Convict Labor, Camp No. 1B, Layton-Dingman's Road, Construction Work.

# Twenty-second Annual Report

OF THE

# Commissioner of Public Roads

For the Year Ending October 31st

1915

---

TRENTON, N. J.
MacCrellish & Quigley Co., State Printers.

1915

OFFICE OF COMMISSIONER OF PUBLIC ROADS,

TRENTON, NEW JERSEY, November 15, 1915.

*To the Honorable James F. Fielder, Governor, and the Legislature of New Jersey:*

I have the honor to submit the Twenty-second Annual Report of the Commissioner of Public Roads for the fiscal year ending October 31, 1915, with such comments and suggestions as existing circumstances seem to require.

E. A. STEVENS,

*Commissioner of Public Roads.*

## FINANCIAL STATEMENT.

### Statement of Appropriations—November 1, 1914 to October 31, 1915.

| Public Road Funds. | *Carried Forward on Contracts.* | *Annual Appropriation.* | *Total Amount Available.* | *Expended.* | *Outstanding on Requisitions.* | *Balance Forward on Contracts.* | *Lapsed to State Treasury.* |
|---|---|---|---|---|---|---|---|
| Appropriation Public Roads, 1909–10, | $1,203 63 | ..... | $1,203 63 | ..... | ..... | $1,203 63 | ..... |
| Appropriation Public Roads, 1910–11, | 7,617 83 | ..... | 7,617 83 | $7,617 83 | ..... | ..... | ..... |
| Appropriation Public Roads, 1912–13, | 18,868 07 | ..... | 18,868 07 | 18,868 07 | ..... | ..... | ..... |
| State Road Fund, 1913–14, | 362,730 03 | ..... | 362,730 03 | 167,032 59 | ..... | 113,163 67 | $82,553 77 |
| State Road Fund, 1914–15, | ..... | $500,000 00 | 500,000 00 | 108,373 02 | $9,840 50 | 378,362 66 | 3,423 82* |
| | $390,419 56 | $500,000 00 | $890,419 56 | $301,891 51 | $9,840 50 | $492,729 96 | $85,957 59 |
| General Appropriations. | | | | | | | |
| Salary of Commissioner, | | $5,000 00 | $5,000 00 | $5,000 00 | ..... | ..... | ..... |
| Salary of State Highway Engineer, | | 4,000 00 | 4,000 00 | 4,000 00 | ..... | ..... | ..... |
| Salary of Division Engineers, | | 8,800 00 | 8,800 00 | 7,300 00 | ..... | ..... | $1,500 00 |
| Clerical and Office Expenses, | | 17,500 00 | 17,500 00 | 11,785 56 | $2,576 40 | ..... | 3,138 04* |
| Convict Labor (General Appropriation), | | 60,000 00 | ..... | ..... | ..... | ..... | ..... |
| Convict Labor (Supplemental Appropriation), | | 50,000 00 | 110,000 00 | 82,053 83 | 26,497 92 | ..... | 1,448 25* |
| | | $145,300 00 | $145,300 00 | $110,139 39 | $29,074 32 | ..... | $6,086 29 |

| Motor Vehicle Account. | *Balance Forward.* | *Receipts.* | *Total Amount Available.* | *Expended.* | *Carried Forward.* |
|---|---|---|---|---|---|
| Motor Vehicle Fund, | $342,644 48 | $1,027,986 76 | $1,370,631 24 | ..... | $522,385 22 |
| Paid on Allotments, | ..... | ..... | ..... | $748,308 52 | ..... |
| Appropriated for Expenses Assistant Supervisors, | ..... | ..... | ..... | 3,000 00 | ..... |
| Appropriated for Expenses Motor Vehicle Department, | ..... | ..... | ..... | 96,937 50 | ..... |
| Ocean Highway Fund, | 2,968 87 | ..... | 2,968 87 | 2,968 87 | ..... |
| | $345,613 35 | $1,027,986 76 | $1,373,600 11 | $851,214 89 | $522,385 22 |

## CASH STATEMENT.

### For Fiscal Year 1914-15.

PUBLIC ROAD FUNDS.

| | | |
|---|---|---|
| Paid on Contracts, | | $228,267 65 |
| Paid on Extras, | | 14,748 58 |
| Paid for Engineering (final), | | 7,594 50 |
| Paid for Inspection (final), | | 5,255 54 |
| | | $255,866 27 |
| Paid in advance for Inspection of 40% roads, | | 13,102 02 |
| Paid for Inspection not charged to any given roads: | | |
| Salary Regular Inspectors, | $6,712 50 | |
| Expenses Regular Inspectors, | 921 16 | |
| Salary Foremen, | 15,058 00 | |
| Salary Extra Inspectors, | 5,400 50 | |
| | | 28,092 16 |
| Survey State Highway, | | 4,831 06 |
| Total paid during year, | | $301,891 51 |

MOTOR VEHICLE FUNDS.

| | | |
|---|---|---|
| Paid on Allotments for maintenance work, | | $748,308 52 |
| Paid on account of Ocean Highway, | | 2,968 87 |
| Paid for Expenses of Assistant Supervisors, | $2,392 04 | |
| Outstanding on requisitions, | 396 58 | |
| Lapsed to State Treasury, | 211 38* | |
| | | 3,000 00 |
| Appropriated for Expenses of Motor Vehicle Department, | | 96,937 50 |
| Total paid from Motor Vehicle Funds, | | $851,214 89 |

## Balance Sheet—October 31, 1915.

PUBLIC ROAD FUNDS.

ASSETS.

| | |
|---|---|
| Cash Balance, Appropriation for Public Roads, 1909–10, | $1,203 63 |
| Cash Balance, State Road Fund, 1913–14, | 113,163 67 |
| Cash Balance, State Road Fund, 1914–15, | 388,203 16 |
| | $502,570 46 |

LIABILITIES.

| | |
|---|---|
| Approved contracts for new construction outstanding, | $433,488 43 |
| Approved extras outstanding, | 5,920 51 |
| Reserve for extras, engineering and inspection, | 53,321 02 |
| Outstanding on requisitions, | 9,840 50 |
| | $502,570 46 |

MOTOR VEHICLE FUNDS.

ASSETS.

| | |
|---|---|
| Cash Balance, Motor Vehicle Fund, | $522,385 22 |

LIABILITIES.

| | |
|---|---|
| Allotments for maintenance outstanding, | 442 531 70 |
| Balance available, | $79,853 52 |

* Amounts as apparent; these may be changed through entire amount outstanding on requisitions not being used.

# Payments on Roads and Bridges, 1915.

## PAYMENTS FROM 1915 APPROPRIATION.

In compliance with chapter 58, laws of 1905, and chapter 395, laws of 1912, and all supplements thereto and amendments thereof, the following statement of cost of roads and bridges is submitted.

The following payments have been made during the fiscal year 1915 and paid for from the appropriation for 1915:

CAMDEN COUNTY—Sharps Corner road, 1.402 miles; cost allowed, $14,976.63; State's share, $5,641.42.

ESSEX COUNTY—Pleasant Valley way, 3.620 miles; cost allowed, $16,437.54; State's share, $5,479.18. See 1911 appropriation for additional payment of $5,005.79.

GLOUCESTER COUNTY—Mickleton-Swedesboro road, 4.079 miles; cost allowed, $53,917.75; State's share, $21,567.10. See 1913 appropriation for additional payment of $6,558.21.

HUNTERDON COUNTY—Lambertville-County Line road, 0.962 mile; cost allowed, $18,747.50; State's share, $7,034.70.

MIDDLESEX COUNTY—Perth Amboy-South Amboy drawbridge. The State pays one-third of the cost of repairs and maintenance from the road fund (chapter 413, laws of 1912). Cost of maintenance and repairs, $23,520.03; State's share, $7,840.01.

MONMOUTH COUNTY—Allentown-New Canton road, 1.070 miles; cost allowed, $13,149.72; State's share, $4,907.04.

OCEAN COUNTY—Bay avenue, first section, Long Beach township, 3.258 miles; cost allowed on partial payment, $7,830.15; State's share on partial payment, $2,286.06. Partial payment of $9,717.07 paid from 1913 appropriation and reported in 1914. Described in 1914 report. Bay avenue, second section, Stafford township, 1.704 miles; cost allowed, $8,158.48; State's share, $3,011.39. Total for county, 4.962 miles; cost allowed, $15,988.63; State's share, $5,297.45.

UNION COUNTY—Shunpike road, middle section, grading only, 0.278 mile; cost allowed, $13,477.21; State's share, $4,580.88.

Total mileage paid for from 1915 appropriation, 16.373 miles; total cost allowed on contracts paid for from 1915 appropriation, $170,215.01; total State's share paid on contracts from 1915 appropriation, $62,347.78; amount of payment for general inspection of roads, $41,194.18; survey of State Highway, $4,831.06; total amount of payments from 1915 appropriation, $108,373.02.

## PAYMENTS ON ROADS AND BRIDGES FROM 1914 APPROPRIATION.

In compliance with chapter 395, laws of 1912, and supplements thereto and amendments thereof, the following statement of cost of roads and bridges is submitted.

The following payments have been made during the fiscal year 1915, but paid from the appropriation for 1914:

ATLANTIC COUNTY—Bridges on the Somers Point-Mays Landing road: Gravelly Run bridge, cost allowed, $3,455.85; State's share, $529.17. Miry Run bridge, cost allowed, $3,664.95; State's share, $510.99. Perch Cove bridge, cost allowed, $2,749.80; State's share, $420.96. Powell's Creek bridge, cost allowed, $1,318.80; State's share, $200.76. Total for county, cost allowed, $11,189.40; State's share, $1,661.88.

BERGEN COUNTY—Anderson avenue, first section, 1.760 miles; cost allowed, $38,190.67; State's share, $14,187.27.

CAMDEN COUNTY—Concrete bridges over Newton creek: Main branch, cost allowed, $5,692.00; State's share, $1,138.40. North branch, cost allowed, $4,785.00; State's share, $957.00. Total for county, cost allowed, $10,477.00; State's share, $2,095.40.

CAPE MAY COUNTY—Ocean City bridge, cost allowed, $26,871.66; State's share, $3,878.83.

HUNTERDON COUNTY—Flemington-Frenchtown road, second section, 5.564 miles; cost allowed, $79,590.33; State's share, $30,771.13. West Portal-Bloomsbury road, 3.069 miles; cost allowed on partial payment, $9,115.18; State's share on partial payment, $3,646.07; partial payment of $12,477.37 made and reported in 1914. White House-New Germantown road, 3.590 miles; cost allowed, $41,468.85; State's share, $16,013.04. Total for county, 12.223 miles; cost allowed, $130,174.36; State's share, $50,430.24.

MERCER COUNTY—Windsor-Newtown-Yardville road, 7.057 miles; cost allowed, $74,362.11; State's share, $27,695.84.

MIDDLESEX COUNTY—Roosevelt-Woodbridge road, first section, 1.166 miles; cost allowed, $23,362.62; State's share, $8,830.55. Roosevelt-Woodbridge road, second section, 0.618 mile; cost allowed, $7,183.74; State's share, $2,863.50. Total for county, 1,784 miles; cost allowed, $30,746.36; State's share, $11,694.05.

MONMOUTH COUNTY—Red Bank-Holmdel road, third section, 1.080 miles; cost allowed, $7,390.00; State's share, $2,560.20.

OCEAN COUNTY—Bay avenue, first section, Stafford township, 1.458 miles; cost allowed on partial payment, $9,141.17; State's share on partial payment, $3,437.47. Partial payment of $3,542.55 reported in 1914.

PASSAIC COUNTY—Paterson and Hamburg turnpike, Bloomingdale section, 0.632 mile; cost allowed, $16,562.80; State's share, $6,297.07.

SALEM COUNTY—Pole Tavern-Elmer road, 2.955 miles; cost allowed, $14,558.93; State's share, $5,424.99.

SOMERSET COUNTY—Blackwell's Mills and Millstone road, third section, 0.434 mile; cost allowed, $13,148.60; State's share, $4,872.44. Bridge on above road, cost allowed, $17,856.00; State's share, $3,571.20. Total for county, 0.434 mile; cost allowed, $31,004.60; State's share, $8,443.64.

SUSSEX COUNTY—Newton-Branchville road, first section, cost allowed on partial payment, $19,000.40; State's share on partial payment, $7,600.16. Newton-Branchville road, second section, cost allowed on partial payment, $21,749.52; State's share on partial payment, $8,699.81. Total for county, cost allowed, $40,749.92; State's share, $16,299.97.

UNION COUNTY—Westfield or North avenue, 1.789 miles; cost allowed, $32,831.86; State's share, $12,925.74.

Total mileage paid for from 1914 appropriation, 31.172 miles; total cost allowed on contracts against 1914 appropriation, $474,250.84; total State's share on contracts against 1914 appropriation, $167,032.59.

## PAYMENTS ON ROADS FROM 1913 APPROPRIATION.

In compliance with chapter 58, laws of 1905, and chapter 395, laws of 1912, and supplements thereto and amendments thereof, the following statement of cost of roads is submitted.

The following payments have been made during the fiscal year 1915, but paid from the appropriation of 1913:

ESSEX COUNTY—Clinton avenue, 1.300 miles; cost allowed, $14,763.85; State's share, $5,059.19. Lindsley road, 1.489 miles; cost allowed, $21,752.00; State's share, $7,250.67. Total for county, 2.789 miles; cost allowed, $36,515.85; State's share, $12,309.86.

GLOUCESTER COUNTY—Mickelton-Swedesboro road, cost allowed, $18,108.55; State's share, $6,558.21. See 1915 appropriation for additional payment of $21,567.10.

Total mileage paid for from 1913 appropriation, 2.789 miles; total cost allowed on contracts against 1913 appropriation, $54,624.40; total State's share on contracts against 1913 appropriation, $18,868.07.

## PAYMENTS ON ROADS FROM 1911 APPROPRIATION.

In compliance with chapter 58, laws of 1905, and all supplements thereto and amendments thereof, the following statement of cost of roads is submitted.

The following payments have been made during the fiscal year 1915, but were made from the appropriation for 1911:

ESSEX COUNTY—Pleasant Valley Way, cost allowed, $15.017.36; State's share, $5,005.79. See 1915 appropriation for mileage and payment of $5,479.18.

SOMERSET COUNTY—Franklin Park and Kingston road (½), 2.595 miles; cost allowed on partial payment, $7,836.12; State's share on partial payment, $2,612.04. One-half of this road is in Middlesex county and one-half is in Somerset county, hence the above mileage is only one-half of the total length. For a description of this road and a detailed statement of cost, see Annual Report for 1914, pp. 37 and 38.

Total mileage paid for from 1911 appropriation, 2.595 miles; total cost allowed on contracts against 1911 appropriation, $22,853.48; total State's share on contracts against 1911 appropriation, $7,617.83.

Total length of improved roads added to mileage during fiscal year ending October 31, 1915, and total amount of money allowed and expended during same period.

| | *Miles.* | *Cost Allowed.* | *State's Share.* |
|---|---|---|---|
| Paid from 1915 appropriation, | 16.373 | $170,215 01 | $108,373 02 |
| Paid from 1914 appropriation, | 31.172 | 474,250 84 | 167,032 59 |
| Paid from 1913 appropriation, | 2.789 | 54,624 40 | 18,868 07 |
| Paid from 1911 appropriation, | 2.595 | 22,853 48 | 7,617 83 |
| | 52.929 | $721,943 73 | $301,891 51 |

The following roads are approaching completion:

| *County.* | *Name of Road.* | *Miles.* | *Cost Approximate.* |
|---|---|---|---|
| Atlantic, | Somers Point-Mays Landing, | 13.819 | $78,181 34 |
| | Wheat road and Twelfth street, Hammonton, | 13.787 | 67,519 58 |
| Bergen, | Market street, | 2.871 | 75,253 81 |
| Camden, | Cresson, | 3.036 | 19,871 15 |
| | Main street, Haddonfield, | 1.16 | 45,833 49 |
| Cumberland, | Landis avenue, sections 1, 2, 3, | 9.741 | 26,363 68 |
| Essex, | Gregory avenue, | 1.675 | 14,000 00 |
| Hunterdon, | Lebanon-Clinton road, extension, | 0.161 | 1,915 00 |
| Middlesex, | Roosevelt-Woodbridge, section 3, | 1.977 | 33,358 02 |
| | Schalk's Station, | 2.295 | 17,191 55 |
| Somerset, | Finderne avenue, | 1.041 | 11,448 13 |
| | Greater Cross roads, section 2, | 2.710 | 53,714 72 |
| Sussex, | Newton-Branchville, section 1, | 4.280 | 44,102 31 |
| | Newton-Branchville, section 2, | 3.320 | 28,089 22 |
| Union, | Wood avenue, Linden, | 1.135 | 27,956 20 |
| | Total, | 63.008 | $544,798 20 |

## Number of Miles of Road Built in Each County with State Aid in Each Year and Total

| COUNTY. | 1893. No. Miles. | 1894. No. Miles. | 1895. No. Miles. | 1896. No. Miles. | 1897. No. Miles. | 1898. No. Miles. | 1899. No. Miles. | 1900. No. Miles. | 1901. No. Miles. | 1902. No. Miles. | 1903. No. Miles. | 1904. No. Miles. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atlantic, .... | ..... | ..... | ..... | 12.00 | 10.00 | 6.84 | 4.03 | ..... | 7.03 | 20.10 | 13.00 | 1.00 |
| Bergen, ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 1.02 | ..... | 9.375 |
| Burlington, .. | 10.54 | 20.46 | 9.75 | 11.02 | 10.48 | 15.03 | 18.36 | 8.93 | 17.36 | 19.131 | 27.98 | 2.48 |
| Camden, ..... | 13.62 | ..... | 8.25 | ..... | 4.125 | 12.79 | 2.23 | 1.00 | 4.48 | 8.80 | 9.50 | 5.985 |
| Cape May, ... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 6.00 | 5.394 | 6.20 | 0.15 |
| Cumberland, . | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 1.22 | ..... |
| Essex, ..... | ..... | ..... | 6.5 | 6.00 | 4.91 | 6.67 | 12.07 | 9.60 | 9.36 | 8.723 | 5.79 | 8.545 |
| Gloucester, .. | ..... | ..... | 7.75 | 6.00 | 5.5 | 7.59 | 11.40 | 6.04 | 17.44 | 6.875 | 7.73 | ..... |
| Hudson, ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2.44 | ..... | ..... | ..... | ..... |
| Hunterdon, .. | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Mercer, ..... | ..... | 9.46 | 6.40 | 10.95 | 4.75 | 2.704 | 10.83 | 9.16 | 10.37 | 15.89 | 12.3 | 7.55 |
| *Middlesex, .. | 3.18 | 2.36 | 7.68 | 8.43 | 4.75 | 6.164 | 13.10 | 9.01 | 6.12 | 14.95 | 9.52 | 12.42 |
| Monmouth, .. | ..... | ..... | ..... | 3.75 | 5.00 | 5.1 | 14.46 | 5.64 | 6.67 | 13.25 | 17.67 | 5.21 |
| Morris, ..... | ..... | ..... | ..... | ..... | 6.13 | 6.3 | 10.46 | 6.53 | 4.306 | 10.079 | 7.13 | 5.98 |
| Ocean, ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 3.9 | 9.97 | 11.83 |
| Passaic, ..... | ..... | ..... | ..... | ..... | 4.79 | 5.48 | 8.67 | 6.73 | 3.987 | 6.57 | 6.09 | 1.54 |
| Salem, ..... | ..... | ..... | ..... | 2.67 | ..... | ..... | 2.17 | 2.05 | ..... | 2.51 | 4.61 | 7.477 |
| Somerset, .... | ..... | ..... | ..... | ..... | 6.22 | 7.27 | 6.6 | 6.65 | 7.93 | 5.88 | 6.24 | 10.68 |
| Sussex, ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 0.893 | ..... | 4.03 | 1.695 |
| Union, ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 3.432 | ..... | 2.141 | ..... | 0.63 |
| Warren, ..... | ..... | ..... | ..... | ..... | ..... | ..... | 0.08 | ..... | 7.43 | 8.792 | 3.94 | 13.09 |
| Totals,..... | 27.34 | 32.28 | 46.33 | 60.82 | 66.655 | 81.938 | 114.46 | 77.212 | 09.376 | 154.005 | 152.92 | 105.637 |

* In 1892, Middlesex, 10.55 miles.

**Each Year Since Passage of State Aid Law, Also Total Number Built Number in Each County.**

| 1905. No. Miles. | 1906. No. Miles. | 1907. No. Miles. | 1908. No. Miles. | 1909. No. Miles. | 1910. No. Miles. | 1911. No. Miles. | 1912. No. Miles. | 1913 No. Miles. | 1914. No. Miles. | 1915. No. Miles. | *Totals. No. Miles. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.51 | ..... | 6.408 | 13.94 | 7.24 | 8.077 | ..... | ..... | 11.016 | 11.867 | ..... | 134.058 |
| 2.22 | 0.42 | 1.14 | 9.595 | 10.533 | ..... | ..... | 3.607 | 8.776 | 2.704 | 1.760 | 51.150 |
| ..... | 2.51 | 3.11 | 7.55 | 0.132 | ..... | 2.9 | 8.095 | 14.244 | 11.595 | ..... | 221.657 |
| 1.40 | ..... | 20.51 | 2.33 | 2.43 | 5.113 | 4.987 | ..... | 2.924 | 8.070 | 1.402 | 119.946 |
| 2.63 | ..... | 4.00 | 3.399 | 11.87 | 3.042 | ..... | 16.809 | 10.797 | 6.161 | ..... | 76.452 |
| ..... | ..... | ..... | ..... | ..... | ..... | ..... | 19.141 | 5.595 | 1.458 | ..... | 27.414 |
| 8.24 | ..... | 7.115 | 12.623 | ..... | ..... | 8.157 | 1.414 | 3.355 | 2.831 | 6.409 | 128.312 |
| ..... | ..... | ..... | 5.74 | ..... | ..... | 3.594 | 2.169 | 3.503 | ..... | 4.079 | 95.410 |
| ..... | 2.32 | ..... | ..... | ..... | ..... | ..... | 0.785 | ..... | ..... | ..... | 5.545 |
| ..... | 5.55 | 5.37 | 6.478 | 5.867 | 1.000 | 9.207 | 4.394 | 5.839 | 9.940 | 13.185 | 66.830 |
| 16.18 | ..... | 5.85 | 7.85 | 2.25 | ..... | 5.308 | 5.506 | ..... | ..... | 7.057 | 150.365 |
| 8.335 | 4.981 | 5.13 | 17.674 | 13.613 | 1.685 | 5.158 | 3.470 | 10.354 | 4.958 | 1.784 | 185.376 |
| 7.47 | 3.36 | 2.18 | 11.54 | 7.085 | 8.226 | 9.607 | 1.173 | 2.781 | 2.310 | 2.150 | 134.632 |
| 3.59 | 5.94 | 0.69 | ..... | ..... | 6.585 | 2.938 | ..... | 4.524 | ..... | ..... | 81.182 |
| 7.16 | ..... | 6.91 | 11.006 | 2.867 | ..... | 5.379 | 19.675 | 22.168 | 5.420 | 6.420 | 112.705 |
| 5.38 | 3.88 | 4.132 | 4.99 | ..... | 0.789 | 2.786 | 0.528 | 2.969 | 7.802 | 0.632 | 77.745 |
| ..... | ..... | ..... | 2.906 | 7.78 | 3.31 | 1.779 | 5.049 | 14.540 | 6.753 | 2.955 | 66.559 |
| 2.685 | 5.6 | 7.284 | 4.37 | 5.365 | 1.268 | 5.155 | 10.343 | 5.038 | ..... | 3.029 | 107.607 |
| 0.98 | ..... | ..... | ..... | ..... | 3.455 | 3.278 | ..... | 12.628 | 5.476 | ..... | 32.435 |
| ..... | 4.01 | 2.336 | 4.232 | 7.757 | ..... | 4.427 | 3.520 | 7.916 | 4.038 | 2.067 | 46.506 |
| ..... | ..... | ..... | 7.95 | 1.92 | ..... | 12.265 | ..... | ..... | 10.663 | ..... | 66.130 |
| 67.78 | 38.571 | 82.165 | 134.173 | 86.709 | 42.550 | 86.925 | 105.678 | 148.967 | 102.046 | 52.929 | 1,988.016 |

