 | 2 | 1 | 1 | 1 | | | |
| Low Normal | | | | | | | | | | | | | 1 | | | | | | | 1 | | | | | | | | |
| Medium Normal | | | | | | | | | | | | 2 | | | | 2 | | | | | | | | | | | | |
| High Normal | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | 3 |
| Low Erratic | | | 1 | 2 | | | 1 | 3 | 1 | | 1 | | 2 | | 1 | | 3 | 1 | | 2 | 1 | 1 | | 1 | 2 | | | |
| Medium Erratic | 3 | | | | | | 1 | | | 2 | | 1 | | | 2 | | | | | | | | | | | | | |
| High Erratic | | | | | | | 1 | | | 1 | | | | | | 1 | | | | | | | | | | | | |

### Construction Type Code Overall Series

| | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size of Charge* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | 5 | 7 | 11 | 2 | 4 | | 11 | 8 | | 8 | | | 13 | | | | 12 | 11 | 1 | 9 | 2 | 7 | 8 | 6 | 9 | | |
| Insignificant | | 4 | 4 | 2 | 2 | 6 | | | 1 | 1 | 4 | | 1 | | | | | 1 | 4 | 3 | 3 | 5 | 3 | 4 | 4 | 3 | | |
| Low Normal | | | | | | | | | | | | | 2 | | | 1 | 1 | | | 1 | 1 | | | | | | | |
| Medium Normal | | | | | | | | | 1 | | | 11 | 1 | | | 14 | | | | | | | | | | | | |
| High Normal | 4 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | 14 | 14 |
| Low Erratic | | 5 | 2 | 2 | 8 | 3 | 6 | 3 | 4 | 4 | 3 | 1 | 9 | 2 | 9 | | 12 | 1 | | 9 | 2 | 8 | 5 | 3 | 4 | 3 | | |
| Medium Erratic | 3 | | 1 | | | 1 | 5 | | | 7 | | 3 | 2 | | 6 | | 2 | | | 1 | | | | | 1 | | | |
| High Erratic | 8 | | 1 | | 3 | 1 | 4 | 1 | 1 | 3 | | | | | | 1 | | | | | | | | | | | 1 | 1 |

# TABLE D-4

## FREQUENCY OF ROUTINE MAINTENANCE CHARGES FOR EACH OPERATION, BY SIZE OF CHARGE, DIVISION 8

### Construction Type Code 2000 Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | | 1 | 1 | | 1 | 1 | 1 | | | | | | | 1 | | | 1 | 1 | | | | 1 | | 1 | 1 | | |
| Insignificant | | | | | | | | | | | | | | 1 | | | | | | 1 | | | | 1 | | | | |
| Low Normal | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Medium Normal | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | |
| High Normal | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 |
| Low Erratic | 1 | | | | 1 | | | | 1 | 1 | 1 | 1 | | | | | 1 | | | | 1 | 1 | | | | | | |
| Medium Erratic | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | |
| High Erratic | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

### Construction Type Code 3000 Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | 1 | 7 | 6 | 2 | 3 | 1 | 4 | 7 | | 3 | | | 6 | 3 | | 2 | 7 | 6 | 2 | 1 | 4 | 4 | 4 | 3 | 6 | | |
| Insignificant | | 4 | | 1 | | 2 | 1 | 2 | | | 1 | 1 | 1 | 1 | | | | | 1 | | | 1 | | 2 | 1 | 1 | | |
| Low Normal | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | |
| Medium Normal | | | | | | | | | | | | 1 | 2 | | | 7 | | | | | | | | | | | | |
| High Normal | | 2 | | | | | | | | | | 3 | | | | | | | | | | | | | | | 6 | 7 |
| Low Erratic | 1 | | | | 3 | 1 | 4 | 1 | | 3 | 3 | 1 | 2 | | 1 | | 5 | | | 4 | 3 | 2 | 3 | 1 | 2 | | |
| Medium Erratic | 2 | | | | 1 | 1 | | | | 3 | | 1 | 2 | | 3 | | | | | | 3 | | | | 1 | | |
| High Erratic | 4 | | | | 1 | | 1 | | | 1 | | | | | | | | | | | | | | | | | 1 | |

### Construction Type Code 4000 Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | | 2 | 3 | | 2 | 1 | 3 | 1 | | 3 | | | 3 | | | | 2 | 3 | | | | 2 | 3 | 3 | 3 | | |
| Insignificant | | 1 | 1 | | | | | | | 1 | | | | | | | | 1 | | | | 3 | 1 | | | | | |
| Low Normal | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Medium Normal | | | | | | | | | | | | 1 | | | 1 | 3 | | | | | | | | | | | | |
| High Normal | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | 3 |
| Low Erratic | | 2 | | | 1 | | 2 | | 2 | | | 1 | 2 | | 1 | | 3 | | | 3 | 1 | | | | | | | |
| Medium Erratic | | | | | 2 | | | | | 2 | | | 1 | | 1 | | | | | | | | | | | | | |
| High Erratic | 2 | | | | | 1 | | | | | | 1 | | | | | | | | | 2 | | | | | | | |

### Construction Type Code 6000 Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | 3 | | 6 | 2 | 2 | | 4 | 3 | | 3 | | | 5 | | | | 5 | 5 | | 1 | 2 | 5 | 6 | 3 | 3 | | |
| Insignificant | | 1 | 1 | | 1 | 1 | | 1 | 1 | | 1 | | | 1 | | | | | 1 | | | 2 | 1 | | | 3 | | |
| Low Normal | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Medium Normal | | | | | | | | | | | | 2 | 2 | | | 4 | | 1 | | 1 | | | | | | | | |
| High Normal | | | | | | | | | | | 1 | 3 | | | | 2 | | | | | | | | | | | 6 | 5 |
| Low Erratic | | | 3 | | 1 | | 5 | 1 | 2 | 5 | 1 | | 2 | | 3 | | 6 | | | 5 | 3 | 2 | | | 1 | | | |
| Medium Erratic | 1 | 1 | 2 | | | 3 | 1 | | | | | 1 | 2 | | 3 | | | | | | | | | | 2 | | | |
| High Erratic | 5 | 1 | | | 2 | | | | | 1 | | | | | | | | | | | 2 | | | | | | | 1 |

### Construction Type Code 7000 Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | 1 | | 3 | 5 | 6 | 1 | 6 | 4 | | 5 | | | 6 | | | | 4 | 2 | 1 | | 2 | 5 | 4 | 3 | 5 | | |
| Insignificant | | 2 | | 2 | | 1 | | | | | 1 | | | | | | | 2 | 2 | | | 3 | 1 | 1 | 1 | 2 | | |
| Low Normal | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Medium Normal | | | | | | | | | | | | | | | | 5 | | | | 1 | | | | | | | | |
| High Normal | 1 | | | | | | | | | | | 5 | | | | | | | | | | | | | | | 5 | 5 |
| Low Erratic | | 4 | 5 | 1 | 2 | | 1 | 1 | 2 | 3 | 1 | | 2 | 1 | 3 | | 7 | 1 | 2 | 4 | | 1 | 1 | 2 | 1 | | 1 | |
| Medium Erratic | 1 | | 2 | 1 | | | 2 | | 1 | 2 | | | 1 | | 4 | 2 | | | 1 | 1 | 1 | | | | 1 | | | |
| High Erratic | 5 | | | | | | 3 | | | 2 | | 2 | 4 | | | | | | | | 6 | 1 | | | 1 | | 1 | 2 |

### Construction Type Code Overall Series

| Size of Charge* | MAINTENANCE OPERATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Total |
| No Charge | | 5 | 10 | 19 | 9 | 14 | 4 | 18 | 15 | | 14 | | | 20 | 4 | | 2 | 19 | 17 | 3 | 2 | 8 | 17 | 19 | 13 | 18 | | |
| Insignificant | | 8 | 2 | 3 | 1 | 4 | 1 | 3 | | 1 | 3 | 1 | 1 | 3 | | | | 3 | 4 | 1 | | 9 | 3 | 4 | 2 | 6 | | |
| Low Normal | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | |
| Medium Normal | | | | | | | | | | | | 4 | 4 | | 1 | 20 | | 1 | | 2 | | | | | | | | |
| High Normal | 2 | 3 | | | | | | | | | 1 | 11 | | | | 2 | | | | | | | | | | | 21 | 21 |
| Low Erratic | 2 | 6 | 8 | 1 | 8 | 1 | 12 | 3 | 7 | 12 | 6 | 3 | 8 | 1 | 8 | | 22 | 1 | 2 | 16 | 8 | 6 | 4 | 1 | 4 | | 1 | |
| Medium Erratic | 4 | 1 | 4 | 1 | 3 | 4 | 3 | | 1 | 7 | | 2 | 7 | | 11 | 2 | | | 1 | 1 | 4 | | | | 4 | | | |
| High Erratic | 16 | 1 | | | 3 | 1 | 4 | | | 4 | | 3 | 4 | | | | | | | | 10 | 1 | | | 1 | | 2 | 3 |