| NAME OF COUNTY. | County Roads. | Township Roads. | Borough Roads. | Town Roads | Village Streets. | City Streets. | Toll Roads. | Estimated Mileage. |
|---|---|---|---|---|---|---|---|---|
| Atlantic, ..... | 153.86 | 653.00 | 30.25 | 180.00 | ..... | 236.65 | ..... | 1,253.76 |
| Bergen, ..... | 45.95 | 389.50 | 776.81 | ..... | 37.40 | 49.70 | 5.00 | 1,304.36 |
| Burlington, ..... | 215.90 | 1,152.45 | 14.75 | ..... | ..... | 41.00 | ..... | 1,424.10 |
| Camden, ..... | 97.56 | 449.00 | 102.29 | ..... | ..... | 349.36 | ..... | 998.21 |
| Cape May, ..... | 106.00 | 253.00 | 108.20 | ..... | ..... | 114.64 | ..... | 581.84 |
| Cumberland, .... | 29.00 | 512.00 | 30.25 | ..... | ..... | 136.85 | 12.00 | 720.10 |
| Essex, ..... | 160.69 | 119.80 | 39.90 | 349.44 | 52.00 | 355.70 | ..... | 1,077.53 |
| Gloucester, ..... | 94.74 | 741.00 | 127.75 | ..... | ..... | 21.63 | 11.00 | 996.12 |
| Hudson, ..... | 42.80 | 31.63 | 9.10 | 126.34 | ..... | 287.67 | 4.00 | 501.54 |
| Hunterdon, ..... | 61.90 | 928.10 | 44.60 | 4.00 | ..... | 11.00 | ..... | 1,049.60 |
| Mercer, ..... | 150.72 | 323.50 | 33.03 | ..... | ..... | 136.20 | ..... | 643.45 |
| Middlesex, ..... | 238.04 | 439.35 | 126.60 | ..... | ..... | 130.47 | ..... | 934.46 |
| Monmouth, ..... | 220.89 | 1,050.20 | 221.70 | 13.10 | ..... | 100.20 | ..... | 1,606.09 |
| Morris, ..... | 152.08 | 864.00 | 79.70 | 66.64 | ..... | ..... | ..... | 1,162.42 |
| Ocean, ..... | 103.50 | 1,173.00 | 60.40 | ..... | ..... | ..... | ..... | 1,336.90 |
| Passaic, ..... | 203.14 | 260.64 | 75.01 | ..... | ..... | 212.82 | ..... | 751.61 |
| Salem, ..... | 68.01 | 591.55 | 18.66 | ..... | ..... | 16.20 | 6.40 | 700.82 |
| Somerset, ..... | 113.50 | 612.10 | 68.44 | 7.00 | ..... | ..... | ..... | 801.04 |
| Sussex, ..... | 39.83 | 936.80 | 34.00 | ..... | ..... | ..... | ..... | 1,010.63 |
| Union, ..... | 67.66 | 217.43 | 120.42 | 68.25 | ..... | 308.72 | ..... | 782.48 |
| Warren, ..... | 66.18 | 687.20 | 17.00 | 38.00 | ..... | ..... | ..... | 808.38 |
| Totals, .... | 2,431.95 | 12,385.25 | 2,138.86 | 852.77 | 89.40 | 2,508.81 | 38.40 | 20,445.44 |

| NAME OF COUNTY. | Brick. | Concrete. | Bit. Macadam. | Plain Macadam. | Gravel, | Shell. | Bit. Concrete. | Sand and Clay Cinders. | Graded Roads. | Unimproved. | Wood-Block. | Stone Block. | Cobble. | Asphalt Block. | Toll Roads | Estimated Mileage. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atlantic, | 8.50 | ..... | 1.75 | 14.49 | 539.51 | .25 | 39.66 | 71.75 | 171.50 | 404.00 | .65 | ..... | 1.70 | ..... | ..... | 1,253.76 |
| Bergen, | 3.02 | ..... | 27.84 | 569.49 | 2.42 | ..... | 33.30 | 1.50 | 495.44 | 163.96 | ..... | 1.69 | ..... | .70 | 5.00 | 1,304.36 |
| Burlington, | 2.00 | ..... | 80.15 | 96.60 | 108.30 | 14.60 | 1.00 | 48.00 | 239.00 | 829.85 | ..... | ..... | 4.60 | ..... | ..... | 1,424.10 |
| Camden, | 3.32 | .27 | 4.50 | 116.42 | 159.81 | ..... | 62.68 | 62.00 | 174.60 | 371.50 | ..... | 26.50 | 13.97 | 2.64 | ..... | 998.21 |
| Cape May, | ..... | 1.26 | 2.70 | 2.90 | 386.10 | ..... | 5.00 | ..... | 34.00 | 149.50 | .38 | ..... | ..... | ..... | ..... | 581.84 |
| Cumberland, | 1.25 | .25 | ..... | ..... | 499.00 | ..... | ..... | ..... | 31.00 | 174.50 | ..... | .10 | ..... | 2.00 | 12.00 | 720.10 |
| Essex, | 52.26 | 2.04 | 87.94 | 469.72 | ..... | ..... | 103.87 | ..... | 195.30 | 63.25 | 2.36 | 93.94 | 1.40 | 5.45 | ..... | 1,077.53 |
| Gloucester, | .68 | ..... | 2.21 | 37.03 | 360.62 | 28.50 | 19.83 | 106.50 | 102.50 | 327.25 | ..... | ..... | ..... | ..... | 11.00 | 996.12 |
| Hudson, | 22.08 | .44 | 32.05 | 51.48 | ..... | ..... | 92.07 | ..... | 74.36 | 73.87 | 5.92 | 142.23 | ..... | 3.04 | 4.00 | 501.54 |
| Hunterdon, | ..... | ..... | 25.69 | 110.37 | ..... | .60 | 4.34 | 2.00 | 489.00 | 417.60 | ..... | ..... | ..... | ..... | ..... | 1,049.60 |
| Mercer, | 11.22 | 1.60 | 13.44 | 165.14 | ..... | ..... | 40.35 | 41.50 | 345.09 | 20.00 | ..... | 5.11 | ..... | ..... | ..... | 643.45 |
| Middlesex, | 11.47 | 3.40 | 16.69 | 220.70 | 74.05 | ..... | 11.53 | 10.00 | 534.17 | 44.46 | .39 | 2.52 | ..... | 5.08 | ..... | 934.46 |
| Monmouth, | 3.30 | .30 | ..... | 75.35 | 839.24 | ..... | 4.30 | 188.20 | 202.70 | 291.20 | 1.40 | .10 | ..... | ..... | ..... | 1,606.09 |
| Morris, | .24 | .98 | 52.82 | 189.96 | ..... | ..... | 46.21 | 24.62 | 443.75 | 403.80 | ..... | ..... | .04 | ..... | ..... | 1,162.42 |
| Ocean, | ..... | ..... | 8.00 | 4.20 | 333.80 | ..... | ..... | 45.50 | 496.00 | 449.40 | ..... | ..... | ..... | ..... | ..... | 1,336.90 |
| Passaic, | 8.19 | ..... | 42.97 | 310.31 | ..... | ..... | 32.40 | ..... | 269.67 | 74.00 | 44.51 | 7.81 | .98 | .77 | ..... | 751.61 |
| Salem, | ..... | .78 | 1.95 | 6.30 | 292.59 | 44.76 | 1.89 | 103.30 | 242.60 | ..... | ..... | ..... | ..... | .25 | 6.40 | 700.82 |
| Somerset, | ..... | .09 | 4.50 | 275.90 | ..... | ..... | ..... | ..... | 371.85 | 148.70 | ..... | ..... | ..... | ..... | ..... | 801.04 |
| Sussex, | ..... | ..... | 22.38 | 61.65 | 1.00 | ..... | ..... | ..... | 549.80 | 375.80 | ..... | ..... | ..... | ..... | ..... | 1,010.63 |
| Union, | 14.52 | 3.99 | 30.81 | 288.57 | ..... | ..... | 45.82 | ..... | 251.01 | 117.00 | ..... | 29.76 | ..... | 1.00 | ..... | 782.48 |
| Warren, | 1.00 | ..... | 14.38 | 105.10 | 2.00 | ..... | ..... | ..... | 409.90 | 275.00 | ..... | 1.00 | ..... | ..... | ..... | 808.38 |
| Totals, | 143.05 | 15.40 | 472.77 | 3,171.68 | 3,598.44 | 88.71 | 544.25 | 704.87 | 6,123.24 | 5,174.64 | 15.61 | 310.76 | 22.69 | 20.93 | 38.40 | 20,445.44 |

## Total Number of Square Yards of Each Class of Road Built in Each County Under the State Aid Act.

MACADAM.—Atlantic Co., 28,776; Bergen Co., 241,561; Burlington Co., 1,113,449; Camden Co., 641,284; Essex Co., 1,066,459; Gloucester Co., 239,313; Hudson Co., 55,665; Hunterdon Co., 320,006; Mercer Co., 1,231,142; Middlesex Co., 1,156,792; Monmouth Co., 529,466; Morris Co., 492,181; Passaic Co., 597,473; Salem Co., 44,124; Somerset Co., 794,184; Sussex Co., 86,673; Union Co., 173,326; Warren Co., 417,312. Total, 9,229,186.

MACADAM WITH BITUMINOUS DRESSING.—Bergen Co., 53,212; Camden Co., 19,712; Cumberland Co., 24,977; Essex Co., 112,700; Hunterdon Co., 237,771; Mercer Co., 67,518; Middlesex Co., 9,257; Morris Co., 24,818; Passaic Co., 40,040; Somerset Co., 36,976; Sussex Co., 70,338; Union Co., 54,456; Warren Co., 118,099. Total, 869,874.

BITUMINOUS MACADAM.—Bergen Co., 49,575; Mercer Co., 74,686; Middlesex Co., 108,257; Sussex Co., 103,452; Union Co., 2,416. Total, 338,386.

CONCRETE SURFACE.—Middlesex Co., 5,998. Total, 5,998.

BITUMINOUS MORTAR MACADAM, E-E.—Salem Co., 7,999; Union Co., 11,294. Total, 19,293.

BITUMINOUS CONCRETE MIXED, HOT.—

T-1. Bergen Co., 43,575; Middlesex Co., 18,292; Passaic Co., 45,550. Total, 110,417.

W. Essex Co., 13,765; Gloucester Co., 69,557; Passaic Co., 32,937. Total, 116,259.

B. Salem Co., 16,115. Total, 16,115.

BITUMINOUS CONCRETE MIXED, COLD.—Atlantic Co., 166,721; Bergen Co., 67,835; Camden Co., 178,263; Gloucester Co., 60,284; Hudson Co., 8,759; Middlesex Co., 36,553; Morris Co., 99,230; Passaic Co., 30,781; Salem Co., 10,409; Union Co., 197,556. Total, 856,391.

CONCRETE BASE, BITUMINOUS DRESSING.—Union Co., 10,513. Total, 10,513.

GRAVEL.—Atlantic Co., 1,237,861; Burlington Co., 501,814; Camden Co., 226,656; Cape May Co., 875,678; Cumberland Co., 260,731; Gloucester Co., 494,281; Middlesex Co., 248,232; Monmouth Co., 670,710; Ocean Co., 1,335,639; Salem Co., 361,353; Total, 6,212,955.

OYSTER SHELLS.—Burlington Co., 11,620; Salem Co., 183,890. Total, 195,510.

## Total Number of Square Yards of All Classes of Roads Built in the State Since the Passage of the State Aid Law.

Atlantic Co., 1,433,358; Bergen Co., 455,758; Burlington Co., 1,626,883; Camden Co., 1,065,915; Cape May, 875,678; Cumberland Co., 285,708; Essex Co., 1,192,924; Gloucester Co., 863,435; Hudson Co., 64,424; Hunterdon Co., 557,777; Mercer Co., 1,373,346; Middlesex Co., 1,583,381; Monmouth Co., 1,200,176; Morris Co., 616,229; Ocean Co., 1,335,639; Passaic Co., 749,781; Salem Co., 623,890; Somerset Co., 831,160; Sussex Co., 260,463; Union Co., 449,561; Warren Co., 535,411. Total, 17,980,897.

# Description and Statement of Cost of Roads Improved in 1915.

## BERGEN COUNTY.

### Anderson Avenue, First Section, 1.76 Miles Long.

This improvement begins at the Fort Lee turnpike, or Main street, and extends thence southerly through the boroughs of Fort Lee, Palisades Park, and Cliffside Park to Lafayette avenue. The contract for the improvement of this road was originally let for the entire length of 3.35 miles, but before the work was commenced the borough of Cliffside Park decided to build a sewer through the southern end of the proposed improvement, and for this reason the amount contracted for was reduced to 1.76 miles, with the understanding that the remainder would be built the following year.

The actual cost of this work greatly exceeded the original estimate, owing to the fact that much more rock was encountered than had been anticipated.

When the entire improvement is completed, it will form a very important link between the Hudson County boulevard, the improved roads of Hudson county and the boroughs on the top of the Palisades, thence either north or west over roads already improved. The road, on the whole, is one of much more than local importance.

The road is graded to a width of 30 feet; the pavement is 16 feet wide and 7 inches deep. The material used was trap rock for the foundation and a hot bituminous mixture for the top.

Work on the second section has progressed as far as is possible until the laying of the sewer is completed.

Detailed statement of the cost of the Anderson avenue, first section, from Lafayette avenue to Main street, boroughs of Cliffside Park, Palisade Park and Fort Lee, county of Bergen. Total length, 9,296 feet, or 1.760 miles.

Kind of pavement, asphalt concrete.
Width of paved way, 16 feet.
Length of paved way, 9,296 feet.
Depth, 7 inches.
Width between slopes or curbs, 30 feet.

| | |
|---|---|
| Foundation, type "C," 17,971 square yards, at 40 cents; total, ..... | $7,188 40 |
| Foundation, type "A," 1,445 square yards, at 30 cents; total, ..... | 433 50 |
| Surface, type "G," 16,526 square yards, at 85 cents; total, ..... | 14,047 10 |
| Earth excavation, inside, 911 cubic yards, at 50 cents; total, ..... | 455 50 |
| Earth excavation, outside, 500 cubic yards, at 50 cents; total, ..... | 250 00 |
| Rock excavation, 4,969 cubic yards, at $2.00; total, ..... | 9,938 00 |

| | |
|---|---|
| Under drain, type French 6-inch, 3,890 lineal feet, at 90 cents; total, .... | 3,501 00 |
| Removing trees, 50, at $5.00; total, ..... | 250 00 |
| Total, ..... | $36,063 50 |
| 900 square yards of surface, type "G," not accepted by State, at 85 cents, | 765 00 |
| Total, ..... | $35,298 50 |
| Inspection, ..... | 1,089 00 |
| Engineering, 5 per cent., ..... | 1,803 17 |
| | $38,190 67 |
| Extras paid entirely by county, $15,937.32 plus 5 per cent., ..... | 16,734 19 |
| 900 square yards of surface paid entirely by the county, ..... | 765 00 |
| Total cost of road, ..... | $55,689 86 |
| Lump sum, contract price (revised contract), ..... | $29,336 00 |
| Amount allowed by State, ..... | 38,190 67 |
| Forty per cent of above, State's share, ..... | $15,276 27 |
| Less credit by cost of inspection already paid by State, ..... | 1,089 00 |
| Amount due by State, ..... | $14,187 27 |
| Maximum grade before, ..... | 2.91 per cent. |
| Minimum grade after, ..... | 2.91 per cent. |

We hereby certify that the above road is finished in all respects in strict compliance with the plans and specifications.

RALPH D. EARLE, JR.,
*Engineer.*

WM. J. LALLY,
*Inspector.*

December 1st, 1914.

## CAMDEN COUNTY.

### Sharps Corner Road, 1.4 Miles Long.

This improvement begins at the end of the old macadam road at Sharps Corner and extends easterly to the White Horse road in West Berlin. It completes the improvement of the road from Blackwood through Clementon to Berlin, thus giving a direct outlet to the White Horse pike and points east and south for a large territory of fine farming land lying along the upper waters of the several branches of Timber creek.

The road proper is part of an old turnpike, and is laid out 66 feet wide. The graded portion thereof is 30 feet in width, while the pavement of water-bound macadam is 16 feet wide and 8 inches thick.

This road was laid out over one hundred years ago, and, in consequence, is practically a straight line from end to end; therefore, no change was made in the alignment and very little in grade.

The maximum grade was reduced from 2.40 to 1.80.

Detailed statement of the cost of the Sharps Corner road, township of Berlin, county of Camden. Total length, 7,401.75 feet, or 1.402 miles.

Kind of pavement, water-bound macadam.
Width of paved way, 16 feet.
Length of paved way, 7,401.75 feet.
Depth, 8 inches.
Width between slopes or curbs, 30 feet.

| | |
|---|---|
| Foundation, type crushed stone macadam, 13,075.6 square yards, at 52 cents; total, | $6,799 31 |
| Surface, type water-bound macadam, 13,075.6 square yards, at 47 cents; total, | 6,145 53 |
| Earth excavation, 2,548 cubic yards, at 30 cents; total, | 764 40 |
| Excavation, outside road, 58.41 cubic yards, at 40 cents; total, | 23.36 |
| Cross drain, type C. I. P., 7,710 pounds, at 2 cents; total, | 154 20 |
| Concrete, 5.52 cubic yards, at $8.00; total, | 44 16 |
| Total, | $13,930 96 |
| Less difference between items and lump sum bid, | 10 |
| Total, | $13,930 86 |
| Inspection, | 349 23 |
| Engineering, at 5 per cent., | 696 54 |
| | $14,976 63 |
| Extras paid entirely by county, | 144 33 |
| Total cost of road, | $15,120 96 |
| Lump sum, contract price, | $13,930 86 |
| Amount allowed by State, | 14,976 63 |
| Forty per cent. of above, State's share, | $5,990 65 |
| Less credit by cost of inspection already paid by State, | 349 23 |
| Amount due by State, | $5.641 42 |

Maximum grade before, .....2.40 per cent.
Maximum grade after, .....1.80 per cent.

We hereby certify that the above road is finished in all respects in strict compliance with the plans and specifications.

J. J. ALBERTSON,
*County Engineer.*
W. S. TRAVIS,
*Inspector.*

August 9th, 1915.

## ESSEX COUNTY.

### Pleasant Valley Way, 3.62 Miles Long.

This work of improvement begins at Bloomfield avenue, Verona, and runs thence southerly along the westerly slope of the Rahway river valley between the First and Second Watchung mountains.

The work was commenced late in 1910, but, owing to several complications, it was not completed in time to be reported before this year. One of the causes of delay was the fact that after work had been begun the county officials obtained a right of way on the section just south of Verona whereby the alignment was very much improved. This change of

alignment was the cause of increase in excavation, as it was necessary to make a long fill across a piece of low ground which the old road had made a detour around.

The completion of this work finishes the improved roadway from Little Falls to West Orange, along the valley between the First and Second Watchung mountains, and furnishes one of the most beautiful drives for through travel, at the same time furnishing a good and convenient road for the transportation of the large quantities of produce that are raised along it.

The road was graded for a width of 30 feet, and was paved with stone for a width of 16 feet and a depth of 8 inches.

The maximum grade was reduced from 4.65 per cent. to 3.24 per cent.

Detailed statement of the cost of the Pleasant Valley way, boroughs of Verona and West Orange, county of Essex. Total length 19,113 feet, or 3.620 miles.

Width of stone-bed, 16 feet.
Length of stone-bed, 19,113 feet.
Depth of stone-bed, 8 inches.

| | |
|---|---|
| Telford, with asphalt top dressing, 33,850 square yards, at 60 cents; total, .. | $20,310 00 |
| Earth excavation, 28,151 cubic yards, at 35 cents; total, ..... | 9,852 85 |
| Drain, field stone, 131 cubic yards, at 75 cents; total, ..... | 98 25 |
| Drain, 6-inch tile, 635 lineal feet, at 50 cents; total, ..... | 317 50 |
| Field stone foundation, 89 square yards, at 30 cents; total, ..... | 26 70 |
| Cobble stone gutter, 1,062 square yards, at 80 cents; total, ..... | 849 60 |
| Total, ..... | $31,454 90 |
| Supervisor's salary, ..... | 1,833 00 |
| Engineering expenses, approximately, ..... | 1,650 00 |
| Extras, paid by county, ..... | 1,554 05 |
| Total cost of road, ..... | $36,491 95 |
| Lump sum, contract price, ..... | $29,624 95 |
| Total allowed by the State, ..... | 31,454 90 |
| One-third of above, amount paid by the State, ..... | 10,484 97 |

Maximum grade before, .....4.65 per cent.
Maximum grade after, .....3.24 per cent.

FREDERICK A. REIMER,
*Engineer.*
FRANK W. SHRUMP,
*Supervisor.*

### Clinton Avenue, 1.30 Miles Long.

This improvement begins at Dutch lane in West Caldwell and extends westerly to the Fairfield road. It was built to accommodate the dairymen and farmers located upon the Passaic meadows who haul their products to Caldwell, the Oranges and Newark. It may properly be called a local road.

The pavement is 16 feet wide and 8 inches deep. It is built on a telford base and finished with a surface application of asphalt oil.

The maximum grade was reduced from 9 per cent. to 4.61 per cent.

Detailed statement of the cost of the Clinton Avenue road, township of Caldwell, county of Essex. Total length, 6,863 feet, of 1.30 miles.

Kind of pavement, Telford.
Width of paved way, 16 feet.
Length of paved way, 6,863 feet.
Depth, 8 inches.
Width between slopes or curbs, 30 feet.

| | |
|---|---|
| Telford macadam pavement, 12,330 square yards, at 80 cents; total, | $9,864 00 |
| Earth excavation in road, 8,757 cubic yards, at 40 cents; total, | 3,502 80 |
| Earth excavation, outside, 112 cubic yards, at 40 cents; total, | 44 80 |
| Plus difference between items and lump sum, | 6 00 |
| Total, | $13,417 60 |
| Inspection, | 846 25 |
| Engineering, | 500 00 |
| | $14,763 85 |
| Extras paid entirely by county, extension to cross drains, | 907 50 |
| Total cost of road, | $15,671 35 |
| Lump sum, contract price, | $13,580 35 |
| Amount allowed by State, | 14,763 85 |
| Forty per cent of above, State's share, | $5,905 44 |
| Less credit by cost of inspection already paid by State, | 846 25 |
| Amount due by State, | $5,059 19 |
| Maximum grade before, | 9.00 per cent. |
| Maximum grade after, | 4.61 per cent. |

We hereby certify that the above road is finished in all respects in strict compliance with the plans and specifications.

FREDERICK A. REIMER,
*Engineer.*
PETER BLAUVELT,
*Inspector.*

### Lindsley Road, 1.489 Miles Long.

The improvement of this old road begins at the Passaic county line, in the township of Cedar Grove, and extends northwesterly to the Passaic county line in North Caldwell township. It connects the improved roads of the Great Notch district with those built along the Passaic river, thus connecting the through line of upper Essex county with the adjoining highways on either side in Passaic county.

The pavement is 16 feet wide and 8 inches deep, and is finished with a heavy bituminous dressing.

The maximum grade was reduced from 12.2 per cent. to 5.5 per cent.

Detailed statement of the cost of the Lindsley road, township of Cedar Grove and borough of North Caldwell, county of Essex. Total length, 7,865 feet, or 1.489 miles.

Width of stone-bed, 16 feet.
Length of stone-bed, 7,865 feet.
Depth of stone-bed, 8 inches.

| | |
|---|---|
| Telford, with asphaltum binder, 14,192 square yards, at 74 cents; total, | $10,502 08 |
| Rebuilding pavement at Stevens avenue, 450 square yards, at 56 cents; total, | 252 00 |
| Earth excavation, 29,356 cubic yards, at 34 cents; total, | 9,981 04 |
| Outside excavation, 1,245 cubic yards, at 34 cents; total, | 423 30 |
| Cobble stone gutter, 865 square yards, at 80 cents; total, | 692 00 |
| | $21,850 42 |
| Less difference between items and lump sum bid, | 98 42 |
| Total, | $21,752 00 |
| Supervisor's salary, | 948 00 |
| Engineering expenses, | 1,200 00 |
| Extras, paid by county, | 3,481 29 |
| Total cost of road, | $27,381 29 |
| Lump sum, contract price, | $21,500 00 |
| Total allowed by the State, | 21,752 00 |
| One-third of above, amount paid by State, | $7,250 67 |
| Maximum grade before, | 12.2 per cent. |
| Maximum grade after, | 5.5 per cent. |

FREDERICK A. REIMER,
*Engineer.*
JAMES A. HIGGINS,
*Supervisor.*

## GLOUCESTER COUNTY.

### Mickleton and Swedesboro Road, 4.079 Miles Long.

This improvement begins at the end of the present pavement south of Mickleton, in the township of East Greenwich, and extends in a southerly direction to the north end of the bridge over Raccoon creek, in the township of Woolwich.

The vast improvement made in this old King's Highway, south of Swedesboro, was so greatly appreciated by the farmers that they insisted that the improvement should be extended northerly from Swedesboro to the portion already improved ending just south of Mickleton.

The completion of this work finishes the improved road from Woodbury entirely across Gloucester county to the Salem county line. It is of great value to the farmers and truck raisers living north of Swedesboro, as it affords them a good and convenient means of access to Swedesboro, one of the largest agricultural shipping points in southern New Jersey.

Gloucester county has shown its grasp of the State improvement idea by completing this road from one end to the other of its jurisdiction.

The pavement proper is a bituminous concrete, 2 inches thick, laid upon a 5-inch macadam base, and is 16 feet wide. The roadway is graded to a width of 30 feet. As this is one of the roads that was laid out years ago by our wise forefathers, the right of way is 66 feet wide. The im-

provement as a whole is of great benefit to Gloucester county, and a credit to its foresight.

The maximum grade was reduced from 5.20 per cent. to 3.40 per cent.

Detailed statement of the cost of the Mickleton and Swedesboro road, townships of East Greenwich and Woolwich, county of Gloucester, New Jersey. Total length, 21,538 feet, or 4.079 miles.

Width of stone-bed, 16 feet.
Length of stone-bed, 21,538 feet.
Depth of stone-bed, 7 inches.
Width graded between curb lines, 30 feet.