FIGURE 3.
DISTRIBUTION OF ROUTINE MAINTENANCE CHARGES TO OPERATIONS, BY SIZE OF CHARGE

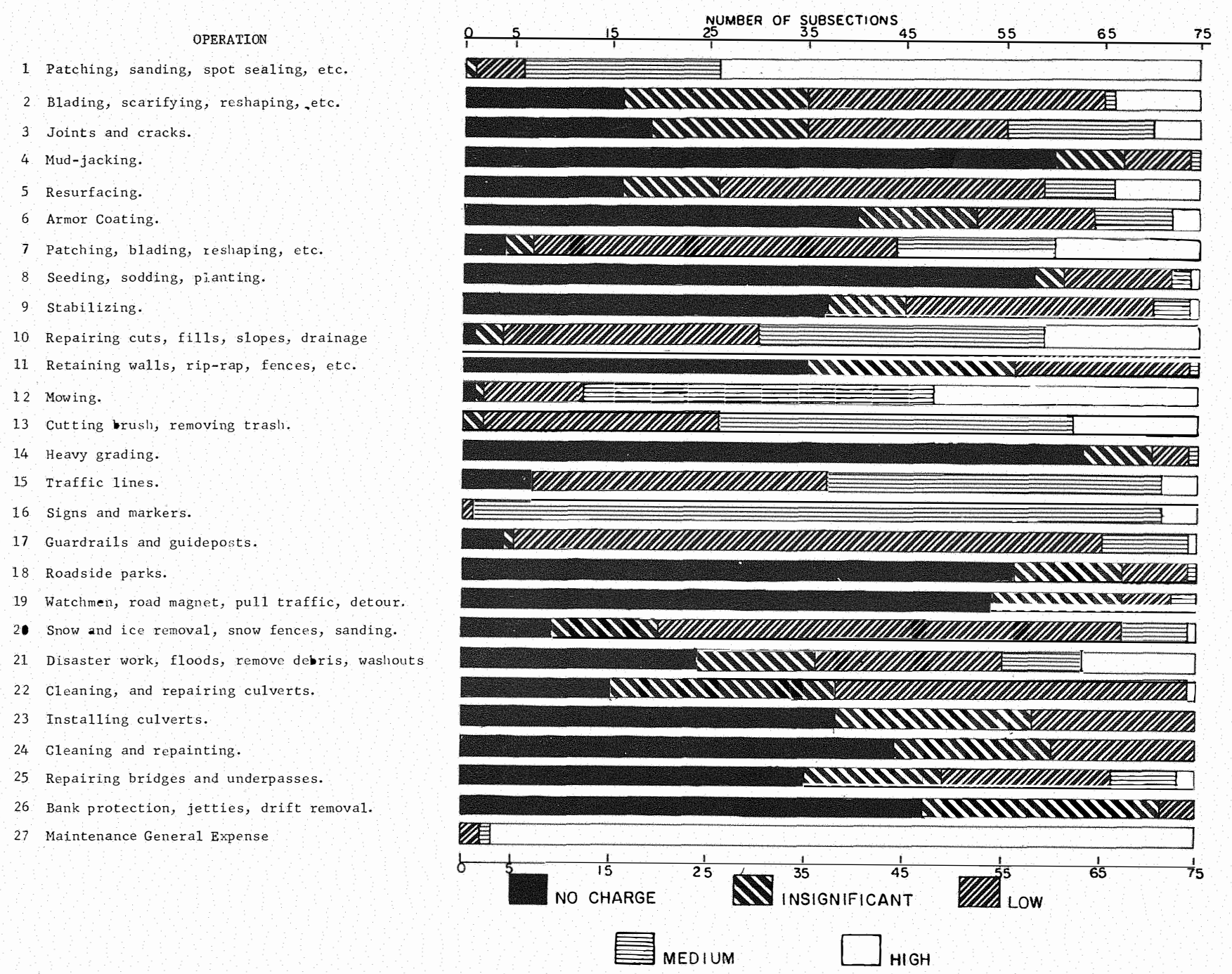


Table E summarizes the updated costs for each code type and division. Comparisons of the means shows that there are large differences in average cost per mile for routine maintenance between divisions for each code type (See Fig. 4, page 25). The same holds true for special maintenance costs (Fig. 5, page 26). Comparisons of the standard deviations also show large variability between divisions. All of this is due to several factors:

1. Sampling error - Columns 15 and 16 compare the mean costs per mile for the sample with that of all roads for the eight chargeable periods from 1957 to 1964.

2. Inherent differences in maintenance requirements.

3. Differences in maintenance practices.

4. Differences in methods of charging maintenance costs.

# TABLE E

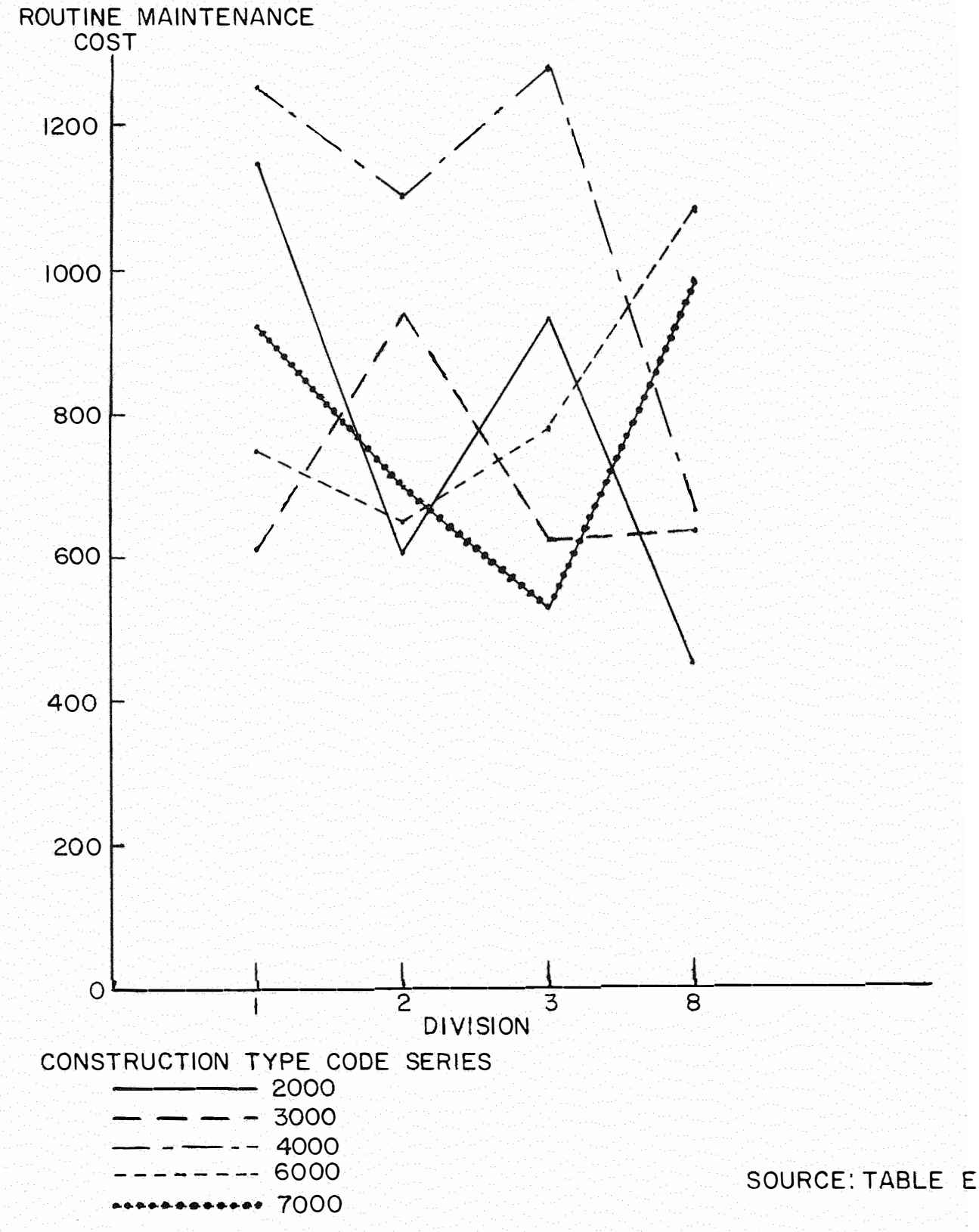
## MAINTENANCE COSTS BY DIVISION AND CONSTRUCTION TYPE CODE.