ORIGINAL CONTRACT.

| | | |
|---|---|---|
| Excavation, 21,829 cubic yards, at 35 cents; total, | | $7,640 15 |
| Ballast foundation, 38,290 square yards, at 58 cents; total, | | 22,208 20 |
| Macadam with asphaltum binder (amiesite), 38,290 square yards, at 75 cents; total, | | 28,717 50 |
| Approaches (amiesite), 1,407 square yards, at 80 cents; total, | | 1,125 60 |
| Gutters (concrete), 4,220 lineal feet, at 40 cents; total, | | 1,688 00 |
| Tile drain, 3,400 lineal feet, at 20 cents; total, | | 680 00 |
| French drain, 400 lineal feet, at 50 cents; total, | | 200 00 |
| Retaining wall, 300 cubic yards, at $7.00; total, | | 2,100 00 |
| Total amount original contract, | | $64,359 45 |

EXTRAS ORDERED AND APPROVED.

| | | |
|---|---|---|
| Excavation, 910 cubic yards, at 35 cents; total, | $318 50 | |
| Ballast foundation, 2,408 square yards, at 58 cents; total, | 1,396 64 | |
| Approaches (amiesite), 230 square yards, at 80 cents; total, | 184 00 | |
| Gutters (concrete), 435 lineal feet, at 40 cents; total, | 174 00 | |
| Tile drain, 3,315 lineal feet, at 20 cents; total, | 663 00 | |
| French drain, 1,224 lineal feet, at 50 cents; total, | 612 00 | |
| Ditches—excavation, 42.85 cubic yards, at 35 cents; total, | 15 00 | |
| Reinforcing rods placed, 9,950 pounds, at 3 cents; total, | 298 50 | |
| Extra stone on ballast, 1,000 tons, at $2.40; total, $2,400 00 | | |
| Less 20 per cent. paid by contractor, 480 00 | | |
| | 1,920 00 | |
| Total amount paid contractor for extras, | | 5,581 64 |
| Total, | | $69,941 09 |
| Inspector's salary, | | 685 21 |
| Engineering expenses (approximately), | | 1,400 00 |
| | | $72,026 30 |
| Other extras paid by county (railings and concrete overflow gutters on causeways, | | 681 35 |
| Total cost of road, | | $72,707 65 |
| Lump sum, contract price, | | $64,359 45 |
| Total allowed by State, | | 72,026 30 |
| Forty per cent. of above paid by State, | | $28,810 52 |
| Less credit by cost of inspection already paid by State, | | 685 21 |
| Amount due by State, | | $28,125 31 |

Maximum grade before, .....5.20 per cent.
Maximum grade after, .....3.40 per cent.

We hereby certify that the above road is finished in all respects in strict compliance with the plans and specifications.

WM. C. CATTELL,
*County Engineer.*
ROBERT ELDRIDGE,
*Inspector.*

---

## HUNTERDON COUNTY.

### Lambertville County Line Road, .962 Mile Long.

This road begins at the Lambertville city line and extends southerly along the Delaware river to a point 2,100 feet from the Mercer county line. The road was stopped at this point in order that a proper connection might be made with the proposed improvement in Mercer county from Washington's Crossing north.

This work, in connection with that contemplated during the year 1915, will complete the through line along the Delaware river from Trenton to Lambertville, and will furnish one of the most beautiful drives in New Jersey.

The road was graded to a width of 30 feet along the base of the mountain, and was partially in cut and partially in fill. In order to protect the high fill on the westerly side adjoining the feeder of the Delaware and Raritan canal, a novel kind of fender or guard was constructed, consisting of large stones, about 3½ feet in length, imbedded at least 1 foot into the stone fill. These stones were placed at a distance of about 3 feet apart, from center to center, thus forming a natural barricade which will last as long as the road, and forms a most effectual protection for the traveling public.

This macadam pavement, finished with a bituminous binder, is 14 feet wide and 6 inches thick.

The changes in alignment are much more striking and enhance the value of the road much more than the changes in grade.

The maximum grade was reduced from 4 per cent. to 2.6 per cent.

Detailed statement of the cost of the Lambertville County Line road, township of West Amwell, county of Hunterdon. Total length, 5,080 feet, or 0.962 mile.

Kind of pavement, macadam with bituminous surface.
Width of paved way, 14 feet.
Length of paved way, 5,080 feet.
Depth, 6 inches.
Width between slopes or curbs, 30 feet.

| | |
|---|---|
| Foundation, type C, 7,902 square yards, at 35 cents; total, ..... | $2,765 70 |
| Surface, type B, binder B (in contract, 7,902 square yards; extra, 19 square yards), 7,921 square yards, at 45 cents; total, ..... | 3,564 45 |
| Earth excavation, 6,021 cubic yards, at 85 cents; total, ..... | 5,117 85 |
| Rock excavation (in contract, 1,000 cubic yards; extra, 1,188 cubic yards), 2,188 cubic yards, at $2.50; total, ..... | 5,470 00 |

| | |
|---|---|
| Under drain, type French (in contract, 500 lineal feet; decrease, 20 lineal feet), 480 lineal feet, at 25 cents; total, | 120 00 |
| 16-inch C. I. pipe (in contract, 96 lineal feet; decrease, 24 lineal feet), 72 lineal feet, at $2.60; total, | 187 20 |
| Rubble masonry, 44 cubic yards, at $8.00; total, | 352 00 |
| Dry slope wall, 89 cubic yards, at $4.00; total, | 356 00 |
| Total, | $17,933 20 |
| Inspection, | 464 30 |
| Engineering, | 350 00 |
| | $18,747 50 |
| Extras paid entirely by county (79 cubic yards dry slope wall, at $4.00; 22.7 cubic yards rubble masonry, at $8.00; 66 feet 12-inch C. I. pipe, at $1.75), | 613 10 |
| Total cost of road, | $19,360 60 |
| Lump sum, contract price, | $15,022 05 |
| Amount allowed by State, | 18,747 50 |
| Forty per cent. of above, State's share, | $7,499 00 |
| Less credit by cost of inspection already paid by State, | 464 30 |
| Amount due by State, | $7,034 70 |
| Maximum grade before, | 4 per cent. |
| Maximum grade after, | 2.6 per cent. |

We hereby certify that the above road is finished in all respects in strict compliance with the plans and specifications.

GRANT DAVIS,
*Engineer.*
WM. J. CANE,
*Inspector.*

September 10th, 1914.

**Flemington–Frenchtown Road, Second Section, 5.564 Miles Long.**

This improvement begins at the borough line of Flemington on Mine street. It extends thence in a general westerly direction, then, at the foot of Hardscrabble hill, continues in a wide sweep to the northward, cutting the contours diagonally in such a manner that the former grade of 11.2 per cent. is reduced to 5 per cent. The road then follows practically the old roadway, with the exception of a few necessary changes in the alignment to remove objectionable angles, to the end of the first section, which was completed last year, this point being at the intersection of the Flemington-Frenchtown road with the road to Pittstown.

This road is a very important addition to Hunterdon county's improved mileage, as it connects the county seat with the Delaware river at Frenchtown, and also, by means of the road built several years ago, furnishes a good, improved highway up the shore of the Delaware river to Milford and Spring Mills, thus giving the populous river valley section of Hunterdon an outlet to the county seat, and from thence over the improved road system of the State in either direction.

The road is graded to a width of 30 feet, and paved 16 feet wide and

7 inches deep for macadam, and 10 inches in depth for the telford section. The road itself extends over a very treacherous and springy soil, and in the process of construction many underground springs and much sub-surface water was encountered; as a result, nearly $5,000 was expended for the improvement of the drainage conditions which were found to be such that it was imperative that this excessive amount of water should be taken care of. The change in both alignment and grade on this road are most marked, and a trip from the Delaware river at Frenchtown to Flemington, that formerly required hours to make, can now easily be accomplished in half an hour. Thus much time and effort are saved to the inhabitants of Hunterdon county.

Detailed statement of the cost of the Flemington-Frenchtown road, Second Section, townships of Raritan, Delaware, Franklin and Kingwood, county of Hunterdon. Total length, 29,379 feet, or 5.564 miles.

Kind of pavement, water-bound macadam.
Width of paved way, 16 feet.
Length of paved way, 29,262 feet.
Depth, 7 inches for macadam, 10 inches for telford.
Width between slopes or curbs, 30 feet.

| | |
|---|---|
| Foundation, type M, 2, 195 square yards, at 45 cents; total, | $987 75 |
| Foundation, type T, 50,034 square yards, at 45 cents; total, | 22,515 30 |
| Surface, type MWB, 52,229 square yards, at 32 cents; total, | 16,713 28 |
| Surface, type entrances, 2,548 square yards, at 43 cents; total, | 1,095 64 |
| Excavation, outside road, 2,673.5 cubic yards, at 80 cents; total, | 2,138 80 |
| Earth excavation, 30,709 cubic yards, at 76 cents; total, | 23,338 84 |
| Foreign material, 707.4 cubic yards, at $1.25; total, | 884 25 |
| Under drain, type stone, 2,088 lineal feet, at 30 cents; total, | 626 40 |
| Under drain, type French, 13,303 lineal feet, at 30 cents; total, | 3,990 90 |
| Gutter, type rubble, 296 square yards, at 82 cents; total, | 242 72 |
| 12-inch C. I. pipe, 372 lineal feet, at $2.00; total, | 744 00 |
| 16-inch C. I. pipe, 114 lineal feet, at $2.55; total, | 290 70 |
| 18-inch C. I. pipe, 24 lineal feet, at $3.25; total, | 78 00 |
| 12-inch corrugated pipe, 183 lineal feet, at $1.40; total, | 256 20 |
| 16-inch corrugated pipe, 30 lineal feet, at $1.55; total, | 46 50 |
| Concrete for cross drains, 229.3 cubic yards, at $8.00; total, | 1,834 40 |
| Dry retaining walls, 219 cubic yards, at $4.00; total, | 876 00 |
| 1½-inch stone for maintenance, 50 tons, at $1.75; total, | 87 50 |
| Screenings for maintenance, 125 tons at $1.75; total, | 218 75 |
| Total, | $76,965 93 |
| Less difference between items and lump sum, | 60 |
| | $76,965 33 |
| Inspection, | 1,065 00 |
| Engineering, | 1,560 00 |
| | $79,590 33 |
| Extras paid entirely by county, guard railing, $370.20; pipe, $16.80; total, | 387 00 |
| Total cost of road, | $79,977 33 |
| Lump sum, contract price, | $72,189 46 |
| Amount allowed by State, | 79,590 33 |

| | |
|---|---|
| Forty per cent. of above, State's share, | $31,836 13 |
| Less credit by cost of inspection already paid by State, | 1,065 00 |
| Amount due by State, | $30,771 13 |

Maximum grade before, ..... 11.2 per cent. on new line.
Maximum grade after, ..... 5+ per cent.

We hereby certify that the above road is finished in all respects in strict compliance with the plans and specifications.

GRANT DAVIS,
*Engineer.*
I. H. HIGGINS,
*Inspector.*

**West Portal–Bloomsbury Road, 3.069 Miles Long.**

This road begins at West Portal at the foot of the Musconetcong mountain and extends westerly through the borough of Bloomsbury to the Musconetcong river. It is a portion of the old Jersey turnpike, incorporated in 1804, which ran from the head of the navigation of the Raritan river at New Brunswick to the Delaware river at Phillipsburg.

This road is very important at the present time, and its importance will grow as the few remaining connecting links are constructed. As it is at present, the road is improved from Somerville through North Branch, White House, Lebanon, Annandale to Clinton. The extreme westerly end is also improved from Phillipsburg to Still Valley. It is the intention of Warren county to complete its section, from Still Valley to the Musconetcong river at Bloomsbury, the coming year.

The section referred to was graded to a width of 30 feet, paved for a width of 16 feet and a depth of 7 to 9 inches in the center, and bordered on either side with wings 3 inches in depth.

The maximum grade was reduced from 11 per cent. to 5 per cent.

Detailed statement of the cost of the West Portal-Bloomsbury road, township of Bethlehem and borough of Bloomsbury, county of Hunterdon. Total length, 16,202 feet, or 3.069 miles.

Kind of pavement, macadam with bituminous surface.
Width of paved way, 16 feet.
Length of paved way, 16,202 feet.
Depth, 7 inches and 9 inches.
Width between slopes or curbs, 30 feet.

| | |
|---|---|
| Foundation, type B, 2,086 square yards, at 50 cents; total, | $1,043 00 |
| Foundation, type C, 3,734 square yards, at 41 cents; total, | 1,530 94 |
| Foundation, type rock bottom, 10,716 square yards, at 30 cents; total, | 3,214 80 |
| Surface, type B, 31,236 square yards, at 53 cents; total, | 16,555 08 |
| Excavation, outside of road, 1,445 cubic yards, at 50 cents; total, | 722 50 |
| Earth excavation, 18,764 cubic yards, at 48 cents; total, | 9,006 72 |
| Rock excavation, 1,023 cubic yards, at $1.75; total, | 1,790 25 |
| Under drain, type stone, 2,420 lineal feet, at 25 cents; | 605 00 |
| Under drain, type French, 2,906 lineal feet, at 35 cents; total, | 1,017 10 |
| Gutter, 677 square yards, at $1.25; total, | 846 25 |
| 12-inch C. I. pipe, 228 lineal feet, at $1.75; total, | 399 00 |

| | |
|---|---|
| 16-inch C. I. pipe, 132 lineal feet, at $2.50; total, | $330 00 |
| 18-inch C. I. pipe, 48 lineal feet, at $3.25; total, | 156 00 |
| 12-inch corrugated pipe, 36 lineal feet, at $1.50; total, | 54 00 |
| Rubble masonry, 16 cubic yards, at $6.00; total, | 96 00 |
| Concrete, 303.25 cubic yards, at $8.00; total, | 2,426 00 |
| Crushed stone, 130 tons, at $1.50; total, | 195 00 |
| Special driveway at station 276 + 94, | 225 95 |
| Receiving basins, etc., | 293 64 |
| Total, | $40,507 23 |
| Inspection, | 899 09 |
| Engineering, | 1,150 00 |
| | $42,556 32 |
| Extras paid entirely by county, retaining walls and 10-inch pipe, | 537 00 |
| Total cost of road, | $43,093 32 |
| Lump sum, contract price, | $38,342 83 |
| Amount allowed by State, | 42,556 32 |
| Forty per cent. of above, State's share, | $17,022 53 |
| Less credit by cost of inspection already paid by State, | 899 09 |
| Amount due by State, | $16,123 44 |
| Previous payments on account, | 12,477 37 |
| Amount due from State on final payment, | $3,646 07 |
| Maximum grade before, | 11 per cent. |
| Maximum grade after, | 5 per cent. |

We hereby certify that the above road is finished in all respects in strict complance with the plans and specifications.

GRANT DAVIS,
*Engineer.*
JAS. W. BOGART,
*Inspector.*

December 31, 1914.

**White House–New Germantown Road, 3.59 Miles Long.**

This improvement begins at New Germantown and extends to the New Jersey turnpike near White House. Owing to the fact that the Rockaway Valley railroad has been abandoned, this improvement furnishes the inhabitants of New Germantown and vicinity their only outlet to the railroad and markets. The road is built over a heavy red shale soil, and in the spring of the year was almost impassable for anything except the lightest vehicles.

The pavement proper is of water-bound macadam, 16 feet wide, and from 7 to 11 inches thick, the 11-inch pavement being telford, laid over a very soft foundation.

Many changes in the alignment were made in order that the people might have a road with as good an alignment as possible and with as easy grades as practicable. The result achieved is a credit to the county and the County Engineer. Both alignment and grade might be accepted as models for any modern road. An idea of the amount of grading may be had from the

fact that one-third of the cost of the road was for excavation. In addition to this, over $2,000 was expended for underdrains.

The result of all of this work is that what was once an almost impassable quagmire for several months of the year is now a smooth, hard and safe highway.

An idea of the amount of excavation is further gained by the fact that the maximum grade was reduced from 9 per cent. to 5 per cent.

Detailed statement of the cost of the Whitehouse-New Germantown road, townships of Readington and Tewksbury, county of Hunterdon. Total length, 18,956 feet, or 3.590 miles.

Kind of pavement, water-bound macadam.
Width of paved way, 16 feet.
Length of paved way, 18,896 feet.
Depth, 7 inches macadam; 11 inches telford.
Width between slopes or curbs, 30 feet.

| | |
|---|---|
| Foundation, type M, 26,075 square yards, at 25 cents; total, | $6,518 75 |
| Foundation, type T, 8,711 square yards, at 28 cents; total, | 2,439 08 |
| Screenings (maintenance), 90 tons, at $1.70; total, | 153 00 |
| Surface, type M. W. B., 33,558 square yards, at 24 cents; total, | 8,053 92 |
| Surface, type entrances, 2,207 square yards, at 50 cents; total, | 1,103 50 |
| Foreign material, 195 square yards, at $1.00; total, | 195 00 |
| Borrow, 2,886 cubic yards, at 80 cents; total, | 2,308 80 |
| Earth excavation, 19,405 cubic yards, at 60 cents; total, | 11,643 00 |
| Excavation outside road, 1,278 cubic yards, at 60 cents; total, | 766 80 |
| Under drain, type French, 6,539 lineal feet, at 30 cents; total, | 1,961 70 |
| Under drain, type stone, 200 lineal feet, at 30 cents; total, | 60 00 |
| Gutter, type rubble, 172 square yards, at $1.00; total, | 172 00 |
| 12-inch C. I. pipe, 186 feet, at $1.60; total, | 297 60 |
| 16-inch C. I. pipe, 228 feet, at $2.50; total, | 570 00 |
| Concrete retaining walls, 276.7 cubic yards, at $8.00; total, | 2,213 60 |
| Concrete cross drains, 185.7 cubic yards, at $8.00; total, | 1,485 60 |
| 1½-inch stone (maintenance), 30 tons, at $1.70; total, | 51 00 |
| ¾-inch stone (maintenance), 30 tons, at $1.70; total, | 51 00 |
| Total, | $40,044 35 |
| Inspection, | 574 50 |
| Engineering, | 850 00 |
| Total cost of road, | $41,468 85 |
| Lump sum, contract price, | $37,573 75 |
| Amount allowed by State, | 41,468 85 |
| Forty per cent. of above, State's share, | $16,587 54 |
| Less credit by cost of inspection already paid by State, | 574 50 |
| Total, | $16,013 04 |
| Less payment on account, | 11,427 53 |
| Amount due by State, | $4,585 51 |
| Maximum grade before, | 9 per cent. |
| Maximum grade after, | 5 per cent. |

We hereby certify that the above road is finished in all respects in strict compliance with the plans and specifications.

GRANT DAVIS,
*Engineer.*
FRANK MOKE,
*Inspector.*

May, 1915.

---

## MERCER COUNTY.

### Windsor-Newtown-Yardville Road, 7.057 Miles Long.

This improvement begins at Windsor and extends through Robbinsville and Yardville to the Burlington county line at Crosswicks creek, following the line of the Amboy Division of the Pennsylvania Railroad. When the extension of this road in Burlington county is improved to Mile Hollow, near Bordentown, it will form an important connecting link from the northeastern part to the southwestern part of the State.

The construction is plain macadam, 16 feet wide, with a total graded width between slopes of 30 feet. The depth of the macadam is 6 inches.

In constructing this road there were a great many clay pockets encountered during excavation. These were all dug out and filled with stone from 18 inches to 2 feet in depth, thus increasing the estimated cost. This condition also necessitated the laying of more tile underdrains than was called for in the original contract, the construction of which insures a dry, firm and compact roadway at all seasons of the year.

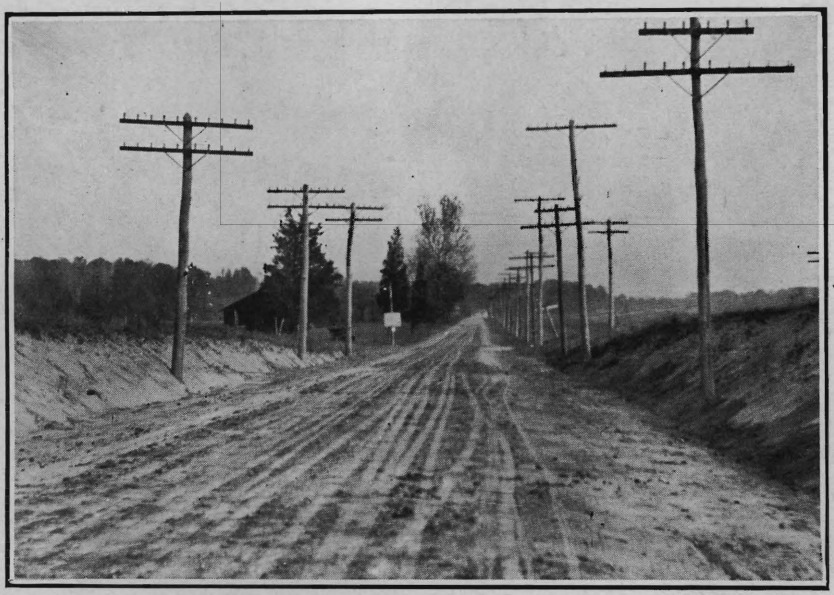
The maximum grade was reduced from 7 per cent. to 3.2 per cent.

Detailed statement of the cost of the Windsor-Newtown-Yardville road, townships of Hamilton and Washington, county of Mercer. Total length, 37,263 feet, or 7.057 miles.

Kind of pavement, water-bound macadam.
Width of paved way, 16 feet.
Length of paved way, 37,263 feet.
Depth, 6 inches.
Width between slopes or curbs, 30 feet.

| | |
|---|---|
| Foundation, type C (macadam), 66,049 square yards, at 30 cents; total,.... | $19,814 70 |
| Macadam drives, 867 square yards, at 40 cents; total, ..... | 346 80 |
| Guard rails, 7,738 lineal feet, at 17 cents; total, ..... | 1,315 46 |
| Surface, type A (macadam), 66,049 square yards, at 35 cents; total, ..... | 23,117 15 |
| Foreign material for sub-grade, 18,220 cubic yards, at 30 cents; total, .... | 5,466 00 |
| Extra embankment, 68 cubic yards, at 25 cents; total, ..... | 17 00 |
| Excavation outside of road, 98 cubic yards, at 25 cents; total, ..... | 24 50 |
| Earth excavation, 38,266 cubic yards, at 25 cents; total, ..... | 9,566 50 |
| 18-inch T. C. pipe, 2,950 lineal feet, at 90 cents; total, ..... | 2,655 00 |
| 4-inch under drain, type (porous tile), 10,000 lineal feet, at 20 cents; total, | 2,000 00 |
| Extra— | |
| 4-inch under drain, 17,899 lineal feet, at 20 cents; total, ..... | 3,579 80 |
| 8-inch T. C. pipe, 3,791 lineal feet, at 55 cents; total, ..... | 2,085 05 |
| 12-inch T. C. pipe, 5,085 lineal feet, at 66 cents; total, ..... | 3,356 10 |
| 18-inch T. C. pipe, 1,690 lineal feet, at 90 cents; total, ..... | 1,521 00 |
| Stone, 2,384.493 tons, at $1.75; total, ..... | 4,172 86 |

Yardville-Newtown-Windsor Road, Mercer County, Before Improvement.



Yardville-Newtown-Windsor Road, Mercer County, After Improvement.

| | | |
|---|---|---|
| Type C macadam, 7,377⅓ square yards, at 30 cents; total, | | $2,213 20 |
| Areas of Y's 631.39 square yards, at 40 cents; total, | | 252 60 |
| Ecavation in road, 9,108.1 cubic yards, at 25 cents; total, | | 2,277 02 |
| Excavation in drive, 1,109 cubic yards, at 25 cents; total, | | 277 25 |
| Foreign material for sub-grade, 1,060 cubic yards, at 30 cents; total, | | 318 00 |
| Concrete gutter, including gutter, catch basin and wall, | | 545 44 |
| Total, | | $84,921 43 |
| Less difference between items and lump sum, | | 10 00 |
| | | $84,911 43 |
| Inspection, | | 2,049 00 |
| Engineering, | | 3,000 00 |
| Extras paid entirely by county, included in above, | $15,598 32 | |
| Total cost of road, | | $89,960 43 |
| Lump sum, contract price, | | $64,484 20 |
| Amount allowed by State, | | 74,362 11 |
| Forty per cent. of above, State's share, | | $29,744 84 |
| Less credit by cost of inspection already paid by State, | | 2,049 00 |
| Amount due by State, | | $27,695 84 |
| Maximum grade before, | | 7 per cent. |
| Maximum grade after, | | 3.2 per cent. |

We hereby certify that the above road is finished in all respects in strict compliance with the plans and specifications.

THEODORE TOBISH,
*Engineer.*
JARRETT S. GENNET,
*Inspector.*

October 12th, 1915.

## MIDDLESEX COUNTY.

### Roosevelt–Woodbridge Road, First Section, 1.166 Miles Long.

This work is more in the nature of a street than a road improvement. Beginning at Rahway avenue, it passes through a closely built-up factory section to Noes' creek, thence along across the meadows to the borough of Roosevelt, where it forms the main street, and ends at the township line of Woodbridge township. The factory section is paved twenty feet wide, while the borough end is paved for the full width from curb to curb, or thirty-four feet, this extra width being paid for by the borough.