| | | ROUTINE MAINTENANCE | | | | | | SPECIAL MAINTENANCE | | | | | | TOTAL | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Code Type | Within Code Types | | | Within Divisions | | | Within Code Types | | | Within Divisions | | | Actual Cost Mile | | |
| Div. | Series | $n_i$ | $m_i$ | $s_i$ | $n_j$ | $m_j$ | $s_j$ | $n_i$ | $m_i$ | $s_i$ | $n_j$ | $m_j$ | $s_j$ | Sample | State | 1964 |
| | 2000 | 15 | 1149 | 459 | 121 | 879 | 487 | 1 | 2448 | | 27 | 2715 | 3463 | 1312 | 1169 | 1667 |
| | 3000 | 27 | 613 | 392 | | | | 5 | 3185 | 2476 | | | | 1203 | 1215 | 1304 |
| 1 | 4000 | 16 | 1253 | 743 | | | | 8 | 2073 | 1709 | | | | 2290 | 1628 | 1482 |
| | 6000 | 33 | 755 | 394 | | | | 7 | 4916 | 5414 | | | | 1798 | 1198 | 919 |
| | 7000 | 30 | 922 | 234 | | | | 6 | 656 | 337 | | | | 1053 | 1379 | 1566 |
| | 2000 | 7 | 605 | 302 | 134 | 814 | 550 | 3 | 593 | 609 | 45 | 1980 | 1896 | 859 | 752 | 904 |
| | 3000 | 20 | 946 | 660 | | | | 7 | 1923 | 1177 | | | | 1619 | 949 | 948 |
| 2 | 4000 | 32 | 1104 | 787 | | | | 13 | 2082 | 1692 | | | | 1950 | 2136 | 2329 |
| | 6000 | 42 | 655 | 328 | | | | 18 | 2289 | 2408 | | | | 1636 | 1106 | 935 |
| | 7000 | 33 | 698 | 243 | | | | 4 | 1398 | 305 | | | | 867 | 768 | 1419 |
| | 2000 | 8 | 935 | 399 | 120 | 801 | 647 | | | | 17 | 3782 | 3094 | 935 | 826 | 1006 |
| | 3000 | 30 | 623 | 529 | | | | 5 | 2078 | 1067 | | | | 969 | 929 | 734 |
| 3 | 4000 | 24 | 1279 | 839 | | | | 8 | 5120 | 3396 | | | | 2986 | 1589 | 1624 |
| | 6000 | 34 | 780 | 643 | | | | 4 | 3236 | 2945 | | | | 1161 | 1257 | 1704 |
| | 7000 | 24 | 529 | 228 | | | | | | | | | | 529 | 824 | 1088 |
| | 2000 | 8 | 449 | 58 | 190 | 858 | 678 | | | | 34 | 1730 | 2046 | 449 | 1146 | 3308 |
| | 3000 | 55 | 635 | 327 | | | | 14 | 1802 | 2570 | | | | 1094 | 1392 | 1028 |
| 8 | 4000 | 24 | 762 | 368 | | | | 6 | 1356 | 1108 | | | | 1101 | 1508 | 1863 |
| | 6000 | 47 | 1085 | 1007 | | | | 10 | 1915 | 1876 | | | | 1492 | 1416 | 2718 |
| | 7000 | 56 | 986 | 639 | | | | 4 | 1578 | 1222 | | | | 1099 | 1101 | 1421 |
| | 2000 | 38 | 856 | 465 | 565 | 840 | 606 | 4 | 1057 | 961 | 123 | 2321 | 2626 | 967 | 942 | 1260 |
| | 3000 | 132 | 675 | 345 | | | | 31 | 2097 | 2169 | | | | 1167 | 1163 | 1159 |
| Overall | 4000 | 96 | 1087 | 741 | | | | 35 | 2650 | 2540 | | | | 2053 | 1669 | 1537 |
| | 6000 | 156 | 833 | 698 | | | | 39 | 2762 | 3297 | | | | 1524 | 1230 | 2026 |
| | 7000 | 143 | 829 | 474 | | | | 14 | 1131 | 823 | | | | 940 | 1013 | 1407 |

$n_i$ = Number of years of data within code types
$m_i$ = Mean cost within code types
$s_i$ = Standard deviation within code types
$n_j$ = Number of years of data within divisions
$m_j$ = Mean cost within divisions
$s_j$ = Standard deviation within divisions

FIGURE 4

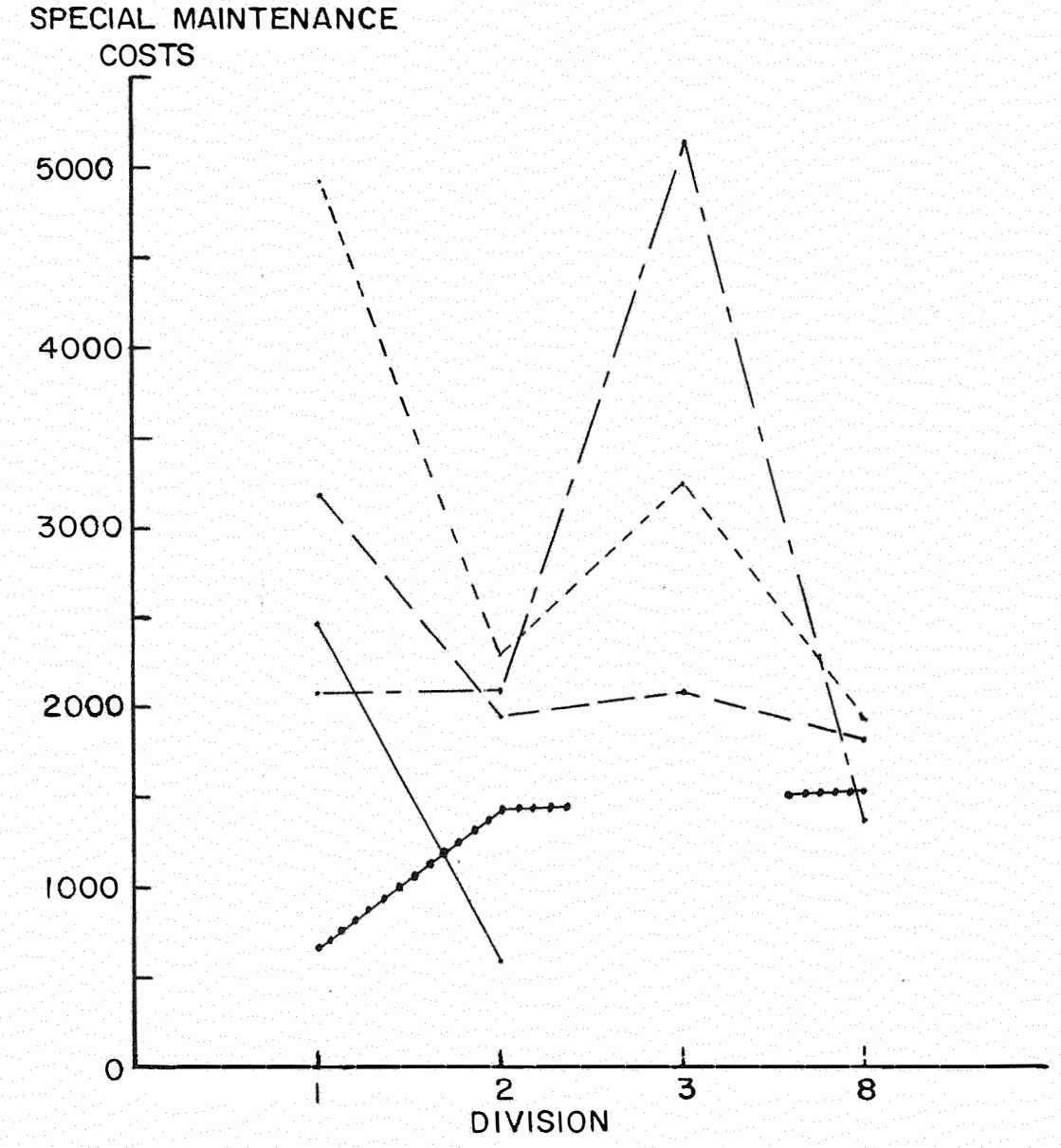
GRAPH OF MEAN ROUTINE MAINTENANCE COST FOR EACH CODE TYPE, BY DIVISION.




SOURCE: TABLE E

FIGURE 5.

GRAPH OF MEAN SPECIAL MAINTENANCE COST FOR EACH CODE TYPE, BY DIVISION




SOURCE: TABLE E

Analysis of Estimated Cost Data

Surveys were made in 1964, 1965, and 1966 to estimate the amount of money required to return the subsections under study to an "as constructed" condition. The cost estimates were made only for existing deficiencies and did not include such operations as mowing or emergency services. The actual expenditures for each subsection were also gathered. All costs were adjusted to a 1964 base.

The unpaid rate of deterioration was defined as:

$$r = \frac{M_e}{C} ;$$

Where: $M_e$ = estimated maintenance cost
$C$ = original construction cost

The unpaid rate of deterioration reflects the relative degree to which a given subsection has deteriorated.

Table F, page 28, lists the subsections under study in Division 3. Of the 17 subsections, ten had an increase in estimated maintenance costs from 1964 to 1965, indicating a worsening of conditions. Estimated costs remained constant for four subsections, which suggests that actual maintenance espenditures only held conditions at the same level. Estimated costs for three subsections decreased to show improvement in conditions. The picture was much the same for the years 1965 to 1966 with estimated costs increasing in nine cases, remaining constant in five cases, and decreasing in 3 cases. The trend in the unpaid rate of deterioration is the same as for estimated costs.

Figure 6, page 29 shows the trends of average actual expenditures and average estimated costs. Theoretically the trend in actual costs should be reflected in the next years estimated costs. Thus the drop in actual expenditures from 1964 to 1965 is followed by a sharp rise in estimated costs from 1965 to 1966.

The average increase in the unpaid rate of deterioration was from .045 in 1964 to .050 in 1965. In 1966 it increases to .070.