The pavement is of bituminous concrete on a Portland cement concrete base. No marked changes in grade were made, as the section is very level.

Detailed statement of the cost of the Roosevelt-Woodbridge road, First Section, borough of Roosevelt, county of Middlesex. Total length, 6,158 feet, or 1.166 miles.

Kind of pavement, concrete base and bituminous concrete surface.
Width of paved way, 20 feet and 30 feet to 34 feet.
Length of paved way, 6,158 feet.
Depth, 8 inches.
Width between slopes or curbs, 30 feet to 34 feet.

| | |
|---|---|
| Foundation, type C, 18,318 square yards, at 68 cents; total, | $12,456 24 |
| Surface, type B, 18,291.5 square yards, at 69 cents; total, | 12,621 13 |
| Surface, type brick, 26.5 square yards, at $2.50; total, | 66 25 |
| Earth excavation, 2,710 cubic yards, at 46 cents; total, | 1,246 60 |
| Extra embankment, 2,048 cubic yards, at 74 cents; total, | 1,515 52 |
| Total, | $27,905 74 |
| Inspection, | 514 50 |
| Engineering, 3 per cent., | 837 17 |
| Total cost of road, | $29,257 41 |
| Lump sum, contract price, | $27,857 78 |

PORTION TO BE PAID BY BOROUGH.

| | |
|---|---|
| Foundation, type C, 3,997 square yards, at 68 cents; total, | $2,717 96 |
| Surface, type B, 3,983.75 square yards, at 69 cents; total, | 2,748 79 |
| Surface, type brick, 13.25 square yards, at $2.50; total, | 33 12 |
| Earth excavation, 331 cubic yards, at 46 cents; total, | 152 26 |
| Total, | $5,652 13 |
| Inspection (borough share), | 73 10 |
| Engineering (borough share), 3 per cent., | 169 56 |
| Total cost of road to borough, | $5,894 79 |
| Total cost of road to county, | $23,362 62 |
| Amount allowed by State, | 23,362 62 |
| Forty per cent. of above State's share, | $9,345 05 |
| Less credit by cost of inspection already paid by State, | 514 50 |
| Amount due by State, | $8,830 55 |

Maximum grade before, ..... 1.00 per cent.
Maximum grade after, ..... 0.683 per cent.

We hereby certify that the above road is finished in all respects in strict compliance with the plans and specifications.

ALVIN B. FOX,
*Engineer.*
JOHN BURNS,
R. J. DELANEY,
*Inspectors.*

June 23d, 1915.

**Roosevelt–Woodbridge Road, Second Section, .618 Mile Long.**

This is a concrete pavement 16 feet wide, 8 inches deep in the center and 6 inches on either side. The improvement begins at the end of the present pavement at the Roosevelt borough line and extends southwesterly through the township of Woodbridge toward the old town of Woodbridge.

This road is a part of the old road to Blazing Star ferry.
The maximum grade was reduced from 2 per cent. to 1.60 per cent.

Detailed statement of the cost of the Roosevelt-Woodbridge road, Second Section, township of Woodbridge, county of Middlesex. Total length, 3,262 feet, or 0.618 mile.

Kind of pavement, concrete.
Width of paved way, 16 feet.
Length of paved way, 3,262 feet.
Depth, 8 inches at center and 6 inches at sides.
Width between slopes or curbs, 30 feet.

| | |
|---|---|
| Concrete foundation and surface (type C), 5,998 square yards, at 95 cents; total, | $5,698 10 |
| Earth excavation, 930 cubic yards, at 50 cents; total, | 465 00 |
| Extra embankment, 1,347 cubic yards, at 60 cents; total, | 808 20 |
| Cross drain, type 12-inch C. I. pipe, 12 lineal feet, at $2.50; total, | 30 00 |
| Concrete retaining walls, 8 cubic yards, at $10.00; total, | 80 00 |
| Total, | $7,081 30 |
| Inspection, | 90 00 |
| Engineering, | 212 44 |
| | $7,383 74 |
| Total cost of road, | $7,383 74 |
| Lump sum, contract price, | $7,303 15 |
| Amount allowed by State, | 7,383 74 |
| Forty per cent. of above, State's share, | $2,953 50 |
| Less credit by cost of inspection already paid by State, | 90 00 |
| Amount due by State, | $2,863 50 |

Maximum grade before, ..... 2.00 per cent.
Maximum grade after, ..... 1.60 per cent.

We hereby certify that the above road is finished in all respects in strict compliance with the plans and specifications.

ALVIN B. FOX,
*Engineer.*
JOHN BURNS,
RICHARD J. DELANEY.
*Inspectors.*

October 28th, 1914.

## MONMOUTH COUNTY.

### Allentown–New Canton Road, 1.07 Miles Long.

This improvement begins at the easterly end of the Y constructed at the intersection of the Imlaystown road with the main street of Allentown, and extends thence northeasterly for a distance of a little over one mile to the southwesterly side of the road to Cox corner. This improvement extends the paved roads leading into Allentown northeasterly toward the county line road leading to Hightstown, and forms the first section

of a cross-country road connecting Hightstown and Allentown. The remainder of the line, being a joint county road, will have to be taken up by the counties of Monmouth and Mercer as an inter-county road.

The work just completed consists of grading the highway from a width of 30 to 40 feet and of paving the same to a width of from 18 to 24 feet with water-bound macadam having a depth of from 6 to 18 inches, the excessive depth being for a short stretch over very bad bottom.

The grading was comparatively light, consisting simply in removing a few light hills and filling up some small hollows, reducing the maximum grade from 1.70 to .95 per cent.

Detailed statement of the cost of the Allentown-New Canton road, township of Upper Freehold, county of Monmouth. Total length, 5,652.23 feet, or 1.070 miles.

Kind of pavement, water-bound macadam.
Width of paved way, 18 to 24 feet.
Length of paved way, 5,652.23 feet.
Depth, 6 to 18 inches.
Width between slopes or curbs, 30 to 40 feet.

| | |
|---|---|
| Foundation, type "M," 11,900 square yards, at 40 cents; total, | $4,760 00 |
| Surface, type "M. W. B.," 11,900 square yards, at 45 cents; total, | 5,355 00 |
| Earth excavation, 1,920 cubic yards, at 30 cents; total, | 576 00 |
| Under drain, type 4-inch round tile, 3,000 lineal feet, at 15 cents; total, | 450 00 |
| 10-inch vitrified pipe, 710 lineal feet, at 60 cents; total, | 426 00 |
| One "T" and one "four-way," | 8 00 |
| 20 tons of stone for maintenance, at $2.85; total, | 57 00 |
| Total, | $11,632 00 |
| Less difference between items and lump sum. | 257 00 |
| Contract price, | $11,375 00 |
| Extra macadam foundation, 2,679.675 square yards, at 40 cents; total, | 1,071 87 |
| | $12,446 87 |
| Inspection, | 352 85 |
| Engineering, | 350 00 |
| | $13,149 72 |
| Extras paid entirely by county, | 344 83 |
| Total cost of road, | $13,494 55 |
| Lump sum, contract price, | $11,375 00 |
| Amount allowed by State, | 13,149 72 |
| Forty per cent. of above, State's share, | $5,259 89 |
| Less credit by cost of inspection already paid by State, | 352 85 |
| Amount due by State, | $4,907 04 |
| Maximum grade before, | 1.70 per cent. |
| Maximum grade after, | 0.95 per cent. |

We hereby certify that the above road is finished in all respects in strict compliance with the plans and specifications.

GEORGE D. COOPER,
*Engineer.*
JOSEPH P. BARRETT,
*Inspector.*

**Red Bank–Holmdel Road, Third Section, 1.08 Miles Long.**

This is the final section to be improved on the road between Red Bank and Holmdel. The work began at the end of the second section and extended through Holmdel to the stone road built a number of years ago.

The present improvement consists of a graded carriageway 30 feet wide, in the center of which a coating of gravel 18 feet wide and 8 inches thick was laid.

The old road was very narrow and crooked. It was, therefore, necessary to purchase a new right of way for nearly the entire third section.

The completion of this road not only gives the inhabitants of Monmouth county an improved highway from Red Bank to Holmdel, but also, in connection with the roads already improved, furnishes an improved highway from Red Bank to Freehold, the county seat.

The maximum grade was reduced from 5 per cent. to 4 per cent.

Detailed statement of the cost of the Red Bank-Holmdel road, Third Section, township of Holmdel, county of Monmouth. Total length, 5,700 feet, or 1.080 miles.

Kind of pavement, gravel.
Width of paved way, 18 feet.
Length of paved way, 5,651 feet.
Depth, 8 inches.
Width between slopes or curbs, 30 feet.

| | |
|---|---|
| Gravel, 2,512 cubic yards, at $1.10; total, | $2,763 20 |
| Earth excavation, 9,390 cubic yards, at 30 cents; total, | 2,817 00 |
| Under drain, type round porous tile, 9,000 lineal feet, at 12 cents; total, | 1,080 00 |
| | $6,660 20 |
| Plus difference between items and lump sum, | 1 00 |
| Total, | $6,661 20 |
| Inspection, | 395 80 |
| Engineering, | 333 00 |
| | $7,390 00 |
| Extras paid entirely by county, | 156 00 |
| Total cost of road, | $7,546 00 |
| Lump sum, contract price, | $6,661 20 |
| Amount allowed by State, | 7,390 00 |
| Forty per cent. of above, State's share, | $2,956 00 |
| Less credit by cost of inspection already paid by State, | 395 80 |
| Amount due by State, | $2,560 20 |
| Maximum grade before, | 5 per cent. |
| Maximum grade after, | 4 per cent. |

We hereby certify that the above road is finished in all respects in strict compliance with the plans and specifications.

GEORGE D. COOPER,
*County Engineer.*
JOHN H. STILLWAGON,
*Inspector.*

January 8th, 1915.

## OCEAN COUNTY.

### Bay Avenue, First Section, Stafford Township, 1.458 Miles Long.

This work is really the rebuilding of an old and important road to the landing from whence boats formerly sailed to the beach.

The present improvement begins at the bridge over Barnegat bay and extends over a new route across the meadows to the old road. It is the most important and necessary section for the reason that without it the bridge across the bay and the improvements there would be of little value. In other words, it connects, and makes useful, work that has heretofore been done.

As the road is built across the salt meadows, it is practically level. This is a gravel road 24 feet wide, 8 inches deep in the center and 4 inches at the sides.

Detailed statement of the cost of the Bay avenue, First Section, township of Stafford, county of Ocean. Total length, 7,700 feet, or 1.458 miles.

Kind of pavement (type I), gravel A.
Width of paved way, 24 feet.
Length of paved way, 7,700 feet.
Depth, 8 inches to 4 inches.
Width between slopes or curbs, 33 feet.

| | |
|---|---|
| Foundation, type earth, 11,669 cubic yards, at 60 cents; total, | $7,001 40 |
| Retaining sod wall, 2,202 cubic yards, at 95 cents; total, | 2,091 90 |
| Piling, creosoted 12-inch, 256 lineal feet, at 50 cents; total, | 128 00 |
| Piling, creosoted 8-inch, 352 lineal feet, at 35 cents; total, | 123 20 |
| Lumber, B. M., 1,174 feet, at 6 cents; total, | 70 44 |
| Grubbing, .6 acre, at $50.00; total, | 30 00 |
| Gravel, type A, 3,804 cubic yards, at $1.90 cents; total, | 7,227 60 |
| Earth excavation, 205 cubic yards, at 60 cents; total, | 123 00 |
| Cross drain, T. C. pipe, 6-inch, 40 lineal feet, at 25 cents; total, | 10 00 |
| Cross drain, T. C. pipe, 12-inch, 156 lineal feet, at 60 cents; total, | 93 60 |
| Cross drain, T. C. pipe, 16-inch, 56 lineal feet, at 90 cents; total, | 50 40 |
| Cross drain, T. C. pipe, 24-inch, 134 lineal feet, at $1.75; total, | 234 50 |
| Concrete culvert, four-foot span, 27.5 cubic yards, at $15.00; total, | 412 50 |
| Concrete retaining wall, 19.5 cubic yards, at $18.00; total, | 351 00 |
| Total cost by items, | $17,947 54 |
| Less difference between sum by items and lump sum, | 90 |
| Total, | $17,946 64 |
| Inspection, | 690 00 |
| Engineering, | 538 40 |
| Total cost of road, | $19,175 04 |
| Lump sum, contract price, | $17,946 64 |
| Amount allowed by State, | 19,175 04 |
| Forty per cent. of above, State's share, | $7,670 02 |
| Less credit by cost of inspection already paid by State, | 690 00 |
| Total, | $6,980 02 |
| Partial payment, | 3,542 55 |
| Amount due by State, | $3,437 47 |

Maximum grade after, .....2 per cent.

We hereby certify that the above road is finished in all respects in strict compliance with the plans and specifications.

I. H. CRAMER,
*Engineer.*
DAVID M. WHITE,
*Inspector.*

October 3, 1914.

**Bay Avenue, Second Section, Stafford Township, 1.704 Miles Long.**

The work just completed connects the Main Shore road at Manahawkin with the bridge over Barnegat bay by means of the first section, which was done last year. The beach front of Ocean county is its most rapidly increasing asset, and it is therefore of great importance that the best possible means of ingress and egress to the beach should be had at all times. The improvement just finished completes the line of improved roads from the Main Shore road at Manahawkin to Beach Haven, the largest borough on Long Beach.

The road is graded to a width of 30 feet and graveled 30 feet wide on the Y's connecting this road with the Main Shore road, and to a width of 24 feet for the remainder of the distance. The grade was changed slightly to remove a few depressions.

Detailed statement of the cost of the Bay avenue, Second Section, township of Stafford, county of Ocean. Total length, 9,000 feet, or 1.704 miles.

Kind of pavement, gravel.
Width of paved way, from Sta. 0 to Sta. 2+39, 30 feet, from Sta. 2+39 to Sta. 90, 24 feet.
Length of paved way, 9,000 feet.
Depth, on center line, 8 inches; at edges, 4 inches.
Width between slopes or curbs, 30 feet.

| | | |
|---|---|---|
| Gravel, type A entrances, .74 cubic yard, at $1.00; total, | | $0 74 |
| Gravel, type A, 4,565 cubic yards, at $1.00; total, | | 4,565 00 |
| Earth excavation, 2,787 cubic yards, at 55 cents; total, | | 1,532 85 |
| Embankment, 292 cubic yards, at 55 cents; total, | | 160 60 |
| Cross drain, type C. I. pipe, 16-inch, 300 lineal feet, at $2.80; total, | | 840 00 |
| Grubbing, .65 acre, at $100.00; total, | | 65 00 |
| Covering slopes, sod and turf, 1,965 square yards, at 16 cents; total, | | 314 40 |
| Catch basins, 2, at $25.00; total, | | 50 00 |
| Items omitted in construction— | | |
| Foreign material, 50 cubic yards, | $27 50 | |
| Gravel at entrances, 1.73 cubic yards, at $1.00; total, | 1 73 | |
| | $29 23 | |
| Total, | | $7,528 59 |
| Inspection, | | 252 00 |
| Engineering, | | 377 89 |
| Total cost of road, | | $8,158 48 |
| Lump sum, contract price, | | $7,557 82 |
| Amount allowed by State, | | 8,158 48 |

| | |
|---|---|
| Forty per cent. of above, State's share, | $3,263 39 |
| Less credit by cost of inspection already paid by State, | 252 00 |
| Amount due by State, | $3,011 39 |

Maximum grade before, .....1.27 per cent.
Maximum grade after, .....0.97 per cent.

We hereby certify that the above road is finished in all respects in strict compliance with the plans and specifications.

I. H. CRAMER,
*Engineer.*
DAVID M. WHITE,
*Inspector.*

July 24th, 1915.

(Described in 1914 Report.)

Detailed statement of the cost of the Bay Avenue road, First Section, township of Long Beach, county of Ocean. Total length, 17,200 feet, or 3.258 miles.

Kind of pavement, gravel.
Width of paved way, 24 feet.
Length of paved way, 17,200 feet.
Depth, 8 inches and 4 inches.
Width between slopes or curbs, 33 feet.

| | |
|---|---|
| Extra embankment, 43,654 cubic yards, at 20 cents; total, | $8,730 80 |
| Salt hay covering, 63,066 square yards, at 1¼ cents; total, | 788 33 |
| Sod retaining wall, 3,326 cubic yards, at 82 cents; total, | 2,727 32 |
| Grubbing, 7 1/10 acres, at $50.00; total, | 355 00 |
| Gravel, type A, 8,492 cubic yards, at $2.00; total, | 16,984 00 |
| Earth excavation, 960 cubic yards, at 30 cents; total, | 288 00 |
| Cross drain, 6-inch T. C. pipe, 1,320 lineal feet, at 22 cents; total, | 290 40 |
| Cross drain, type T. C., 12-inch pipe, 200 lineal feet, at 50 cents; total, | 100 00 |
| Cross drain, type T. C., 18-inch pipe, 40 lineal feet, at 90 cents; total, | 36 00 |
| Cross drain, type T. C., 24-inch pipe, 44 lineal feet, at $1.50; total, | 66 00 |
| Total, | $30,365 85 |
| Inspection, | 846 00 |
| Engineering, | 910 98 |
| Total cost of road, | $32,122 83 |
| Lump sum, contract price, | $30,365 85 |
| Amount allowed by State, | 32,122 83 |
| Forty per cent. of above, State's share, | $12,849 13 |
| Less credit by cost of inspection already paid by State, | 846 00 |
| | $12,003 13 |
| Less payment on account, October 3d, 1914, | 9,717 07 |
| Amount due from State, | $2,286 06 |

New road. Maximum grade after, level.

We hereby certify that the above road is finished in all respects in strict compliance with the plans and specifications.

I. H. CRAMER,
*Engineer.*
WM. PITTIS,
*Inspector.*

## PASSAIC COUNTY.

### Paterson and Hamburg Turnpike (Bloomingdale Section), .632 Mile Long.

This work begins at the Bloomingdale bridge over the Pequannock river and extends through Bloomingdale to Reeves bridge over the same stream. It is a short section of the old Paterson and Hamburg turnpike in Passaic county lying between sections in Morris county. The work of widening and straightening is very important on the score of safety.

The pavement is laid 20 feet wide and the roadway graded 30 feet. The maximum grade was reduced from 4 per cent. to 3½ per cent.

Detailed statement of cost of the Paterson and Hamburg Turnpike road (Bloomingdale Section), township of Pompton, county of Passaic. Total length, 3,337 feet, or 0.632 mile.

Kind of pavement, asphalt concrete, type B.
Width of paved way, 20 feet.
Length of paved way, 3,337 feet.
Depth, 6½ inches.
Width between slopes or curbs, 30 feet.

| | |
|---|---|
| Foundation, type "M," 7,958 cubic yards, at 37 cents; total, | $2,944 46 |
| Surface, type "B," 7,958 square yards, at $1.00; total, | 7,958 00 |
| Surface, type "M. W. B.," 373.4 square yards, at 50 cents; total, | 186 70 |
| Rip-rap, 25 cubic yards, at $4.00; total, | 100 00 |
| Concrete retaining wall, 165 cubic yards, at $7.00; total, | 1,155 00 |
| Earth excavation, 2,333.58, cubic yards, at 60 cents; total, | 1,400 14 |
| Cobble gutters, 140.6 square yards, at 75 cents; total, | 105 45 |
| Pipe, 15-inch vitrified, 756 lineal feet, at $1.25; total, | 945 00 |
| Basins, Passaic Co., Standard, 12, each at $70.00; total, | 840 00 |
| Total, | $15,634 75 |
| Inspection, | 328 05 |
| Engineering, | 600 00 |
| | $16,562 80 |
| Extras paid entirely by the county (as per supplementary contract for retaining wall and excavation for same, pavement and repairs to basins), | 2,651 92 |
| Total cost of the road, | $19,214 72 |
| Lump sum, contract price, | $16,614 80 |
| Amount allowed by State, | 16,562 80 |
| Forty per cent. of above, State's share, | $6,625 12 |
| Less credit by cost of inspection already paid by State, | 328 05 |
| Amount due by State, | $6,297 07 |
| Maximum grade before, | 4 per cent. |
| Maximum grade after, | 3½ per cent. |

We hereby certify that the above road is finished in all respects in strict compliance with the plans and specifications.

GARWOOD FERGUSON,
*Engineer.*
JOSEPH McCABE,
*Inspector.*

November 26th, 1914.

## SALEM COUNTY.

### Pole Tavern–Elmer Road, 2.955 Miles Long.

This new gravel road is an extension of the gravel streets of the thriving borough of Elmer northwesterly to the old Pole Tavern in Pittsgrove. It is a part of the through line across the State from Atlantic City to Pennsgrove, opposite Wilmington, Delaware. When this entire line is completed it will form the main thoroughfare for tourists from Delaware, Maryland and southern points to the New Jersey seaside resorts. The local value of the road is also great, as it traverses a very fertile farming region and thus furnishes a fine wide and smooth road for the farmers to the market and railroad station at Elmer.

The roadway is graded 30 feet wide and gravel is spread to a width of 20 feet and a depth of 8 inches.

The grade was practically unchanged.

Detailed statement of the cost of the Pole Tavern-Elmer road, township of Upper Pittsgrove, county of Salem. Total length, 15,603 feet, or 2.955 miles.

Kind of pavement, gravel.
Width of paved way, 20 feet.
Length of paved way, 15,603 feet.
Depth, 8 inches.
Width between slopes or curbs, 30 feet.

| | |
|---|---|
| Surface, type gravel, 34,673 square yards, at 25 cents; total, | $8,668 25 |
| Earth excavation, 10,146 cubic yards, at 35 cents; total, | 3,551 10 |
| Earth excavation outside road, 212 cubic yards, at 40 cents; total, | 84 80 |
| Culverts—12-inch, 82 feet vitrified pipe, at $0.60 per foot, | 49 20 |
| 15-inch, 12 feet vitrified pipe, at $0.80 per foot, | 9 60 |
| 18-inch, 106 feet vitrified pipe, at $0.80 per foot, | 84 80 |
| 24-inch, 72 feet vitrified pipe, at $1.50 per foot, | 108 00 |
| 36-inch, 76 feet vitrified pipe, at $3.00 per foot, | 228 00 |
| 12-inch, 120 feet cast-iron pipe, at $2.00 per foot, | 240 00 |
| 49.45 cubic yards concrete, at $8.00 per cubic yard, | 395 60 |
| 13 shade trees and stumps to be removed, at $5.00, | 65 00 |
| One-tenth acre of land to be cleared, at $200.00 per acre, | 20 00 |
| Total, | $13,504 35 |
| Inspection, | 398 58 |
| Engineering, | 656 00 |
| **Total cost of road,** | $14,558 93 |
| Lump sum, contract price, | $13,629 35 |
| Amount allowed by State, | 14,558 93 |
| Forty per cent. of above, State's share, | $5,823 57 |
| Less credit by cost of inspection already paid by State, | 398 58 |
| Amount due by State, | $5,424 99 |
| Maximum grade before, | 2.8 per cent. |
| Maximum grade after, | .38 per cent. |

We hereby certify that the above road is finished in all respects in practical compliance with the plans and specifications.

H. B. KEASBY,
*Engineer.*
JOHN D. SCHADE,
*Inspector.*

October 19th, 1914.

---

## SOMERSET COUNTY.

### Blackwell's Mills–Millstone Road, Third Section, .434 Mile Long.

The completion of this third section, which begins at the end of the present macadam at Groendyke's Corner and extends across the meadows of the Raritan river to the bridge over the same, is the most important portion of the whole road. It furnishes a good, smooth and convenient outlet at all seasons for the hundreds of men and teams that daily pass over it to and from the large Johns Manville Plant.

The improvement is one of the most marked made during the past year. It consists in the main of a fill, 9 feet high, across the meadows, and a series of 6 reinforced concrete arches having a span of 50 feet each.

The road is graded to a width of 33 feet, and is paved for a width of 16 feet with plain macadam. The maximum grade was reduced from 8.40 per cent. to 1.53 per cent., not by cutting, but by filling.

Detailed statement of the cost of the Blackwell's Mills and Millstone road, Third Section, or Manville road, township of Hillsborough, county of Somerset. Total length, 2,293 feet, or .434 mile.

Kind of pavement, M-MWB.
Width of paved way, 16 feet.
Length of paved way, 2,293 feet.
Depth, 8 inches.
Width between slopes or curbs, 33 feet.

| | |
|---|---|
| Foundation, type M, 4,152 square yards, at 45 cents; total, | $1,868 40 |
| Surface, type MWB, 4,152 square yards, at 53 cents; total, | 2,200 56 |
| Private driveways, 4-inch, 94 square yards, at 60 cents; total, | 56 40 |
| Earth excavation, 16,950 cubic yards, at 42 cents; total, | 7,119 00 |
| Under drain, type, round porous tile, 768 lineal feet, at 30 cents; total, | 230 40 |
| Guard rail, 2,386 lineal feet, at 24 cents; total, | 572 64 |
| Cost of road section, | $12,047 40 |
| Reinforced concrete arch bridge, complete, | 17,856 00 |
| Total, | $29,903 40 |
| Inspection, | 387 00 |
| Engineering, | 714 20 |
| | $31,004 60 |
| Extras paid entirely by county (410 feet guard rail, at 24 cents; 200 feet excavation, at 42 cents; 1,957 feet excavation, at 35 cents), | 867 35 |
| Total cost of road and bridge, | $31,871 95 |

| | |
|---|---|
| Lump sum, contract price (bridge, $17,856.00; road, $11,762.14), | $29,618 14 |
| Amount allowed by State, | 31,004 60 |
| Forty per cent. of road section and twenty per cent. of bridge section, State's share, | $8,830 64 |
| Less credit by cost of inspection already paid by State, | 387 00 |
| Amount due by State, | $8,443 64 |
| Maximum grade before, | 8.4 per cent. |
| Maximum grade after, | 1.53 per cent. |

We hereby certify that the above road is finished in all respects in strict compliance with the plans and specifications.

JOSHUA DOUGHTY, JR.,
*Engineer.*
C. A. WYCKOFF,
*Inspector.*

November 9th, 1914.

## UNION COUNTY.

### Shunpike Road, Middle Section, Grading Only, .278 Mile Long.

This heavy work completes the grading of the Shunpike road for its entire length from Westfield avenue to the city of Summit. The end sections were completed and reported last year. This section contained a very large percentage of trap rock, as the report will show. The total amount of trap rock excavated was 9,707 cubic yards, necessitating a cut in solid rock to a depth of 39 feet. The work was done by the quarry company, whose crusher plant is in close proximity to the road, and for that reason the price was very low, averaging about 35 cents per cubic yard.

The change wrought by this improvement is one of the most marked in the year's work. This is readily understood when we know that the maximum grade was reduced from 18 per cent. to 5 per cent.

The chief value of this work is that it furnishes a much shorter and more convenient route to Summit from the southern end of the county.

Detailed statement of the cost of the Shunpike road, Middle Section (grading only), township of Springfield, county of Union, Contract No. 3 for grading from Sta. 51 to Sta. 65 + 68. Total length, 1,468 feet, or 0.278 mile.

Width between slopes or curbs, 33 feet.

| | |
|---|---|
| Earth excavation, 22,972 cubic yards, | |
| Rock excavation, 9,707 cubic yards, | |
| Under drain, type tile, 200 lineal feet, | |
| Bids for this work were received May 11th, 1912, and the contract was subsequently awarded to the Commonwealth Quarry Co., of Summit, N. J., at $11,757.49, being a lump-sum bid for the whole work complete. | |
| Total, | $11,757 49 |
| Inspection, | 810 00 |
| Engineering, | 909 72 |
| | $13,477 21 |

| | |
|---|---|
| Lump sum, contract price, | $11,757 49 |
| Amount allowed by State, | 13,477 21 |
| Forty per cent. of above, State's share, | $5,390 88 |
| Less credit by cost of inspection already paid by State, | 810 00 |
| Amount due by State, | $4,580 88 |
| Maximum grade before, | 18 per cent. |
| Maximum grade after, | 5 per cent. |

We hereby certify that the above road is finished in all respects in strict compliance with the plans and specifications.

J. L. BAUER,
*Engineer.*
WILBUR F. SICKEY,
*Inspector.*

**Westfield or North Avenue, 1.789 Miles Long.**

This reconstruction of the last section of the old county road between Elizabeth and Plainfield begins at the bridge over the Rahway river in Cranford, and extends to the asphalt concrete pavement in Roselle. The road, as improved, consists of a road 40 feet wide, paved in the center with bituminous concrete to a width of 14 feet 2 inches to 19 feet, this in turn protected with a shoulder of macadam, treated with tar applied by the penetration method. The idea of this reinforced shoulder is to prevent the cutting away of the sides of the pavement by traffic.

With the completion of this section we have a continuous bituminous pavement from Elizabeth to Plainfield. The original pavement was laid in 1889, and served its purpose well until the increase of traffic, and the advent of the motor vehicle compelled its replacement with something more fitted to withstand the present-day traffic.

Detailed statement of the cost of the Westfield or North Avenue road, township of Cranford and borough of Roselle Park, county of Union. Total length, 9,448 feet, or 1.789 miles.

Kind of pavement, type B, bituminous concrete (Amiesite).
Width of paved way, 14 feet, 2 inches, to 19 feet.
Length of paved way, 9,448 feet.
Depth, 3 inches or more on 8-inch to 14-inch base.
Width between slopes or curbs, 34 to 74 feet.

| | |
|---|---|
| Foundation, type crushed stone, 5,238.75 tons, at $1.50; total, | $7,858 13 |
| Gutter and shoulder work, 12,956 lineal feet, at 2.5 cents; total, | 323 90 |
| Scarifying roadway, 8,848 lineal feet, at 4 cents; total, | 353 92 |
| Surface, type bituminous concrete (cold), 19,603 square yards, at 95 cents; total, | 18,622 85 |
| Tar on wings, 2,416 square yards, at 20 cents; total, | 483 20 |
| Manhole heads (reset), 6, at $2.00; total, | 12 00 |
| Earth excavation, 2,517 cubic yards, at 40 cents; total, | 1,006 80 |
| Crosswalk (reset), 36 lineal feet, at 12 cents; total, | 4 32 |

| | |
|---|---|
| Under drain, type 4-inch French, 1,400 lineal feet, at 22 cents; total, | $308 00 |
| Sodding, 445 square yards, at 6 cents; total, | 26 70 |
| Gutter, type concrete, 940 lineal feet, at 69 cents; total, | 648 60 |
| Gutter, type stone block, 162 square yards, at $1.60; total, | 259 20 |
| Gutter, type cobble (reset), 140 square yards, at 15 cents; total, | 21 00 |
| Cross drain, Sta. 61 + 40.5, | 245 00 |
| Cross drain, Sta. 46 + 0, | 295 00 |
| Basins at Gordon St., 2, at $20.00; total, | 40 00 |
| Basins at Sta. 15 + 20, 2, at $22.50; total, | 45 00 |
| Basins at Sta. 39 + 80, 2, at $21.00; total, | 42 00 |
| Basins at John St., Arlington road, Forest Avenue (3), at $18.00; total, | 54 00 |
| Force account work at intersecting streets and approaches to properties as per itemized statement, | 453 49 |
| Total, | $31,103 11 |
| Inspection, | 207 00 |
| Engineering, | 1,521 75 |
| | $32,831 86 |
| Extras paid entirely by county, | 474 92 |
| Total cost of road, | $33,306 78 |
| Lump sum, contract price, | $28,894 36 |
| Amount allowed by State, | 32,831 86 |
| Forty per cent. of above, State's share, | $13,132 74 |
| Less credit by cost of inspection already paid by State, | 207 00 |
| Amount due by State, | $12,925 74 |

Maximum grade before, ..... 3.94 per cent.
Maximum grade after, ..... 3.94 per cent.

We hereby certify that the above road is finished in all respects in strict compliance with the plans and specifications.

J. L. BAUER,
*Engineer.*
JAS. BOGART,
*Inspector.*

December 2d, 1914.

# Description and Statement of Cost of Bridges Constructed in 1915.

## ATLANTIC COUNTY.

### Gravelly Run Bridge on the Somers Point–Mays Landing Road.

By this construction the old line of the road was straightened at Gravelly Run. This new bridge is of the reinforced concrete slab type, supported by encased I-beams.

The clear width of roadway is 30 feet, and the length of the bridge span is 20 feet.

The wearing surface of the bridge floor is of gravel of the same depth as the pavement of the road.

DETAILED STATEMENT OF COST OF BRIDGE.

County—Atlantic.
Township—Hamilton.
Name of road—Mays Landing-Somers Point.
Name of bridge—Gravelly Run.
Type of bridge—Encased I-beams; concrete abutments.
Total length—About forty-four (44) feet, including wing-walls.
Number of spans—One.
Span length—Twenty (20) feet clear.
Clear width—Thirty (30) feet.

| | | |
|---|---|---|
| Inspection, | $162 00 | |
| Engineering, | 153 65 | |
| | | $315 65 |
| Extras, 10 piles, 8-foot, 80 feet; 9 piles, 10-foot, 90 feet; 6 piles, 9-foot, 54 feet; total, 224 feet, at 30c., | | 67 20 |
| Lump sum, contract price, | | 3,073 00 |
| Total cost of bridge, | | $3,455 85 |
| Amount allowed by State, | | $3,455 85 |
| Twenty per cent. of above, State's share, | | $691 17 |
| Less credit by cost of inspection already paid by State, | | 162 00 |
| Amount due by State. | | $529 17 |

We hereby certify that the above bridge is finished in all respects in strict compliance with the plans and specifications.

A. H. NELSON,
*County Engineer.*
JOHN R. TILTON,
*Inspector.*

May 5th, 1915.

### Miry Run Bridge on the Somers Point–Mays Landing Road.

This new bridge over Miry Run consists of a reinforced concrete slab floor resting on encased I-beams. The heavy wing-walls necessary to support the fill of the road, as well as the abutments, are supported on a substantial wooden platform resting on piles. The clear span is 18 feet and the width of roadway 30 feet.

DETAILED STATEMENT OF COST OF BRIDGE.

County—Atlantic.
Township—Egg Harbor.
Name of road—Mays Landing-Somers Point.
Name of bridge—Miry Run.
Type of bridge—Steel girders encased in concrete; stone abutments on piles.
Total length—Fifty-two (52) feet, including wing-walls.
Number of spans—One.
Span length—Eighteen (18) feet clear.
Clear width—Thirty (30) feet.

| | | |
|---|---|---|
| Inspection, | $222 00 | |
| Engineering, | 163 95 | |
| | | $385 95 |
| Lump sum, contract price, | | 3,279 00 |
| Total cost of bridge, | | $3,664 95 |
| Amount allowed by State, | | $3,664 95 |
| Twenty per cent. of above, State's share, | | $732 99 |
| Less credit by cost of inspection already paid by State, | | 222 00 |
| Amount due by State, | | $510 99 |

We hereby certify that the above bridge is finished in all respects in strict compliance with the plans and specifications.

A. H. NELSON,
*County Engineer.*
JOHN R. TILTON,
*Inspector.*

May 5th, 1915.

### Perch Cove Bridge on the Somers Point–Mays Landing Road.

This improvement consists of a reinforced concrete slab bridge with encased I-beams supported by concrete abutments on piles. The clear span is 15 feet 6 inches, and the width of roadway is 30 feet. This new bridge straightens the old line of the road and provides a clear roadway of the same width as the road pavement.

DETAILED STATEMENT OF COST OF BRIDGE.

County—Atlantic.
Township—Egg Harbor.
Name of road—Mays Landing-Somers Point.
Name of bridge—Perch Cove.
Type of bridge—Steel girders encased in concrete; concrete abutments on piles.

Total length—Thirty-seven (37) feet, including wing-walls.
Number of spans—One.
Span length—Fifteen (15) feet, six (6) inches clear.
Clear width—Thirty (30) feet.

| | | |
|---|---|---|
| Inspection, | $129 00 | |
| Engineering, | 124 80 | |
| | | $253 80 |
| Lump sum, contract price, | | 2,496 00 |
| Total cost of bridge, | | $2,749 80 |
| Amount allowed by State, | | $2,749 80 |
| Twenty per cent. of above, State's share, | | $549 96 |
| Less credit by cost of inspection already paid by State, | | 129 00 |
| Amount due by State, | | $420 96 |

We hereby certify that the above bridge is finished in all respects in strict compliance with the plans and specifications.

A. H. NELSON,
*County Engineer.*
JOHN R. TILTON,
*Inspector.*

May 5th, 1915.

**Powell's Creek Bridge on the Somers Point–Mays Landing Road.**

This construction consists of an addition to the old bridge at Powell's creek, and increases the former roadway of 18 feet to a clear width of 30 feet. The bridge has a span of 16 feet.

The bridge floor is of reinforced concrete supported by encased I-beams. Owing to the poor foundation, the stone abutments and wing-walls are built on a substantial wooden platform resting on piles.

DETAILED STATEMENT OF COST OF BRIDGE.

County—Atlantic.
Township—Egg Harbor.
Name of road—Mays Landing-Somers Point.
Name of bridge—Powell's Creek.
Type of bridge—Addition to old span; encased I-beams; stone abutments on piles.
Total length—Thirty-four (34) feet, including wing-walls
Number of spans—One.
Span length—Sixteen (16) feet clear.
Clear width—(Addition to old span) Eleven (11) feet; total, thirty (30) feet.

| | | |
|---|---|---|
| Inspection, | $63 00 | |
| Engineering, | 59 80 | |
| | | $122 80 |
| Lump sum, contract price, | | 1,196 00 |
| Total cost of bridge, | | $1,318 80 |
| Amount allowed by State, | | $1,318 80 |
| Twenty per cent of above, State's share, | | $263 76 |
| Less credit by cost of inspection already paid by State, | | 63 00 |
| Amount due by State, | | $200 76 |

We hereby certify that the above bridge is finished in all respects in strict compliance with the plans and specifications.

A. H. NELSON,
*County Engineer.*
JONAS H. CAMP,
*Inspector.*

May 5th, 1915.

---

## CAMDEN COUNTY.

### Bridge over Main Branch of Newton Creek, Camden and Blackwood Pike.

Owing to the poor foundation, the new bridge over the Main Branch of Newton creek is constructed on a substantial wooden platform built on piles.

This concrete slab bridge has a span of 30 feet and a clear width of roadway of 30 feet, with an 11′-6″ sidewalk on either side.

The bridge floor is of reinforced concrete with encased steel I-beams. The bituminous wearing surface is the same as that of the road.

A tumbling dam was constructed under the bridge for the purpose of forming a lake above the bridge site.

DETAILED STATEMENT OF COST OF BRIDGE.

County—Camden.
Township—Haddon.
Name of road—Blackwood Pike.
Name of bridge—Main Branch Newton Creek.
Type of bridge—Encased "I"-beam, with floor slab.
Total length—Sixty-one (61) feet.
Number of spans—One.
Span length—Thirty (30) feet.
Clear width—Roadway, thirty (30) feet; two sidewalks, eleven (11) feet, six (6) inches.

| | |
|---|---|
| Inspection, | $447 00 |
| Engineering, | 100 00 |
| Extras paid entirely by county, | 190 22 |
| Lump sum, contract price, | 5,592 00 |
| Total cost of bridge, | $6,329 22 |
| Amount allowed by the State, | $5,692 00 |
| Twenty per cent. of above, State's share, | $1,138 40 |
| Amount due by State, | $1,138 40 |

We hereby certify that the above bridge is finished in all respects in strict compliance with the plans and specifications.

J. J. ALBERTSON,
*County Engineer.*
L. D. COLES,
*Inspector.*

October 13th, 1914.

**Bridge over North Branch of Newton Creek, Camden and Blackwood Pike.**

The new bridge over the North Branch of Newton creek is similar in construction to the one erected over the Main Branch. It consists of a reinforced concrete slab with encased I-beams. The span is 30 feet and the clear width of roadway 30 feet, with two 11′-6″ sidewalks. The bituminous road surface extends over the bridge.

A heavy pile and platform foundation supports the bridge.

DETAILED STATEMENT OF COST OF BRIDGE.

County—Camden.
Township—Haddon township, Woodlynne borough, Camden city.
Name of road—Blackwood Pike.
Name of bridge—North Branch Newton Creek.
Type of bridge—Encased "I"-beam, with floor slab.
Total length—Seventy-five (75) feet.
Number of spans—One.
Span length—Thirty (30) feet.
Clear width—Roadway, thirty (30) feet; two sidewalks, eleven (11) feet six (6) inches.

| | |
|---|---|
| Inspection, | $285 58 |
| Engineering, | 75 00 |
| Extras paid entirely by county, | 445 50 |
| Lump sum, contract price, | 4,710 00 |
| Total cost of bridge, | $5,516 08 |
| Amount allowed by the State, | $4,785 00 |
| Twenty per cent. of above, State's share, | $957 00 |
| Amount due by State, | $957 00 |

We hereby certify that the above bridge is finished in all respects in strict compliance with the plans and specifications.

J. J. ALBERTSON,
*County Engineer.*
L. D. COLES,
*Inspector.*

October 13th, 1914.

## CAPE MAY COUNTY.

**Ocean City Drawbridge, Ocean City Road.**

This modern center-bearing draw-span replaced an old timber bridge which was constantly in need of repair. The present bridge is a pony truss span supported at the center on a large concrete pier and resting at either end, when in closed position, on wooden pile bents of the creosoted timber approaches.

The draw-span is 140 feet in length, with a clear width of 24 feet. The floor is of plank and the guard-rail of galvanized iron.

The bridge is designed to be operated by either hand or electric power. The bridge-tender's house, located on the side of the trestle work near the end of the draw, contains the gasoline engine, electric generator and storage batteries, which are connected by cable with the operating motors of the wedges and rotating machinery.

DETAILED STATEMENT OF COST OF THE OCEAN CITY BRIDGE.

County—Cape May.
Township—Upper.
Total length—Three hundred and forty (340) feet.
Number of panels—Draw, eight panels; trestle, eighteen panels.
Panel length—Draw, seventeen and one-half (17½) feet; trestle, sixteen (16) panels at eleven and one-half (11½) feet; two (2) panels at eight (8) feet.
Clear width—Twenty-four (24) feet.
Type of bridge—Riveted steel truss, pivot swing draw; wooden trestle approaches.

| | |
|---|---|
| Contract price, | $24,500 00 |
| Less deduction on caisson ring, | 216 62 |
| | $24,283 38 |
| Inspection, | 1,495 50 |
| Engineering, | 1,092 78 |
| Total cost of bridge, | $26,871 66 |
| Amount allowed by State, | $26,871 66 |
| Twenty per cent. of above, State's share, | $5,374 33 |
| Less credit by cost of inspection already paid by State, | 1,495 50 |
| Amount due by State, | $3,878 83 |

We hereby certify that the above bridge is finished in all respects in strict compliance with the plans and specifications.

L. M. RICE,
*Engineer.*
WARDELL HIGBEE,
*Inspector.*

October 28th, 1914.

## MIDDLESEX COUNTY.

### Perth Amboy—South Amboy Drawbridge.

State pays one-third of repairs and maintenance from road fund. (Chapter 413, Laws of 1912.)

| | |
|---|---|
| Total cost of repairs and maintenance, May 1st, 1912, to October 1st, 1913, .. | $22,366 79 |
| State's share, | 7,455 59 |
| Total cost of repairs and maintenance, October 1st, 1913, to October 31st, 1914, | $20,892 78 |
| State's share, | 6,964 26 |
| Total cost of repairs and maintenance, November 1st, 1914, to October 31st, 1915, | $26,396 01 |
| State's share, | 8,798 67 |

## SOMERSET COUNTY.

### Finderne Bridge, Blackwell's Mills and Millstone Road, Third Section.

This reinforced concrete arched bridge of six spans was built as an addition to the old steel bridge over the Raritan river in order to furnish the increased waterway deemed necessary by raising the grade of the road to that of the old bridge. Under former conditions the river flowed over the low approaches and temporarily stopped traffic.

Each of the six arches are of 50 feet in span, and the macadam roadway over the bridge has a clear width of 30 feet.

The bridge was completed early in the year, and has withstood several heavy floods.

The total cost of the bridge was $17,856.00, of which the State's share was 20 per cent., or $3,571.20.

(The cost of this bridge is included in the statement of cost of the above road.)

# Cost of Repairs.

In compliance with Chapter 113, P. L. 1906, amended Chapter 235, P. L. 1909, amended Chapter 225, P. L. 1910, also amended Chapter 395, P. L. 1912, further amended Chapter 317, P. L. 1913, money from the motor vehicle fund, during the fiscal year from November 1, 1914, to October 31, 1915, has been sent to the various authorities for repairs on the following roads:

| *Name of Road.* | *County.* | *Amount.* |
|---|---|---|
| Adelphia-Farmingdale-Lakewood road, | Monmouth, | $1,000 00 |
| Adelphia-Farmingdale-Lakewood road, | Monmouth, | 1,500 00 |
| Adelphia-Lakewood road, | Monmouth, | 1,000 00 |
| Amboy avenue, Perth Amboy, | Middlesex, | 15,000 00 |
| Atlantic Highlands, | Monmouth, | 2,968 87 |
| Ballinger's Mills-Pole Tavern road, | Salem, | 1,719 75 |
| Belleville turnpike, | Hudson, | 1,470 21 |
| Belleville turnpike, | Hudson, | 2,500 00 |
| Belleville turnpike, | Hudson, | 1,000 00 |
| Belmar-Manasquan road, | Monmouth, | 1,500 00 |
| Beverly-Delanco road, | Burlington, | 1,000 00 |
| Blackwell street, Dover, | Morris, | 2,500 00 |
| Blackwood pike, | Camden, | 3,700 00 |
| Bordentown-Columbus road, | Burlington, | 496 30 |
| Bordentown to Crosswicks creek, | Burlington, | 4,492 65 |
| Bordentown-Crosswicks Creek road, | Burlington, | 246 00 |
| Branchville-Layton road, | Sussex, | 1,000 00 |
| Bridgeboro-Westfield road, | Burlington, | 515 98 |
| Bridgeport-Nortonville road, | Goucester, | 300 00 |
| Broad avenue, Leonia, | Bergen, | 500 00 |
| Broadway, | Bergen, | 20,000 00 |
| Broadway, Leonia, | Bergen, | 100 00 |
| Browning Lane, | Camden, | 2,400 00 |
| Brown's Mills-Lakehurst road, | Burlington, | 999 50 |
| Burlington-Bowne's Corner road, | Burlington, | 10,009 13 |
| Church road, | Camden, | 3,800 00 |
| Clayton-Malaga road, | Gloucester, | 1,200 00 |
| Clayton-Williamstown road, | Gloucester, | 200 00 |
| Clinton-High Bridge road, | Hunterdon, | 500 00 |
| Clinton-Glen Gardner road, | Hunterdon, | 1,000 00 |
| Clinton-Glen Gardner road, | Hunterdon, | 1,500 00 |
| Columbus-Bordentown road, | Burlington, | 18,298 44 |
| Cranbury-Plainsboro-Aqueduct road, | Middlesex, | 500 00 |
| Cranbury Station-Union Valley road, | Middlesex, | 500 00 |
| Cranbury turnpike, | Middlesex, | 10,000 00 |
| Crown Point road, | Gloucester, | 2,500 00 |
| Denville-Rockaway road, | Morris, | 4,000 00 |
| East and West State Aid road, Haworth, | Bergen, | 500 00 |
| East Rahway road, | Middlesex, | 1,000 00 |
| Edinburg-Windsor-Highstown road, | Mercer, | 4,000 00 |
| Egg Harbor-Mays Landing road, | Atlantic, | 3,000 00 |

| *Name of Road.* | *County.* | *Amount.* |
|---|---|---|
| Far Hills-Chester road, | Somerset, | $1,000 00 |
| Farmingdale-Asbury Park road, | Monmouth, | 1,500 00 |
| Farmingdale-Lakewood road, | Monmouth, | 1,500 00 |
| Flemington-Whitehouse road, | Hunterdon, | 3,500 00 |
| Flemington-Whitehouse-County line road, | Hunterdon, | 2,500 00 |
| Flemington-Whitehouse-County line road, | Hunterdon, | 2,000 00 |
| Franklin Park-Kingston road, | Somerset, | 1,000 00 |
| Freehold-Adelphia road, | Monmouth, | 2,000 00 |
| Freehold-Colt's Neck road, | Monmouth, | 1,500 00 |
| Freehold-Farmingdale road, | Monmouth, | 1,000 00 |
| Frenchtown-Spring Mills road, | Hunterdon, | 1,000 00 |
| General Repairs, | Morris, | 21,000 00 |
| General Repairs, | Union, | 6,000 00 |
| General Repairs, | Union, | 10,900 00 |
| Glassboro-Clayton road, | Gloucester, | 500 00 |
| Glassboro-Hardingville road, | Gloucester, | 600 00 |
| Glen Gardner Sanatorium road, | Hunterdon, | 300 00 |
| Godwin avenue, Ridgewood, | Bergen, | 1,500 00 |
| Hamburg avenue, | Passaic, | 2,096 89 |
| High Bridge-Califon road, | Hunterdon, | 1,000 00 |
| Highlands road, | Monmouth, | 1,200 00 |
| Highland Park-Bonhamtown road, | Middlesex, | 3,000 00 |
| Highland Park-Metuchen-Menlo Park road, | Middlesex, | 2,500 00 |
| Hudson County boulevard, | Hudson, | 1,945 00 |
| Hudson boulevard, | Hudson, | 1,365 00 |
| Hudson terrace, | Bergen, | 600 00 |
| Hudson terrace, | Bergen, | 2,150 00 |
| Hurffville-Glassboro (Cross Keys) road, | Gloucester, | 900 00 |
| Jamesburg-Englishtown road, | Middlesex, | 1,500 00 |
| Jamesburg-Helmetta-Spotswood road, | Middlesex, | 1,000 00 |
| Keyport-Red Bank road, | Monmouth, | 10,000 00 |
| King's Highway-Haddon Heights-Westville road, | Camden, | 2,500 00 |
| Kingston-Franklin Park road, | Somerset, | 500 00 |
| Kingston-Franklin Park road, | Somerset, | 1,500 00 |
| Kingston-Somerville-Bernardsville road, | Somerset, | 500 00 |
| Kingston-Somerville-Van Doren's Mills road, | Somerset, | 6,000 00 |
| Lakehurst-Toms River road, | Ocean, | 1,000 00 |
| Lakewood-Lakehurst road, | Ocean, | 300 00 |
| Lakewood-New Egypt road, | Ocean, | 1,000 00 |
| Lakewood-Point Pleasant road, | Ocean, | 1,000 00 |
| Lakewood-Toms River road, | Ocean, | 1,000 00 |
| Lambertville-Flemington road, | Hunterdon, | 2,500 00 |
| Lambertville-Flemington road, | Hunterdon, | 2,000 00 |
| Lambertville-Flemington road, | Hunterdon, | 3,000 00 |
| Lawrenceville road, | Mercer, | 5,000 00 |
| Lawrenceville-Princeton; Princeton-Kingston, borough of Princeton, | Mercer, | 2,000 00 |
| Lincoln Highway signs, | | 199 10 |
| Long Hill road, | Passaic, | 1,000 00 |
| Lumberton-Medford road, | Burlington, | 3,360 89 |
| Madison avenue, | Morris, | 5,000 00 |
| Main Street-Little Falls turnpike, | Passaic, | 2,000 00 |
| Manalapan-Freehold road, | Monmouth, | 1,500 00 |
| Mannington Hill road, | Salem, | 2,000 00 |
| Market street, | Passaic, | 5,000 00 |
| Market street, Gloucester, | Camden, | 1,800 00 |
| Marlton pike, | Camden, | 3,000 00 |
| Matawan-Holmdel road, | Monmouth, | 1,500 00 |
| Medford-Ballinger's Mills road, | Burlington, | 8,527 26 |