# TABLE F

## COMPARISON OF ESTIMATED AND ACTUAL MAINTENANCE COSTS ON RANDOMLY CHOSEN MILES.*

| Subsection Number | Const. Code | Const. Cost | Actual Maintenance Cost | | | Estimated Maintenance Cost | | | Unpaid Rate of Deterioration | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1964 | 1965 | 1966 | 1964 | 1965 | 1966 | 1964 | 1965 | 1966 |
| 35-16-070 | 2,000 | 16,655 | 926 | 937 | 1,449 | -0- | 243 | 243 | -0- | .015 | .015 |
| 67-33-000 | 3,113 | 13,936 | 930 | 332 | 517 | 897 | 2,324 | 1,201 | .064 | .167 | .086 |
| 25-28-000 | 3,212 | 60,631 | 428 | 882 | 1,002 | 1,155 | 1,155 | 3,036 | .019 | .019 | .050 |
| 54-12-000 | 3,212 | 59,608 | 699 | 540 | 415 | 799 | 799 | 959 | .013 | .013 | .016 |
| 67-34-000 | 3,212 | 66,248 | 517 | 544 | 429 | 1,729 | 2,653 | 3,881 | .026 | .040 | .059 |
| 50-20-000 | 4,221** | 41,214 | 1,625 | 630 | 433 | 1,916 | 53 | -0- | .046 | .001 | .000 |
| 15-06-014 | 4,243** | 22,416 | 1,012 | 815 | 715 | 2,233 | 4,651 | 11,078 | .100 | .207 | .494 |
| 63-30-000 | 4,251 | 40,565 | 5,194 | 1,618 | 2,252 | 9,968 | 1,424 | 1,424 | .246 | .035 | .035 |
| 35-18-000 | 6,202 | 46,451 | 1,699 | 695 | 1,435 | 900 | 900 | 900 | .019 | .019 | .019 |
| 67-02-034*** | 6,202 | 136,649 | 1,280 | 1,496 | 1,180 | 3,947 | 1,846 | 1,616 | .029 | .014 | .012 |
| 44-34-000 | 6,222 | 52,488 | 455 | 622 | 594 | 708 | 3,368 | 5,287 | .013 | .064 | .101 |
| 67-14-017*** | 6,222 | 80,193 | 411 | 702 | 390 | 1,437 | 1,437 | 1,905 | .018 | .018 | .024 |
| 15-04-000 | 7,102 | 139,295 | 956 | 771 | 969 | 10,288 | 10,536 | 10,577 | .074 | .076 | .076 |
| 54,02-000 | 7,111 | 144,774 | 724 | 547 | 2,396 | 1,854 | 4,252 | 4,746 | .013 | .030 | .033 |
| 67-02-085 | 7,111 | 188,917 | 444 | 301 | 1,108 | 3,964 | 5,566 | 5,566 | .021 | .029 | .029 |
| 25,02-034 | 9,670 | 105,302 | 666 | 1,640 | 1,765 | 1,399 | 1,418 | 1,452 | .013 | .013 | .014 |
| 50,04-000 | 9,670 | 145,465 | 2,680 | 4,791 | 2,938 | 7,978 | 14,092 | 14,092 | .055 | .097 | .097 |