| *Name of Road.* | *County.* | *Amount.* |
|---|---|---|
| Menlo Park-Iselin-Colonia road, | Middlesex, | $3,000 00 |
| Mercer County roads, Convict labor work, | Mercer, | 9,066 60 |
| Mercerville-Edinburg road, | Mercer, | 150 00 |
| Metlar's lane, | Middlesex, | 1,000 00 |
| Metlar's Lane-New Market road, | Middlesex, | 173 25 |
| Metlar's Lane-New Market road, | Middlesex, | 621 00 |
| Metuchen-Perth Amboy road, | Middlesex, | 5,000 00 |
| Middletown road and Grand avenue, | Bergen, | 500 00 |
| Middletown road, Rivervale, | Bergen, | 500 00 |
| Middletown road, Rivervale, | Bergen, | 500 00 |
| Midland-Wyckoff Station road, | Bergen, | 1,000 00 |
| Millstone-New Brunswick road, | Somerset, | 1,000 00 |
| Mine Brook road, Bernards township, Smith contract, | Somerset, | 693 92 |
| Mine Brook road, Bernards township, Pine contract, | Somerset, | 498 59 |
| Monmouth Beach road, | Monmouth, | 1,500 00 |
| Moorestown-Masonville road, | Burlington, | 14,067 99 |
| Morris Plains-Denville road, | Morris, | 6,000 00 |
| Morris Plains-Morristown road, | Morris, | 10,000 00 |
| Morristown-Bernardsville road, | Morris, | 1,500 00 |
| Morris turnpike, | Warren, | 6,000 00 |
| Mount Holly-Moorestown road, | Burlington, | 1,029 53 |
| Mullica Hill-Harrisonville road, | Gloucester, | 500 00 |
| Mullica River-Ocean County line road, | Burlington, | 18 00 |
| Nassau street, Princeton, | Mercer, | 5,000 00 |
| Neshanic road, | Somerset, | 500 00 |
| Newark turnpike (Brennan pavement), | Hudson, | 500 00 |
| Newark turnpike (Jersey City end), | Hudson, | 500 00 |
| Newark turnpike, | Hudson, | 1,000 00 |
| New Brunswick-Franklin Park road, | Middlesex, | 1,600 00 |
| Newton-Stanhope road, | Sussex, | 2,500 00 |
| Newton-Stanhope road, | Sussex, | 2,000 00 |
| Newton-Stanhope road, | Sussex, | 1,000 00 |
| North Plainfield-Watchung-Stirling road, | Somerset, | 1,000 00 |
| Norwood avenue, | Monmouth, | 5,000 00 |
| Ocean highway, | Burlington, | 12 00 |
| Ocean highway, | Burlington, | 372 90 |
| Ocean highway, | Monmouth, | 4,132 00 |
| Ocean highway, Galilee, | Monmouth, | 4,000 00 |
| Ocean highway through Monmouth county, | Monmouth, | 10,000 00 |
| Ocean highway through Ocean county, | Ocean, | 29,068 88 |
| Old Bridge-Matawan road, | Middlesex, | 683 00 |
| Opdyke's bridge, change of line, | Somerset, | 8,500 00 |
| Passaic avenue, | Hudson, | 4,701 47 |
| Paterson and Hamburg turnpike, | Passaic, | 1,477 12 |
| Paterson and Hamburg turnpike, | Morris, | 1,500 00 |
| Patrol system, | Essex, | 60,000 00 |
| Paulsboro-Swedesboro road, | Gloucester, | 550 00 |
| Paulsboro-Swedesboro road, | Gloucester, | 800 00 |
| Pedricktown-Nortonville road, | Salem, | 997 73 |
| Pennsville-Pennsgrove road, | Salem, | 3,000 00 |
| Pennsville-Salem road, | Salem, | 1,000 00 |
| Perth Amboy-Keasbey road, | Middlesex, | 1,500 00 |
| Phillipsburg-Belvidere road, | Warren, | 4,000 00 |
| Phillipsburg-Belvidere road, | Warren, | 5,000 00 |
| Pine Brook road, | Morris, | 4,000 00 |
| Point Pleasant-Seaside Park road, | Ocean, | 2,000 00 |
| Pole Tavern-Malaga road, | Salem, | 484 50 |
| Pompton turnpike, Verona and Cedar Grove, | Essex, | 52,000 00 |
| Ramapo Valley road, Hohokus, | Bergen, | 1,000 00 |
| Red Bank-Eatontown-Long Branch road, | Monmouth, | 4,000 00 |

| *Name of Road.* | *County.* | *Amount.* |
|---|---|---|
| Red Bank-Holmdel road, third section, | Monmouth, | $1,000 00 |
| Repair bids, advertising, | | 58 88 |
| Richmond avenue, Point Pleasant, | Ocean, | 1,000 00 |
| Ringoes-Woodsville road, | Hunterdon, | 2,000 00 |
| Ringoes-Woodsville road, | Hunterdon, | 1,500 00 |
| River road, | Camden, | 2,300 00 |
| River road, | Middlesex, | 3,700 00 |
| River road, | Mercer, | 7,000 00 |
| Rivervale road, Rivervale, | Bergen, | 900 00 |
| Rockaway-Dickerson's Bridge road, | Morris, | 3,000 00 |
| Salem-Pennsgrove road, | Salem, | 250 00 |
| Salem-Pointers road, | Salem, | 3,000 00 |
| Schraalenburg, Kinderkamack, River roads and Sylvan avenue, | Bergen, | 6,100 00 |
| Seabright-Highlands road, | Monmouth, | 5,000 00 |
| Seashore road, | Cape May, | 1,020 51 |
| Seashore road, second section, | Cape May, | 10,000 00 |
| Seaside Park-Bayhead road, | Ocean, | 700 00 |
| Shore road, second section, | Cape May, | 1,675 00 |
| Singac road, | Passaic, | 2,700 00 |
| South Amboy bridge approach, | Middlesex, | 2,000 00 |
| South Amboy-Keyport road, | Middlesex, | 2,000 00 |
| South Amboy-Sayreville road, | Middlesex, | 1,000 00 |
| South Pemberton road, | Burlington, | 4,933 79 |
| Spotswood-Old Bridge-South Amboy road, | Middlesex, | 2,500 00 |
| Stanhope road, | Sussex, | 900 00 |
| Stelton-New Market road, | Middlesex, | 1,000 00 |
| Stoutsburg-Blawenburg road, | Somerset, | 1,000 00 |
| Stult's Corner-Prospect Plains-Hoffman's Station road, | Middlesex, | 500 00 |
| Swedesboro Borough road, | Gloucester, | 450 00 |
| Terrace avenue (Polifly road), | Bergen, | 26,150 00 |
| Toms River-Tuckerton-County line road, | Ocean, | 2,000 00 |
| Trenton-Princeton-Kingston road, | Mercer, | 2,000 00 |
| Trenton turnpike, | Middlesex, | 317 00 |
| Union avenue, | Middlesex, | 500 00 |
| Union avenue, | Somerset, | 2,000 00 |
| Union avenue, Rutherford, | Bergen, | 2,500 00 |
| Valley drive, | Monmouth, | 2,000 00 |
| Washington-Hackettstown road, | Warren, | 5,000 00 |
| Washington-Hackettstown road, | Warren, | 5,000 00 |
| Westfield avenue, Elizabeth-Roselle Park road, | Union, | 15,000 00 |
| Westville-Glassboro road, | Gloucester, | 2,500 00 |
| Westville-Glassboro road, | Gloucester, | 5,200 00 |
| White Horse pike, | Atlantic, | 9,500 00 |
| White Horse pike, | Atlantic, | 920 00 |
| White Horse pike, | Camden, | 6,000 00 |
| White Horse road, | Mercer, | 3,000 00 |
| White Horse pike, | Camden, | 7,000 00 |
| White Horse Pike-Berlin-Waterford road, | Camden, | 2,000 00 |
| Woodbury-Knights Run road, | Gloucester, | 1,000 00 |
| Woodbury-Knights Run road, | Gloucester, | 300 00 |
| Wyckoff road, | Bergen, | 950 00 |
| Wyckoff road, Hohokus, | Bergen, | 440 10 |
| Wyckoff road, Ramsey, | Bergen, | 600 16 |
| Wyckoff road, Ramsey, | Bergen, | 352 50 |
| Yardville-Allentown road, | Mercer, | 2,000 00 |
| Yardville-Crosswicks road, | Mercer, | 1,500 00 |
| Yardville-Crosswicks road, | Mercer, | 3,000 00 |
| Total, | | $751,277 39 |

## REPAIRS AND RESURFACING FROM COUNTY FUNDS DURING THE YEAR 1915.

In some cases it is difficult to secure accurate returns; consequently, the figures in this table are approximate only.

| *County.* | *Amount.* |
|---|---|
| Atlantic, | $57,964 52 |
| Bergen, | 1,225,727 08 |
| Burlington, | 77,212 00 |
| Camden, | 43,135 36 |
| Cape May, | 69,463 34 |
| Cumberland, | 2,785 85 |
| Essex, | 192,791 36 |
| Gloucester, | 17,981 76 |
| Hudson, | 394,285 12 |
| Hunterdon, | 17,000 00 |
| Mercer, | 179,766 24 |
| Middlesex, | 474,611 36 |
| Monmouth, | 136,388 46 |
| Morris, | 220,620 29 |
| Ocean, | 9,758 85 |
| Passaic, | 183,774 51 |
| Salem, | 11,000 00 |
| Somerset, | 19,352 80 |
| Sussex, | 6,828 76 |
| Union, | 27,567 07 |
| Warren, | 42,210 86 |
| Total, | $3,410,225 59 |

# REPORT.

The detail work done by our Department in the last year is covered by the reports of the State Highway Engineer, the Chemist to the Department of Conservation and Development and the Division Engineers.

In addition thereto, I would call the attention of the Legislature to the work that has been done during the last three years by the inmates of the State Prison on various roads in this State. The legislation under which this work is done has proven far from satisfactory. If results are to be obtained, some modification thereof will be found necessary.

The continual and phenomenal increase in our motor vehicle traffic is creating problems, not only as to the construction and maintenance of our roads, but as to our future policy in their general administration, of the most serious and difficult nature. Assuming that the rate of increase of population shown between the United States census of 1900 and 1910 has been maintained, the motor vehicle registration in the State has shown the following increases:

1912, one automobile for every 50 population.
1913, one automobile for every 46 population.
1914, one automobile for every 40 population.
1915, one automobile for every 32.4 population.

There are to-day in service in the State about six automobiles for every mile of country road, excluding streets.

Such heavy traffic and such increases as shown above render it only prudent for the State to carefully reconsider its road policy and to adapt it to the conditions which appear to be probable.

While New Jersey is probably as fully automobilized as any other community, there still remain increased fields of usefulness that have not yet been filled by the automobile. It has been estimated by competent automobile manufacturers that the

motor vehicle output can be increased from the present figure of about 750,000 to anywhere from 1,600,000 to 3,800,000 within a comparatively short time. The manufacturers are preparing themselves to meet such a demand. While the export trade will probably absorb a large share of the output, there can be no doubt that there will be, in the near future, a very substantial increase in the use of our roads. The growth of the past few years has been largely due to the extended use of motor vehicles for strictly business purposes, and represents not merely a growth of pleasure traffic. This very large increase and the ever-growing demand for road improvement are eloquent witnesses of the commercial and industrial importance of our roads. Even the pleasure car has a decided business value in this State, and especially so in the counties bordering on the Atlantic ocean.

The present traffic is taxing our roads to the utmost, and is imposing upon our local authorities very heavy burdens in the way of maintenance. The increase in the receipts from the motor vehicles has been in nowise proportionate to the increase in the demand for assistance from the various counties. Whereas five years ago from one-third to one-half of the amount needed to keep our main lines of traffic in repair could be met out of the motor vehicle fund, it has this year been impossible to provide more than about twenty per cent. of the money that should have been spent for this purpose, and this in spite of the unexpectedly large increase in receipts. The reason for this is very apparent upon analysis of the conditions. It can be proved that, as a fair average, an automobile, making a mileage of 6,000 in a year, inflicts a damage of from $30 to $35 on our roads, and pays a license fee of $7.50. For an ordinary two-horse team, it is estimated that the damage done will cost not over $8 to replace. It is, therefore, easy to see that the greater the growth of motor vehicle traffic, and the larger the receipts therefrom, the greater will be the demand upon the counties for repair work and the lesser the proportional part thereof which can be contributed from the motor vehicle fund. The situation calls for foresight and careful

business management, as well as for a policy which shall be consistently followed.

We are ill prepared to meet the needs of the situation. We have no exact knowledge of the travel on our roads, their mileage, the cost of repair, nor of the portion thereof that has been improved. This very necessary information cannot be systematically gathered under our legislation. What little has been done in this way has been incidental to other work, and is too spasmodic in character to furnish any basis for design. All we know with certainty is that 1,988 miles have been improved with State aid. Our total road mileage, exclusive of streets, is probably about 15,000. Of this the Legislature has set aside a maximum of 1,500 to be taken over as State highways. This proportion, ten per cent., corresponds with what it has been found advisable in other States and abroad to set aside as the primary road system.

For secondary roads, which with us should be county roads, it is not unreasonable to allow about thirty per cent. The other sixty per cent. should remain as local roads.

Accepting some such principle of subdivision, and taking our total improved road mileage as 4,500 miles at the utmost, we would have approximately:

| | *Improved.* | *Unimproved.* | *Total.* |
|---|---|---|---|
| State Highways, | 1,150 | 350 | 1,500 |
| County Roads, | 1,500 | 3,000 | 4,500 |
| Local Roads, | 1,850 | 7,150 | 9,000 |
| | 4,500 | 10,500 | 15,000 |

Any estimate of the cost of improvement is largely guesswork. If, however, we assume that the State highways will average $18,000 a mile, the county roads $10,000, and the local roads $6,000, and that will leave about 2,150 of the latter unimproved, our total cost of improvement would be $51,300,000. Considering the large amount of resurfacing work to be done, the unsatisfactory, and but too often unsafe, condition of our highway bridges, the constantly increasing traffic, the upward tendency of prices and the urgent and growing demand for roads, this figure is none too high.

With a task of such magnitude, and of now universally recognized necessity, it is the manifest duty of the State to provide conditions under which the work can be done with efficiency and despatch—for delay means loss.

Our present road-building policy was not designed to meet the needs of to-day, but for entirely different conditions. The road work in this State is now being mainly done under the statute generally known as the State Aid Act (Chapter 395, P. L. 1912) and under Chapter 380 of the same year. Both acts have been extended and amended in subsequent years. The State Aid Act of 1912 was never intended to do more than to bring together the various amendments and supplements to the Road Act of 1905, and to consolidate therewith certain other acts relating to the same subject. The general policy of the Act of 1905 and the machinery provided therein were continued. The act itself, without amendments or additions, is composed of thirty-two sections, and covers almost twenty pages of pamphlet laws. Of this matter about two sections, covering about one page, refers to repairs, yet to-day the repair work consumes twice as much of State funds as does the construction, and the proportion of county funds expended thereon is probably even greater. It is evident that as both mileage and traffic show further increases, the cost of repairs, and the ratio of this cost to the total road expense, must continue to increase.

The Act of 1905 largely followed the policy laid down in the original State Aid Act of 1891. This act was designed to meet conditions prevailing when the population of the State was approximately one-half of what it is to-day, and for an ante-automobile age. The problem was then largely one of getting farm produce economically to its markets. The principle adopted was to extend help to communities in the improvement, and later in the maintenance, of their roads. The control of the State ends with the job for which State aid is given.

An attempt was made in 1912 to relieve the conditions, which even at that date were ominous, by the so-called State Highway Act (Chapter 396, P. L. 1912). This act is open to several

objections, but has practically been a dead letter in the absence of the large fund on which its provisions were predicated.

Any attempt, without increased appropriations, to take over the system of State highways would involve a total suspension of all other State participation in road work. It was felt that the consequent dislocation would inflict serious injury on our roads and inconvenience to the public that would not be counterbalanced by any advantages to be derived from an undertaking inadequately financed.

Our present legislation contains many inconsistencies and much that embarrasses the work of the Department and of the counties. For example, the State Aid Act, as interpreted to make it consistent with the Requisition Act, provides that no allotment can be made to a county from the motor vehicle fund until the money has been actually collected. It directs that motor vehicle moneys be spent on the repair of the most important improved roads. It also provides that help can be given for the resurfacing and extraordinary repair of roads, which to-day is our most important work, only by setting aside by allotment the State's share of the cost of this work at the time the plans and specifications therefor are approved. This work should all be arranged for in the early months of the year, so that it can be begun towards the end of March or the beginning of April. There is, however, at that time of year, but little money available in the motor vehicle fund, and allotments cannot be made in sufficient amounts to provide for more than a fraction of the work until towards the end of spring. After the approval of specifications, it is necessary to advertise for three weeks, so that this, our most important work, cannot be begun until the season of the heaviest traffic, to the great inconvenience of the public and at considerable increase in expense. As a result, this work is largely done without State aid. Resurfacing is confined to our most important improved roads. These are the ones on which law directs that the motor vehicle fund be spent, yet, under the restrictions above named, this cannot be done.

The subdivision of the road moneys into various funds creates

inequities and difficulties in administration that have resulted in delay, loss and much disappointment. The administrative work and control even over engineering detail rests with the local governing bodies, excepting as they may be limited therein on that part of their work done with State aid. There is thus imposed upon them duties and responsibilities that they cannot be expected to satisfactorily discharge, the work being largely of a technical character and requiring a fixity of administrative policy. It is extremely hard for an elective board whose personnel is changing to maintain any fixed line of policy, and this difficulty is increased when it is considered that its road employees must likewise hold office for limited terms. It is inevitable that men who have to stand for re-election should be influenced, at times unconsciously, by what they may deem politically advantageous instead of by the best interests of the roads. It is also inevitable that officials whose reappointment will depend on the election of their friends should find it hard to keep their work out of politics.

These considerations are not urged to disparage in any way either the members of the governing bodies of the counties and municipalities or their engineers and supervisors of roads. The fault lies not with the men to whose general zeal and earnestness I gladly bear witness, but with the system. Our government is based on making public office a public trust. We have created conditions in our road work which make the efficient discharge of this trust difficult, if not impossible. Lack of efficiency cannot fail to be enormously wasteful, and may prove ruinous.

The Department has failed in its attempts to impress the very serious aspects of the road question on the Legislature and on the people. It cannot but feel that were this importance realized, remedial legislation would be at once enacted. For some years the Department has requested amendments of the law looking to the more or less partial remedy of the defects hereinbefore mentioned. The last Legislature appointed a Commission to thoroughly revise not only the legislation, but the road policy of which the statute is the expression. This work

of revision is of the greatest importance. It should be based on careful study and extended examination of road needs and of the laws affecting them. Such study and examination necessarily involve time and expense. Requests for appropriations or for authority to use the general road appropriation for this purpose have not met with favor in the past. The Department, however, has felt that the need was so urgent that it has undertaken the preparatory work as best it could. The legal assistance, which is absolutely necessary for the drafting of a satisfactory act of so wide a scope, could not be required by the Department of the Attorney-General's office. One of the Attorney-General's assistants has, however, volunteered his very helpful services. On account of the pressure of business in that department, this work has been done outside of office hours. It is not yet completed. When finished, it will be presented to the Commission appointed by the last Legislature for such action as it may deem fit.

Remedial legislation must be based on a realization that our public roads constitute a transportation system of vital business importance to the State, demanding, in addition to a very considerable past investment, much greater expenditures in the future, not only for construction, but also for maintenance. Their importance is such that we cannot do without them. Their administration has become a business, and we must handle it in a businesslike way. For this purpose we must put on the job a body of experts, give them the powers needed to get results and judge them thereby. We cannot afford any amateur trifling in our engineering, nor any political interference in, the administration of our roads. No legislation will satisfactorily solve our difficulties which ignores these principles.

Detail provisions are not of much individual importance. There are, however, two matters that I believe must find a place in our new road policy. Our first undertaking should be to definitely state our problem in figures. This will require a survey of the roads of the State and a thorough and uniform system of accounting to show not only the moneys expended, but also the service rendered therefor. The making and plot-

ting of such a survey and the inauguration of such a system of accounting with its accompanying audit will be a matter of time and expense. It would seem, however, that, even if my above estimate is twice what it should be, thorough preparation will be the best economy we can practice. Based on the proposed survey, we shall have to provide for different classes of roads. I believe that a division of the care and expense between the State, the counties and the municipalities will be found necessary. We must determine what roads each of these agencies will eventually take over, how they shall be improved, what will be the probable cost, how it will be divided and how it will be raised, and the time it will take to complete our road system.

Secondly, and to my mind most important of all, is the creation of a proper road force. Our present system of choosing county engineers and supervisors of roads for a limited term and our failure to provide coöperation are inconsistent with efficiency. We must have a force that, by its trained ability and thorough teamwork, will command the confidence of the public. Such a force cannot exist without permanent tenure of office. I doubt whether there can be found to-day in the State enough trained men available to supply the engineers, foremen and inspectors needed for a State-wide supervision of our roads. The present State and county organizations, however, will supply a nucleus around which the force needed can be built up.

In closing, I would impress the necessity of more adequate and more systematic financial provision. I cannot, however, recommend any large increases in our program of construction until the State has provided for such a road force as I have above outlined. I do, however, feel that the immediate needs for repair work are such that some increased provision therefor should be provided as soon as possible.

# State Highway Engineer's Report.

*Hon. E. A. Stevens, Commissioner of Public Roads, Trenton, New Jersey:*

DEAR SIR—The road work of the State during the past year has been largely one of repaving and realigning roads formerly macadamized. The excessive wear caused by the constantly increasing motor traffic has compelled the several counties to use a pavement of higher resistance to disintegration than macadam. The old pavement has been used as a base in the great majority of cases, and for this reason it is still used in the improvement of roads where the traffic is not heavy, with the idea that when this increases beyond the point of economical maintenance the old pavement will serve as a good base for the more costly and stronger surfacing.

Some idea of the extent to which this rebuilding and resurfacing of roads has been carried, as well as of the amount of repair work deemed necessary, may be had when we find that one county has spent over $1,400,000 in repaving, repairing, straightening of alignment, surface treating and draining of roads already built. In still another county the amount of this expenditure has been over $400,000.00, and in a third more than $200,000.00.

The frequency of automobile accidents at sharp turns has taught the several counties that the requirements of this Department, namely, that all sharp angles in the road should be eliminated and replaced with curves of long radius, and that where this is impossible the roadway at these points should be increased at least fifty per cent. in width, was reasonable.

Another fact which has been strongly impressed upon us is that the pavement on the main thoroughfares should be at least eighteen feet in width, in order that the edges of the pavement might not be worn or crushed away, and also to insure the traveling public against collisions which have frequently been caused by two vehicles attempting to pass one another on a narrow pavement without getting off of it. The several counties, through their Boards of Chosen Freeholders, seem to have appreciated these facts more fully than the State, as is evinced by the fact that they have proceeded to expend large sums of money without waiting for any assistance from the State.

Another point which is constantly brought to our attention by the many accidents, though fortunately none of them serious, is that many of our bridges are entirely too light and to narrow to accommodate the largely increased traffic over them.

The experience of the past few years with different types of pavement has practically established their relative value, and I should therefore most strongly recommend that in the future the State Road Department should

not expend any money for the construction of pavements that have not been in actual use upon our highways, or those of neighboring States, for a period of two or more years.

The reduction of grades in various sections of the State has served to reduce the cost of maintenance, and has also promoted the safety of the traveling public.

The necessity of constructing pavements of much greater first cost than those generally employed five years ago, and for the elimination of grade crossings over the railroads on our main thoroughfares, calls loudly for a larger appropriation from the State funds.

The work in the several convict camps throughout the State has progressed far more satisfactorily during the past year than at any time since this system was adopted. The quality and quantity of work done is greater in proportion to the money spent than ever before, and the experience gained during the past year will enable us to produce much more satisfactory results in the future.

I am submitting herewith the reports of the Division Engineers and of the Chemist to the Department of Conservation and Development.

Respectfully yours,

R. A. MEEKER,

*Engineer.*

# Report from Northern Division.

*Mr. R. A. Meeker, State Highway Engineer, Trenton, New Jersey:*

DEAR SIR—Unusual activities in road building, or rather reconstruction, have been the rule all over Northern New Jersey during 1915. Bergen county alone entered into contracts amounting to over one million dollars. Only a small part of this work was covered by State aid.

The Fort Lee turnpike is being constructed of stone block on concrete foundation. The cuts on this job, and in fact the cuts on all of the jobs along the Palisades, are in trap rock, which speaks for itself in the matter of cost.

Two or three other good jobs have been constructed of bituminous concrete, laid cold, but the greater part of the work in Bergen county was hot mix, or what is commonly known as "Topeka." The County Supervisor of Roads has coöperated very efficiently with the borough and township officials in the repair of roads in several sections of Bergen.

Essex, one of the richest counties in the State, has a good road building organization, and during 1915 has preferred to do its new construction without State aid. Maintenance of the Essex county roads has been attended to by a squad of some fifty or sixty men, working alone, and forming the "patrol system." To this work the State has contributed motor vehicle money. These patrolled roads are noticeable because the shoulders and gutters are always kept clean.

Delays have been experienced in the reconstruction of the Newark turnpike, in Hudson county, which was confidently expected would go forward during 1915. In consequence of legal complications, the contracts were not approved for this road. Considerable progress, however, has been made in moving the street railroad off the right of way and arranging with the railroad company for the elimination of the grade crossing. Contracts were let at the close of the season for repairing the Paterson Plank road with stone block and Passaic avenue with asphalt concrete. The Hudson County boulevard and the other county roads have been maintained in good condition.

The main traveled road east and west through Morris county extends through Morristown, Denville, Rockaway and Dover, and carries much of the traffic to Lake Hopatcong and the Water Gap. The Board of Freeholders received so many complaints about the condition of the road that it finally decided to have the pavements reconstructed and the line and grade improved, even at the risk of being criticised for the expenditure necessary. The result is that this entire stretch is now a road upon which the safety, as well as the comfort, of the traveling public has been greatly enhanced. The other road carrying the Hopatcong and Water Gap traffic

extends from Pine Brook through Parsippany over Fox Hill to Denville. The asphalt concrete on this road has been patched except for about a mile on the eastern end, where the road is extremly narrow, and is crossed by three or four streams over which the county is rebuilding the bridges. The most important is that over the Passaic river at the Essex county line, where a large concrete structure is being erected jointly by Essex and Morris counties. Next year these bridges will be completed, and it is to be hoped that the road will be widened and improved to accord with the bridges.

Good reconstruction work is also being done in several other parts of the county. Owing to the large mileage of Morris roads, and the sums spent on the main lines, very little money has been available for more than the necessary patching and maintenance in other sections.

In Passaic county two sections of the Paterson-Hamburg turnpike are under reconstruction with asphaltic concrete and Portland cement concrete, stone blocks being used on one or two steep hills. The section of the Midvale–Greenwood Lake road lying near the great powder works at Haskell has been resurfaced entirely at the county's expense, as have also several small stretches near Paterson and Passaic. General maintenance throughout the county has been carefully attended to, but many of the back roads are badly in need of widening and straightening. This criticism applies to most of the sections of the State where roads extend through hilly country.

Between Newton and Branchville, in Sussex county, a stretch of eight miles of macadam road is now open to traffic, and is all that could be desired for line, grade and surface, but cannot be expected to maintain a smooth surface if the motor vehicle traffic continues to increase as it has been doing recently. The road from Stanhope to Newton has been put in good condition with the assistance of the State convicts. State Road Camp No. 1 has been moved to Layton, where the construction of an entirely new line from Layton to Dingman's, a distance of two and three-quarter miles, has been begun. The work here contemplated is very heavy, reducing the grades from twenty per cent. to six and one-half per cent. In one section the road runs through a valley, where it is necessary to carry the brook under the roadway in a reinforced concrete sluiceway for a distance of fourteen hundred feet. Judging from the funds available for this purpose, the road will probably not be open for traffic until 1917 or 1918. This connection with the Pennsylvania road system is a link that has long been desired, but owing to its excessive cost its construction could not be financed locally.

The asphalt concrete and Portland cement concrete pavements laid on Wood avenue, extending easterly from St. George's avenue, or "Lincoln Highway," through the borough of Linden, intersecting the Edgar road, have given the people of Linden and the large manufacturing interests to the east their long sought connection with the Union county road system. The road from Springfield to Summit is also greatly improved, and the widening of the pavements on St. George's avenue, from Elizabeth to Rahway, and of Morris avenue, from Hobart Gap to the Passaic river, has

commenced. The maintenance of Union county roads usually includes pretty careful shoulder and gutter work. A few wheelbarrow patrolmen have been put to work with good results.

Two more important links in Warren county's road circuit have been carefully laid out as to line and grade, and are now nearing completion. The road from Bloomsbury to Still Valley will soon be opened, and the six-mile stretch between Buttzville and Great Meadows (formerly called Danville) should be completed by the middle of next summer. The principal item of expense on both of these roads has been grading. Several concrete bridges were also required. The main traveled roads of Warren have been maintained as usual, but, of course, with ever-growing expenditures, due to increase of both mileage and traffic.

The year 1915 has proven to be an unusually active one in all of the North Jersey counties, and the many accidents to automobiles on sharp turns has awakened these counties to a realization of the necessity for improved alignment, and they are actively seconding the State Road Department in its efforts to remove these menaces to travel. The demand for future work comes from all sections and all classes of people. The only question seems to be one of finance.

Respectfully yours,

E. M. VAIL,

*Division Engineer, Northern Division.*

# Report from Central Division.

*Mr. R. A. Meeker, State Highway Engineer, Trenton, New Jersey:*

DEAR SIR—The following is a brief report of road work accomplished in the Central Division during the fiscal year 1915:

In Hunterdon county the Flemington–Frenchtown road has been completed. This is a road leading from the eastern part of the county westerly to the Delaware river, and is a very important highway, not only to the county, but to this section of the State. The county has completed the repair of the Whitehouse–Lebanon road, and has widened it so that this road, which has been in miserable condition for so many years, is now a nice, wide, pleasant riding highway. The condition of the roads in Hunterdon county is very good indeed, and, in view of the good work done in this county, I think they should be given encouragement by the State.

It is the habit of the County Supervisor of Roads to deposit stone along the highway during the fall of the year, so that if the roads become softened during the winter or spring he has the necessary stone on hand with which to make the repairs at the proper time, and is not held up on account of not being able to get stone from the quarries during the winter and early spring, while the quarries are closed down.

In Mercer county the only new construction completed during the year is the Windsor–Newtown–Yardville road. This is an important highway to the State in general. It reduces the distance between Hightstown and Yardville, over improved roads, by about seven miles. The continuation of this road through Burlington county to Bordentown should be finished; then this would be used a great deal by the traffic between New York and Philadelphia. It will also lessen the wear of the Windsor–Mercerville–Trenton road. The county has finished the resurfacing of the White Horse pike with bituminous concrete, one course "Topeka." The Brunswick pike, from the Trenton city line to Clarksville, is being resurfaced with bituminous concrete, two-course "Topeka," and is almost completed at the time of writing. Both of these pavements are guaranteed for a period of five years. On the Brunswick pike the work on the foundation and shoulders is being done by the county. The contractor does not have anything to do with this part of the work. Judging from conditions on this road, it would seem to me that it would be much better to have all of this work included in one contract so that the contractor will be responsible for the whole work.

Middlesex county has been doing some much needed resurfacing work, having improved the following roads, without any aid from the State, with Warrenite pavement and macadam shoulders: Highland Park–Metuchen road, 4.165 miles long; New Brunswick–Old Bridge turnpike, from Drury's

Hill to Commercial avenue, 4.087 miles long; St. George's avenue, from the Union county line to Perth Amboy city line, 3.828 miles long; Metuchen–Perth Amboy road, an amiesite road, 3.210 miles long; South Amboy–Keyport road, Section 1, vitrified brick on a concrete base, 1.474 miles long; South Amboy–Keyport road, Sections 2 and 3, Warrenite, 2 miles long; Rahway avenue, Roosevelt, amiesite, .786 mile long; New Brunswick avenue, from city line of Perth Amboy to Mitchell place, amiesite, 3 miles long. It is expected that work on all of these roads will be finished before January 1, 1916. The Highland Park–Metuchen road is the only one on which the State has given any money, the motor vehicle allotment being used for the repair of other roads in the county. The cost of this work is approximately $434,000.00.

The nation's summer capital in 1916 will be Long Branch, and the roads leading thereto should be put in first-class condition. The worst section between Long Branch and New York is through South Amboy. The private road opened by the Pennsylvania Railroad, which avoids the "hole-in-the-wall," is in deplorable condition, and the "hole-in-the-wall" is a menace to the safety of the traveling public. The streets through South Amboy are sadly in need of improvement. With these streets improved, the road to Long Branch will be in first-class condition.

The only new construction in Monmouth county completed during the past year was the Allentown–New Canton road, a short piece leading toward Hightstown. The roads in Monmouth county have been in very good condition for the past year.

In Ocean county the bridge from Island Heights to Seaside Heights on Island Beach has been completed and opened. This bridge was erected by private capital, and is a toll bridge, but it is a very great convenience to people coming from Philadelphia and the western part of the State and going to Seaside Park. It makes it unnecessary to go from Toms River to Lakewood, Point Pleasant, Bay Head and southerly along the beach to Seaside Park. The road from Lakewood to Burrsville and Point Pleasant is in poor condition, and should be resurfaced.

In Somerset county work has been started on the Greater Cross Roads road, section two. The continuation of this road in Hunterdon county will no doubt be advertised as soon as the Somerset county end is completed, and this will shorten the distance, over improved roads, between Bernardsville and Whitehouse, and points westerly, by approximately eight miles.

## CONVICT LABOR.

The following is a report of the work done by convict labor at Camps No. 2 and No. 4.

### Camp No. 2.

Convict labor on Princeton-Bolmer's Corner road. Value of road work done, at prevailing contract prices for similar work, from November 2, 1914, to October 30, 1915:

| | | |
|---|---|---|
| 6,521 | cubic yards excavation, rock, at $2.50, | $16,302 50 |
| 6,904 | cubic yards excavation, shale and clay, at $0.70, | 4,832 80 |
| 18,461 | square yards foundation, coarse macadam, 4-inch compacted, at $0.46, | 8,492 06 |
| 9,872 | square yards surface, coarse macadam, 4-inch compacted, at $0.50, | 4,936 00 |
| 18 | cubic yards dry wall, at $3.00, | 54 00 |
| 3½ | acres grubbing, heavy work, at $250.00, | 875 00 |
| 162 | cubic yards concrete, at $8.00, | 1,296 00 |
| 16 | cubic yards reinforced concrete, at $10.00, | 160 00 |
| 205 | square yards stone gutter (grouted), at $1.59, | 325 95 |
| 192 | lineal feet 18-inch iron pipe placed, at $2.15, | 412 80 |
| 156 | lineal feet 12-inch iron pipe placed, at $1.75, | 273 00 |
| 85 | cubic yards ditching for pipes, at $0.65, | 55 25 |
| 100 | lineal feet cleaning ditch, at $0.05, | 5 00 |
| 75 | cubic yards excavation for channel for bridge, rock, at $2.50, | 187 50 |
| 220 | cubic yards excavation for channel for bridge, dirt, at $0.70, | 154 00 |
| 350 | tons crushed stone delivered, not counted in foundation or surface, at $1.50, | 525 00 |
| 700 | tons crushed stone, and unused, at $0.80, | 560 00 |
| 825 | lineal feet tile, at $0.35, | 288 75 |
| 1,321 | cubic yards excavation on Blawenburg-Bolmer's Cor. road, at $0.70, | 924 70 |
| | Value of road materials purchased and unused to date, culvert forms, cement, tile, coal, dynamite, iron pipe, terra-cotta pipe, sand, lumber and oils, | 700 00 |
| | Value of work done and materials on hand, | $41,360 31 |
| | Operating expense, | 38,840 57 |

There are about 37,000 cubic yards of excavation on this road. This does not include any extra excavation. So far, we have accounted 31,425 cubic yards, leaving a balance of 5,575 cubic yards. The rough grading is all done, so that the balance will be made up in subgrading and cleaning up.

### Camp No. 4.

CONVICT LABOR ON WOODBRIDGE AVENUE, SECTION THREE.
(Woodbridge–Reformatory Road.)

| | | |
|---|---|---|
| 8,895 | cubic yards excavation, at $0.70, | $6,226 50 |
| 12,400 | square yards macadam foundation, at $0.45, | 5,580 00 |
| 400 | ineal feet under drains, French, $0.50, | 200 00 |
| 16 | lineal feet cross drains, T. C., 12-inch, at $1.00, | 16 00 |
| | | $12,022 50 |
| | Value of road materials on hand, | 293 50 |
| | Value of road work done at prevailing contract prices for similar work, | $12,316 00 |
| | Operating expense, | 7,409 74 |

The work on Woodbridge avenue, Section Three, is being done by young men from the Rahway Reformatory. The board of managers of that institution pays the men fifty cents per day for working on the road, and I believe it makes quite a difference in the amount of work done by the men.

If the same arrangement were made at Camp No. 2, I believe that it would be a great incentive to the men and would require less constant effort in the matter of supervision to secure better results and accomplish a greater amount of work.

Respectfully submitted,

EDWARD E. REED,
*Division Engineer.*

# Report from Southern Division.

*Mr. R. A. Meeker, State Highway Engineer, Trenton, New Jersey:*

DEAR SIR—During the fiscal year just passed, new road work has been under way in six of the seven counties in the Southern Division. State-aid work, involving considerably more than one-third of the annual appropriation, has been carried on in Atlantic, Burlington, Camden and Cumberland counties.

Cape May has completed a large portion of its road system without State aid.

The Salem county section of the convict road between Elmer and Malaga is nearing completion, and the Gloucester county section is about to be started. No new work has been done by Gloucester county, all its available resources having been applied to the repair of the existing roads and the construction of bridges.

In Atlantic county the Oyster Creek road has been finished, the completion of the Somers Point–Mays Landing road and the Wheat road, from Hammonton to the county line south of Buena, is near at hand, and the grade for the new boulevard from Somers Point to Longport is about done.

In Burlington county the Chester township section of the Hartford–Fairview road is finished, the township having contributed sixty per cent. of the cost of construction.

In Camden county the gap in the road between Berlin and Clementon has been closed by the construction of the Sharps Corner road. The King's Highway through the borough of Haddonfield has been paved with brick and amiesite on a concrete base, and the road leading from Haddonfield to Cresson has been started.

In Cumberland county the three sections of Landis avenue, from Bridgeton through Vineland, are nearly done, and the road from Millville down the east side of Maurice river is about half finished.

The Salem county authorities have co-operated in a highly commendable manner with the officials of this Department in the construction of the convict road.

In regard to general methods and conditions in the various counties, little need be said. None of the counties of this division as yet seem to be ready for a patrol system. The gravel roads need constant attention, and on most of the roads of this type the needed care is given; that is, they are scraped and shaped up after each rain and new gravel is added when necessary, but in the care of macadam roads there is a tendency to let them go without repairs until radical treatment is necessary. In the absence of a patrol system on these roads, a yearly application of three-quarter inch stone and screenings, and some bituminous binder, is an effective remedy

against raveling. In selecting the asphalt or tar to be used on such repairs, it must be borne in mind that it is a binder, and not a lubricant, that the road needs.

Asphalt concrete pavements, on the whole, in this division have not been a success, but their failure has for the most part been a matter of faulty design and poor workmanship rather than any inherent defect in the type of material. However, lessons are being learned from the failures, and it is to be hoped that in the near future the feature of endurance will be as necessary in a road as it now is in a public building.

Camp No. 3 was established December 4, 1914, to build the Elmer–Malaga road, which is one section of the road from Pennsgrove and Wilmington to Atlantic City. The winter was spent in temporary quarters in an old shoe factory at Elmer, and, while there, sections were built for a set of portable buildings which were erected in March on a site along the line of the road. The buildings consist of a bunk-house, garage, open sheds and a pump-house. The bunk-house is 24′ x 128′, and contains an office, officers' quarters, bunk-room, dining-room and kitchen, with an annex 16′ x 16′, divided into a toilet and bath and a storeroom. This building is capable of housing sixty men and the officers comfortably. The garage is 10′ x 24′, and is used to house the truck, the upper part being available for miscellaneous storage. The sheds, 16′ x 64′, will shelter all the road machinery and supplies. The pump-house, 10′ x 16′, is set over a dug well which furnishes ample water for the camp.

All of the buildings are sectional, and are bolted together; they are capable of indefinite extension by moving out the ends and filling in additional side sections, and they can be moved to any other location with little work and no waste. Another general utility building has recently been constructed to be used on work remote from the home camp. It embodies all the necessary features for feeding and housing twelve men and all the officers.

Following is an itemized statement of the cost of the convict labor road from December 4, 1914, to October 31, 1915:

| | |
|---|---|
| 25,000 cubic yards excavation, at $0.36, | $9,000 00 |
| 3,300 cubic yards compacted gravel, at $0.67⅓, | 2,222 00 |
| Grubbing, | 1,490 38 |
| Nine vitrified culverts, | 222 45 |
| Buildings, | 2,571 59 |
| Equipment exclusive of buildings, | 4,223 97 |
| Total expenditures, | $19,730 39 |
| Credit buildings and equipment on hand, | 6,795 56 |
| Cost of road to date, | $12,934 83 |

All of the labor, including carpenter work, on the buildings has been done by convicts. Local teams have been employed for the hauling.

An analysis of the cost of operating this camp will show that success can be obtained by keeping a minimum amount of machinery on the work, and relying, as far as possible, on men and teams. A light automobile, of the

Ford type, with a delivery body, is needed, but aside from this a reduction rather than an increase of plant is recommended.

Your subordinates in the Southern Division have, with slight exception, served efficiently and commendably. The rate of pay for several has been increased, as was deserved, but unfortunately it has been impossible so to reward several of the best men. The law regulating the pay of inspectors might well be amended to include those on the regular list, and some of the men on the preferred list would be recommended for the higher rate if it were available for them.

Very respectfully submitted,

ROY MULLINS,

*Division Engineer, Southern Division.*

# Report on State-Aid Bridges, 1915.

*Mr. R. A. Meeker, State Highway Engineer, Trenton, New Jersey:*

DEAR SIR—A serious defect in the water-carrying capacity and design of the older highway bridges has been called to the attention of the traveling public during the past year by the numerous floods resulting from heavy rainfall.

In many cases small steel bridges have been erected on high abutments, with steep approach grades, for the purpose of allowing the stream, at times of flood, to flow over the low portions of the road. This temporarily suspends traffic and makes the bridge useless. These bridges have been built, as it were, on a hill, in order to economize in bridge length, and were designed only to span the stream at ordinary flow.

The raising of these road approaches to the grade of the bridge would aggravate flood conditions. It is, therefore, usually necessary to erect one or more additional spans in order to adequately provide for the area of waterway required during flood seasons.

Second only in importance to the design of the bridge structure is the proper protection of the traveling public against accident from the steep slopes on the graded approaches to a bridge. The approaches to the bridge are often left without the necessary protection of guard railing, leaving the bridge portion protected only by the parapet wall or railing, while the more dangerous unprotected approaches invite accident. Only the most substantial guard railing, of heavy concrete or iron, can adequately protect travel from this danger.

The most satisfactory method of providing this protection is to omit the bridge railing from the wing walls and extend the guard railing up to the main bridge structure, thus giving both the parapet walls, or sides of the bridge, the same alignment as the guards of the road.

On small culverts a common method of construction has been to build small head walls, often only four or five feet in length, depending on the culvert span, to a height of three feet, for protection. These stand out like so many tombstones along the right of way, and particularly where the clear width is less than thirty feet, they become dangerous obstructions.

A better method would be to omit the head walls entirely and to substitute in their places sections of the road guard-rail, properly fastened to the culvert structure, and carried on either side for a sufficient distance to eliminate any danger.

A recent opinion from the Attorney-General's office states that anything such as trees, fences or parts of bridges, within the graded width of the road, is an obstruction which must be removed before the work can be accepted by the State. In compliance with your order and this opinion, all

future bridges will be designed with a minimum clear width of thirty feet.

During the past year the force of temporary inspectors on bridge work has been replaced by experienced men, appointed in accordance with the Civil Service Law. This class of inspectors will greatly increase the efficiency of the work.

The practice of designing highway bridges for light moving loads need be mentioned only to be condemned. Too great attention cannot be paid to the proper design of bridge construction to carry the ever-increasing moving loads. New Jersey occupies a geographical position which has made it a great highway of travel between two of the largest American cities. Such lines of traffic will surely be of great importance in case of military operations. It is not altogether visionary to consider whether our bridge construction should not be sufficient to provide adequate transportation for military purposes. As a chain is no stronger than its weakest link, a military road would be limited in usefulness by its weakest bridge.

The following tables show the bridges accepted by the State during the present year and also the amount of work under construction at the present time.

Respectfully submitted,

L. McENTIRE,

*Division Engineer in Charge of Bridges.*

| State Aid Bridges. | Completed Bridges, 1912–1913. | Completed Bridges, 1913–1914. | Completed Bridges, 1914–1915. | Bridges Under Construction. | Proposed Bridges. | Total. |
|---|---|---|---|---|---|---|
| Atlantic, | ..... | ..... | 4 | 14 | 10 | 28 |
| Burlington, | 1 | ..... | ..... | ..... | ..... | 1 |
| Camden, | ..... | ..... | 2 | ..... | ..... | 2 |
| Cape May, | ..... | ..... | 1 | ..... | 3 | 4 |
| Cumberland, | 4 | ..... | ..... | ..... | ..... | 4 |
| Hunterdon, | ..... | 1 | ..... | ..... | ..... | 1 |
| Mercer, | ..... | ..... | ..... | 4 | ..... | 4 |
| Middlesex, | 1 | 1 | ..... | 1 | 1 | 4 |
| Monmouth, | 1 | ..... | ..... | ..... | 1 | 2 |
| Ocean, | ..... | 1 | ..... | ..... | ..... | 1 |
| Somerset, | ..... | 1 | 1 | 4 | 4 | 10 |
| Sussex, | ..... | ..... | ..... | ..... | 1 | 1 |
| Union, | 3 | ..... | ..... | 1 | ..... | 4 |
| Warren, | ..... | 5 | ..... | 5 | 3 | 13 |
| Total, | 10 | 9 | 8 | 29 | 23 | 79 |

COMPLETED BRIDGES—STATE'S PAYMENT MADE NOVEMBER 1, 1914, TO OCTOBER 31, 1915.

| County. | Bridge. | Road. | Type. | Total Cost. | Cost Allowed by State. | State's Share. |
|---|---|---|---|---|---|---|
| Atlantic, ..... | Gravelly Run, ..... | Somers Point and Mays Landing, .. | Concrete Slab, .. | $3,455 85 | $3,455 85 | $691 17 |
| Atlantic, ..... | Miry Run, ..... | Somers Point and Mays Landing, .. | Concrete Slab, .. | 3,664 95 | 3,664 95 | 732 99 |
| Atlantic, ..... | Perch Cove, ..... | Somers Point and Mays Landing, .. | Concrete Slab, .. | 2,749 80 | 2,749 80 | 549 96 |
| Atlantic, ..... | Powell's Creek, ..... | Somers Point and Mays Landing, .. | Concrete Slab, .. | 1,318 80 | 1,318 80 | 263 76 |
| Camden, ..... | North Branch, Newton Creek, | Camden and Blackwood, ..... | Concrete Slab, .. | 5,516 08 | 4,785 00 | 957 00 |
| Camden, ..... | Main Branch, Newton Creek, | Camden and Blackwood, ..... | Concrete Slab, .. | 6,329 22 | 5,692 00 | 1,138 40 |
| Cape May, ..... | Ocean City, ..... | Ocean City, ..... | Steel Draw, ..... | 26,871 66 | 26,871 66 | 5,374 33 |
| Somerset, ..... | Finderne, ..... | Blackwells Mills and Millstone, third section, ..... | Concrete Arch, six spans, ..... | 17,856 00 | 17,856 00 | 3,571 20 |

## BRIDGES UNDER CONSTRUCTION AND CONTRACT PRICES.

| *County.* | *Bridge.* | *Contract Price.* |
|---|---|---|
| Atlantic, | Lakes creek, | $4,458 00 |
| " | English creek, | 5,334 00 |
| " | Patcong creek, | 37,570 00 |
| " | Northfield road (English creek), | 2,000 00 |
| " | Risleys channel, No. 10, | 73,243 00 |
| " | Hospitality creek, No. 9, | 22,900 00 |
| " | Broad thorofare, No. 5, | 77,932 00 |
| " | Bass harbor, No. 1, | 16,906 00 |
| " | Bridges No. 2, No. 3, No. 4, No. 6, No. 7 and No. 8, Longport road, | 27,000 00 |
| " | Culverts, Longport road, | 12,000 00 |
| Mercer, | Miry run Sta. 117+43, Assunpink creek Sta. 17+85, | 1,745 00 |
| " | Bridge Sta. 223+51, Bridge Sta. 278+78, | 2,641 30 |
| Middlesex, | Devil's run, | 1,400 00 |
| Somerset, | Dunhams bridge, | 1,680 00 |
| " | Extension to arch at Sta. 131, | 1,530 00 |
| " | Bridge east of Wormans, bridge west of Wormans, | 2,300 00 |
| Union, | West Brook bridge, | 1,900 00 |
| Warren, | Bridge No. 1, Bloomsbury, Still Valley road and culverts, | 595 80 |
| " | Bridge No. 2, Bloomsbury, Still Valley road, | 8,300 00 |
| " | Bridge No. 1, Buttzville, Danville road, | 1,300 00 |
| " | Bridge No. 2, Buttzville, Danville road, | 850 00 |
| " | Bridge No. 3, Buttzville, Danville road, | 850 00 |
| | Total, | $304,435 10 |

# Laboratory and Experimental Work.

*Mr. R. A. Meeker, State Highway Engineer, Trenton, New Jersey:*

DEAR SIR—The requirements governing the quantity and quality of the various materials used in the different types of road pavements constructed during 1915 are about the same as those of the previous season. The specifications require that all materials used must meet certain standards and be tested and approved before using. In addition, certain types of pavements, even when constructed of materials previously approved, must be sampled daily during construction, and these samples immediately analyzed in order to insure that the pavement has the required composition and density.