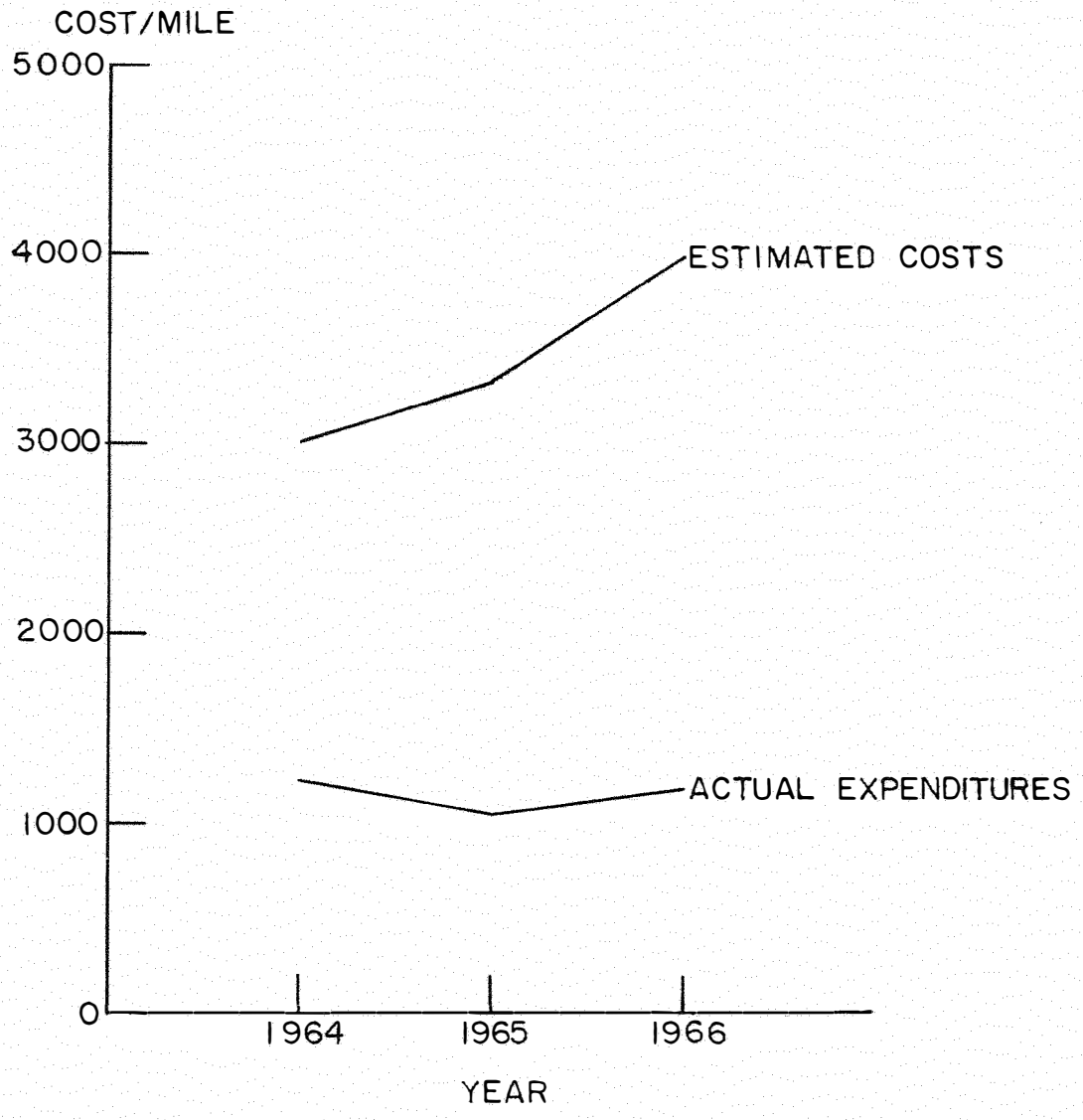
* Estimated costs are for the random miles only. Actual costs are average per mile costs for the whole subsection. All costs are adjusted to 1964 base.

** Construction code type changed in 1964.

*** Subsection length changed in 1966.

# FIGURE 6

GRAPH OF AVERAGE COST/MILE SHOWING BOTH ESTIMATED AND ACTUAL MAINTENANCE COSTS FOR 17 RANDOMLY CHOSEN MILES IN DIVISION 3.



## SUMMARY AND CONCLUSIONS

Yearly costs data do not adequately represent maintenance performed on a particular subsection. Although detailed records are kept, the fact that expenditures were charged to a given subsection does not necessarily mean that maintenance was performed as charged. No provision is made for stock piling of routine maintenance materials in making proper distribution to subsections when the materials are used.

Routine and special maintenance do not appear to be well defined as indicated by the accounting procedures.

The purpose of the random mile approach of observing maintenance and its costs was inhibited by a lack of records of actual costs of maintaining the miles.

Various designs and environmental factors seemed to have no mathematical relationship with maintenance costs. It is not known how much of this is due to invalid cost record or how much is caused by inadequate or improper representation of factors.

An objective method of estimating future maintenance costs must wait for a definition of the level at which maintenance will be performed.

Eleven out of the twenty-seven maintenance operations had low infrequent or no charges made to them in the majority of subsections. These eleven operations account for only 3.86% of the total cost of the maintenance operation.

Only two of the operations had consistent charges. This is accounted for by the prorata distribution of these charges to the subsections. Suggestions made during this study have led to the adoption of chapter seven maintenance accounting "AASHO Manual of Uniform Highway Accounting Procedures" of October 17-20, 1967, with slight modifications with regard to the maintenance operation code or maintenance activity code. This has resulted in the reduction of the number of activity codes to 15 as presented here.

OKLAHOMA HIGHWAY DEPARTMENT
PROPOSED MAINTENANCE OPERATION CODE

| | |
|---|---|
| Physical or General Maintenance | 410 Routine Roadway Surface |
| | 420 Special Maintenance Operations |
| | 430 Shoulders and Side Approaches |
| | 460 Drainage |
| | 470 Roadside and Landscape Maintenance |
| | 471 Mowing |
| | 472 Chemical Control of Vegetation |
| | 480 Structures |
| Traffic Services | 510 Snow and Ice Control |
| | 530 Traffic Control & Motorists Service |
| | 531 Traffic Line Markings |
| | 532 Modern Rest Areas |
| | 540 Litter Cleaning and Control |
| Unusual or Disaster Maintenance | 610 Emergency or Disaster Operation |
| | 650 Maintenance General Expense |

In addition to the above revisions, action has been taken to revise the subsection numbering system to provide a more accurate cost record of maintenance operations.