The quantity of chemical work now required to be done is at least double what is was two years ago. As in previous years, this work has all been performed under my supervision in the laboratory now maintained by the Department of Conservation and Development, Division of Geology. It is impossible to test all the materials now used in road construction because the quarters now occupied as a laboratory are so inadequate that the necessary apparatus cannot be installed. Among such materials are cement, concrete, brick, stone blocks, corrugated culverts, paints, etc. However, it is expected that a new laboratory building will be erected during the coming year upon a site already purchased. When this building, for which plans have already been drawn and approved, is built and the necessary apparatus has been installed therein, we will be prepared to test all materials now being used in road construction.

During the last five years various types of experimental pavements have been constructed. The first trials were on sections of limited extent. If successful, the experiment was repeated on a section a mile or more in length. When the larger experiment demonstrated that a certain type or grade of pavement possessed merit, it was accurately defined and incorporated in the standard specifications of the Department. Grades "$T_1$" and "$T_2$" of the bituminous concretes, as defined in the 1915 specifications, were thus secured. In the smaller sections certain types and grades of pavements were found to be unsuitable or too expensive for our purposes, and were discarded.

It has been demonstrated that, while certain types of pavements can be successfully constructed as an experiment, or by a careful, experienced contractor, yet in the hands of the average contractor they are failures. Such pavements can hardly be recommended for general use. Our experience has shown that the fewer the uncertain factors in a pavement—or, in other words, the more "fool-proof" it is—the fewer the failures due to improper construction.

Most of the pavements now specified in the State specifications, which a

few years ago were considered to be in an experimental state, have now been in use for a sufficient length of time to enable us to judge their efficiency and durability when constructed in different ways and subjected to different conditions of climate and travel. The premature failures which have occurred during this time, particularly in the bituminous concrete pavements, have been mostly local and limited in extent, yet they have shown quite plainly what the elements of danger are from which the pavements must be protected during construction and subsequent use.

The following facts seem definitely established:

1. Any bituminous concrete pavement of either the hot or cold-mixed grade, when properly constructed and laid on a suitable and well-drained base, will last at least five years, with very little repair, and from ten to fifteen years longer if properly repaired and maintained.

2. These pavements cannot be properly constructed by novices or even by experienced contractors unless they have the proper equipment and the necessary financial resources.

3. That it is false economy to award contracts to contractors who have not had the necessary experience or have not the required equipment or financial resources.

4. That hot-mixed bituminous concrete pavements are more difficult to construct than those of the cold-mixed method.

5. That the life of any bituminous concrete pavement is limited unless properly constructed.

6. That hot-mixed bituminous concrete pavements cannot be repaired as cheaply or conveniently as those of the cold-mixed method.

7. When properly constructed, a hot-mixed bituminous concrete pavement will, on the average, require less repairing during the first five years of its life than will a cold-mixed pavement.

8. That a comparatively soft bituminous pavement, having a low tensile strength, is superior to a brittle one with a high tensile strength.

9. That over ninety per cent. of the early failures in bituminous pavements have been caused by faulty construction, unstable or improperly drained bases, and not by the use of inferior materials.

10. That a well-drained, old macadam road, if scarified and redressed with a layer of 1½" stone, can be kept in a satisfactory condition, even when subjected to fairly heavy travel, by frequently coating the surface with a liquid bituminous binder.

11. The cost of maintaining in proper condition such a repaired macadam road is not much in excess of the interest charge on the cost of an expensive bituminous concrete surface.

12. A Portland cement concrete road, if properly constructed, would seem to need but little repairing during the first five years of its life.

13. Such a pavement makes a very satisfactory surface for automobile travel, and is not as slippery in winter as a bituminous concrete pavement.

14. After such a pavement is no longer suitable as a surface, it can be used as a base for a bituminous or block pavement.

15. When a pavement is to be subjected to much automobile travel, the probable difference in durability between a Portland cement concrete road

and a macadam road would seem to indicate that the former is more economical even if the initial cost is somewhat higher.

16. If a Portland cement concrete road is not uniform in composition, it is prone to develop pot-holes. Pavements of this kind are exceedingly hard to repair satisfactorily.

17. The sub-foundation for a Portland cement concrete road should be more carefully prepared and better drained than any other.

18. The application of a lignin binder to a gravel surface greatly prolongs the life of such a road. It prevents them from raveling during the dry season or becoming soft and impassable when the frost is leaving the ground.

All of the above conclusions are approximately correct. They lack definiteness, in so far as records of traffic actually carried by any road section are lacking. The importance of accurate traffic data in judging the wearing properties and durability of different types of pavement can hardly be overestimated.

Respectfully yours,

R. B. GAGE,
*Chemist to Division of Geology,*
*Department of Conservation and Development.*

# Appendix A.

CONTRACT FOR STATE AID
for the Bridge over the

.....

IN THE.....ROAD
Between the
STATE COMMISSIONER OF PUBLIC ROADS
and the
BOARD OF CHOSEN FREEHOLDERS,
COUNTY OF

.....

WHEREAS, The State Commissioner of Public Roads, under authority conferred on him by section 4, chapter 395, laws of 1912, deems the following bridge in the .....
a road to be improved, namely, .....
.....
to be.....
and the cost of the structure yet unbuilt to replace the said bridge as too great for the public body charged with its construction;

AND WHEREAS, The Board of Chosen Freeholders, the body so charged, desires to replace the said structure with.....
.....

NOW, THEREFORE, It is agreed between the said parties, the Board of Chosen Freeholders of.....county and the State Commissioner of Public Roads, that the said Board will erect, or cause to be erected, the structure above described at a location to be approved by said State Commissioner of Public Roads and in strict compliance with plans and specifications likewise to be approved by the said Commissioner.

The said Board further agrees that the contract for the erection of said structure shall specify that payments on account shall be not more than 80 per cent. of the cost of the work, at the prices named in the contract, and that the final payment shall not be made until the structure has been accepted by the Commissioner of Public Roads as complying in all respects with the plans and specifications therefor.

The said Board further agrees to advertise for and receive bids as required in section 3, chapter 395, laws of 1912, in the case of roads.

The said Board further agrees that all of the provisions as to the contract and bond and its approval and as to the approval of the plans and specifications, as provided in section 2 of said act, shall be enforced as to the planning and letting of the contract for the structure aforesaid.

In consideration of the construction by the said Board of the structure under the conditions above set forth, the said State Commissioner of Public Roads agrees, on behalf of the State, to pay to said Board, on completion of the work and its acceptance by said Commissioner, a sum equal to.....per cent. of the contract price therefor.

IN WITNESS WHEREOF, The said Commissioner has signed and sealed these presents, and the said Board has caused the same to be signed by their Director and their corporate seal to be attached thereto and attested by their Clerk this.....
day of....., 191....

.....
*State Commissioner of Public Roads.*

.....
*Director Board of Chosen Freeholders,*
*County of.....*

Attest:

.....
[SEAL.] *Clerk.*

# Appendix B.

## NUMBER OF TONS OF STONE PER MILE REQUIRED TO BUILD THE FOLLOWING DEPTHS AND WIDTHS.

For the information of intending road builders, we have compiled the following tables, which approximate the number of tons of thoroughly rolled stone necessary to construct each mile at the designated depths and widths.

The basis is 3,000 tons of loose stone or 3,500 tons of compressed stone for a road one mile long, sixteen feet wide and eight inches deep. A road eight inches deep, when finished, will have required at least ten inches of stone. It should be placed in two layers of five inches each, and each layer rolled down to four inches. Then the application of the three-quarter inch and screenings will bring the road to the prescribed depth; for other thickness the stone should be placed in proportion to the intended finished depths.

An observance of this rule will insure the contract thickness for the roadbed, and save the sometimes necessary expense of resurfacing before acceptance from the contractor.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| A road | 8 | feet | wide | and | 4 | inches | deep | will require | 875 | tons of stone per mile. |
| " | 8 | " | " | | 6 | " | " | | 1,312½ | " " " |
| " | 8 | " | " | | 8 | " | " | | 1,750 | " " " |
| " | 8 | " | " | | 10 | " | " | | 2,187½ | " " " |
| " | 8 | " | " | | 12 | " | " | | 2,625 | " " " |
| " | 9 | " | " | | 4 | " | " | | 984⅜ | " " " |
| " | 9 | " | " | | 6 | " | " | | 1,476$^{9}/_{16}$ | " " " |
| " | 9 | " | " | | 8 | " | " | | 1,968¾ | " " " |
| " | 9 | " | " | | 10 | " | " | | 2,460$^{15}/_{16}$ | " " " |
| " | 9 | " | " | | 12 | " | " | | 2,953⅛ | " " " |
| " | 10 | " | " | | 4 | " | " | | 1,093¾ | " " " |
| " | 10 | " | " | | 6 | " | " | | 1,640⅝ | " " " |
| " | 10 | " | " | | 8 | " | " | | 2,187½ | " " " |
| " | 10 | " | " | | 10 | " | " | | 2,734⅜ | " " " |
| " | 10 | " | " | | 12 | " | " | | 3,281¼ | " " " |
| " | 11 | " | " | | 4 | " | " | | 1,203⅛ | " " " |
| " | 11 | " | " | | 6 | " | " | | 1,804$^{11}/_{16}$ | " " " |
| " | 11 | " | " | | 8 | " | " | | 2,406¼ | " " " |
| " | 11 | " | " | | 10 | " | " | | 3,007$^{13}/_{16}$ | " " " |
| " | 11 | " | " | | 12 | " | " | | 3,609⅜ | " " " |
| " | 12 | " | " | | 4 | " | " | | 1,312½ | " " " |
| " | 12 | " | " | | 6 | " | " | | 1,968¾ | " " " |
| " | 12 | " | " | | 8 | " | " | | 2,625 | " " " |
| " | 12 | " | " | | 10 | " | " | | 3,281¼ | " " " |
| " | 12 | " | " | | 12 | " | " | | 3,937½ | " " " |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| A road | 13 | feet | wide | and | 4 | inches | deep | will require | 1,421⅞ tons of stone per mile. |
| " | 13 | " | " | | 6 | " | " | | 2,132$^{13}/_{16}$ " " " |
| " | 13 | " | " | | 8 | " | " | | 2,843¾ " " " |
| " | 13 | " | " | | 10 | " | " | | 3,554$^{11}/_{16}$ " " " |
| " | 13 | " | " | | 12 | " | " | | 4,265⅝ " " " |
| " | 14 | " | " | | 4 | " | " | | 1,531¼ " " " |
| " | 14 | " | " | | 6 | " | " | | 2,296⅞ " " " |
| " | 14 | " | " | | 8 | " | " | | 3,062½ " " " |
| " | 14 | " | " | | 10 | " | " | | 3,828⅛ " " " |
| " | 14 | " | " | | 12 | " | " | | 4,593¾ " " " |
| " | 15 | " | " | | 4 | " | " | | 1,640⅝ " " " |
| " | 15 | " | " | | 6 | " | " | | 2,460$^{15}/_{16}$ " " " |
| " | 15 | " | " | | 8 | " | " | | 3,281¼ " " " |
| " | 15 | " | " | | 10 | " | " | | 4,101$^{9}/_{16}$ " " " |
| " | 15 | " | " | | 12 | " | " | | 4,921⅞ " " " |
| " | 16 | " | " | | 4 | " | " | | 1,750 " " " |
| " | 16 | " | " | | 6 | " | " | | 2,625 " " " |
| " | 16 | " | " | | 8 | " | " | | 3,500 " " " |
| " | 16 | " | " | | 10 | " | " | | 4,375 " " " |
| " | 16 | " | " | | 12 | " | " | | 5,250 " " " |
| " | 17 | " | " | | 4 | " | " | | 1,859⅜ " " " |
| " | 17 | " | " | | 6 | " | " | | 2,789$^{1}/_{16}$ " " " |
| " | 17 | " | " | | 8 | " | " | | 3,718¾ " " " |
| " | 17 | " | " | | 10 | " | " | | 4,648$^{7}/_{16}$ " " " |
| " | 17 | " | " | | 12 | " | " | | 5,578⅛ " " " |
| " | 18 | " | " | | 4 | " | " | | 1,968¾ " " " |
| " | 18 | " | " | | 6 | " | " | | 2,953⅛ " " " |
| " | 18 | " | " | | 8 | " | " | | 3,937½ " " " |
| " | 18 | " | " | | 10 | " | " | | 4,921⅞ " " " |
| " | 18 | " | " | | 12 | " | " | | 5,906¼ " " " |
| " | 19 | " | " | | 4 | " | " | | 2,078⅛ " " " |
| " | 19 | " | " | | 6 | " | " | | 3,117$^{3}/_{16}$ " " " |
| " | 19 | " | " | | 8 | " | " | | 4,156¼ " " " |
| " | 19 | " | " | | 10 | " | " | | 5,195$^{5}/_{16}$ " " " |
| " | 19 | " | " | | 12 | " | " | | 6,234⅜ " " " |
| " | 20 | " | " | | 4 | " | " | | 2,187½ " " " |
| " | 20 | " | " | | 6 | " | " | | 3,281¼ " " " |
| " | 20 | " | " | | 8 | " | " | | 4,375 " " " |
| " | 20 | " | " | | 10 | " | " | | 5,468¾ " " " |
| " | 20 | " | " | | 12 | " | " | | 6,562½ " " " |

## TABLES.

As many persons interested in the construction of stone roads are asking questions about their cost, we enclose a table to show at a glance the number of square yards at different widths in a mile of road; also the cost at different widths, and various prices per square yard. Any variations from these prices can be quickly ascertained by adding, subtracting, multiplying and dividing for a less or greater width. For example, a road eight feet wide has 4,693⅓ square yards in one mile. To obtain the

number of square yards in a road having a width of nine feet, add one-eighth to the foregoing figures, and in one having a width of seven feet, subtract one-eighth; in one of twice the width given in the table, multiply by two.

SQUARE YARDS IN ONE MILE OF

| | | |
|---|---|---|
| 8 feet in width, | 4,693⅓ | square yards. |
| 10 " | 5,866⅔ | " |
| 12 " | 7,040 | " |
| 14 " | 8,213⅓ | " |
| 16 " | 9,386⅔ | " |
| 18 " | 10,560 | " |

| | | | | | | |
|---|---|---|---|---|---|---|
| 8 feet wide, or | 4,693⅓ | square yards, at | 25c. | per square yard, | ..... | $1,173 33⅓ |
| 10 " | 5,866⅔ | " | 25c. | " | ..... | 1,466 66⅔ |
| 12 " | 7,040 | " | 25c. | " | ..... | 1,760 00 |
| 14 " | 8,213⅓ | " | 25c. | " | ..... | 2,053 33⅓ |
| 16 " | 9,386⅔ | " | 25c. | " | ..... | 2,346 66⅔ |
| 18 " | 10,560 | " | 25c. | " | ..... | 2,640 00 |
| 8 " | 4,693⅓ | " | 30c. | " | ..... | 1,408 00 |
| 10 " | 5,866⅔ | " | 30c. | " | ..... | 1,760 00 |
| 12 " | 7,040 | " | 30c. | " | ..... | 2,112 00 |
| 14 " | 8,213⅓ | " | 30c. | " | ..... | 2,464 00 |
| 16 " | 9,386⅔ | " | 30c. | " | ..... | 2,816 00 |
| 18 " | 10,560 | " | 30c. | " | ..... | 3,168 00 |
| 8 " | 4,693⅓ | " | 35c. | " | ..... | 1,642 66⅔ |
| 10 " | 5,866⅔ | " | 35c. | " | ..... | 2,053 33⅓ |
| 12 " | 7,040 | " | 35c. | " | ..... | 2,464 00 |
| 14 " | 8,213⅓ | " | 35c. | " | ..... | 2,874 66⅔ |
| 16 " | 9,386⅔ | " | 35c. | " | ..... | 3,285 33⅓ |
| 18 " | 10,560 | " | 35c. | " | ..... | 3,696 00 |
| 8 " | 4,693⅓ | " | 40c. | " | ..... | 1,877 33⅓ |
| 10 " | 5,866⅔ | " | 40c. | " | ..... | 2,346 66⅔ |
| 12 " | 7,040 | " | 40c. | " | ..... | 2,816 00 |
| 14 " | 8,213⅓ | " | 40c. | " | ..... | 3,285 33⅓ |
| 16 " | 9,386⅔ | " | 40c. | " | ..... | 3,754 66⅔ |
| 18 " | 10,560 | " | 40c. | " | ..... | 4,224 00 |
| 8 " | 4,693⅓ | " | 45c. | " | ..... | 2,112 00 |
| 10 " | 5,866⅔ | " | 45c. | " | ..... | 2,640 00 |
| 12 " | 7,040 | " | 45c. | " | ..... | 3,168 00 |
| 14 " | 8,213⅓ | " | 45c. | " | ..... | 3,696 00 |
| 16 " | 9,386⅔ | " | 45c. | " | ..... | 4,224 00 |
| 18 " | 10,560 | " | 45c. | " | ..... | 4,752 00 |
| 8 " | 4,693⅓ | " | 50c. | " | ..... | 2,346 66⅔ |
| 10 " | 5,866⅔ | " | 50c. | " | ..... | 2,933 33⅓ |
| 12 " | 7,040 | " | 50c. | " | ..... | 3,520 00 |
| 14 " | 8,213⅓ | " | 50c. | " | ..... | 4,106 66⅔ |
| 16 " | 9,386⅔ | " | 50c. | " | ..... | 4,693 33⅓ |
| 18 " | 10,560 | " | 50c. | " | ..... | 5,280 00 |
| 8 " | 4,693⅓ | " | 55c. | " | ..... | 2,581 33⅓ |
| 10 " | 5,866⅔ | " | 55c. | " | ..... | 3,226 66⅔ |
| 12 " | 7,040 | " | 55c. | " | ..... | 3,872 00 |
| 14 " | 8,213⅓ | " | 55c. | " | ..... | 4,517 33⅓ |
| 16 " | 9,386⅔ | " | 55c. | " | ..... | 5,162 66⅔ |
| 18 " | 10,560 | " | 55c. | " | ..... | 5,808 00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 8 | feet wide, or | 4,693⅓ | square yards, at | 60c. | per square yard, | ..... | $2,816 00 |
| 10 | " | 5,866⅔ | " | 60c. | " | ..... | 3,520 00 |
| 12 | " | 7,040 | " | 60c. | " | ..... | 4,224 00 |
| 14 | " | 8,213⅓ | " | 60c. | " | ..... | 4,928 00 |
| 16 | " | 9,386⅔ | " | 60c. | " | ..... | 5,632 00 |
| 18 | " | 10,560 | " | 60c. | " | ..... | 6,336 00 |
| 8 | " | 4,693⅓ | " | 65c. | " | ..... | 3,050 66⅔ |
| 10 | " | 5,866⅔ | " | 65c. | " | ..... | 3,813 33⅓ |
| 12 | " | 7,040 | " | 65c. | " | ..... | 4,576 00 |
| 14 | " | 8,213⅓ | " | 65c. | " | ..... | 5,338 66⅔ |
| 16 | " | 9,386⅔ | " | 65c. | " | ..... | 6,101 33⅓ |
| 18 | " | 10,560 | " | 65c. | " | ..... | 6,864 00 |
| 8 | " | 4,693⅓ | " | 70c. | " | ..... | 3,285 33⅓ |
| 10 | " | 5,866⅔ | " | 70c. | " | ..... | 4,106 66⅔ |
| 12 | " | 7,040 | " | 70c. | " | ..... | 4,928 00 |
| 14 | " | 8,213⅓ | " | 70c. | " | ..... | 5,749 33⅓ |
| 16 | " | 9,386⅔ | " | 70c. | " | ..... | 6,570 66⅔ |
| 18 | " | 10,560 | " | 70c. | " | ..... | 7,392 00 |
| 8 | " | 4,693⅓ | " | 75c. | " | ..... | 3,520 00 |
| 10 | " | 5,866⅔ | " | 75c. | " | ..... | 4,400 00 |
| 12 | " | 7,040 | " | 75c. | " | ..... | 5,280 00 |
| 14 | " | 8,213⅓ | " | 75c. | " | ..... | 6,160 00 |
| 16 | " | 9,386⅔ | " | 75c. | " | ..... | 7,040 00 |
| 18 | " | 10,560 | " | 75c. | " | ..... | 7,920 00 |
| 8 | " | 4,693⅓ | " | 80c. | " | ..... | 3,754 66⅔ |
| 10 | " | 5,866⅔ | " | 80c. | " | ..... | 4,693 33⅓ |
| 12 | " | 7,040 | " | 80c. | " | ..... | 5,632 00 |
| 14 | " | 8,213⅓ | " | 80c. | " | ..... | 6,570 66⅔ |
| 16 | " | 9,386⅔ | " | 80c. | " | ..... | 7,509 33⅓ |
| 18 | " | 10,560 | " | 80c. | " | ..... | 8,448 00 |
| 8 | " | 4,693⅓ | " | 85c. | " | ..... | 3,989 33⅓ |
| 10 | " | 5,866⅔ | " | 85c. | " | ..... | 4,986 66⅔ |
| 12 | " | 7,040 | " | 85c. | " | ..... | 5,984 00 |
| 14 | " | 8,213⅓ | " | 85c. | " | ..... | 6,981 33⅓ |
| 16 | " | 9,386⅔ | " | 85c. | " | ..... | 7,978 66⅔ |
| 18 | " | 10,560 | " | 85c. | " | ..... | 8,976 00 |
| 8 | " | 4,693⅓ | " | 90c. | " | ..... | 4,224 00 |
| 10 | " | 5,866⅔ | " | 90c. | " | ..... | 5,280 00 |
| 12 | " | 7,040 | " | 90c. | " | ..... | 6,336 00 |
| 14 | " | 8,213⅓ | " | 90c. | " | ..... | 7,392 00 |
| 16 | " | 9,386⅔ | " | 90c. | " | ..... | 8,448 00 |
| 18 | " | 10,560 | " | 90c. | " | ..... | 9,504 00 |
| 8 | " | 4,693⅓ | " | 95c. | " | ..... | 4,458 66⅔ |
| 10 | " | 5,866⅔ | " | 95c. | " | ..... | 5,573 33⅓ |
| 12 | " | 7,040 | " | 95c. | " | ..... | 6,688 00 |
| 14 | " | 8,213⅓ | " | 95c. | " | ..... | 7,802 66⅔ |
| 16 | " | 9,386⅔ | " | 95c. | " | ..... | 8,917 33⅓ |
| 18 | " | 10,560 | " | 95c. | " | ..... | 10,032 00 |
| 8 | " | 4,693⅓ | " | $1.00 | " | ..... | 4,693 33⅓ |
| 10 | " | 5,866⅔ | " | 1.00 | " | ..... | 5,866 66⅔ |
| 12 | " | 7,040 | " | 1.00 | " | ..... | 7,040 00 |
| 14 | " | 8,213⅓ | " | 1.00 | " | ..... | 8,213 33⅓ |
| 16 | " | 9,386⅔ | " | 1.00 | " | ..... | 9,386 66⅔ |
| 18 | " | 10,560 | " | 1.00 | " | ..... | 10,560 00 |

## TABLE FOR GRAVEL.

Table showing number of cubic yards of gravel required in the construction of one mile of gravel road, of widths varying from 6 feet to 20 feet, and depths from 6 to 12 inches. The within quantities should be multiplied by 1½ to give the number of cubic yards of loose gravel required to make the within depths of compact gravel.

| One Mile in Length. | Number of feet in width. | Number of cubic yards in road 6 inches deep. | Number of cubic yards in road 7 inches deep. | Number of cubic yards in road 8 inches deep. | Number of cubic yards in road 9 inches deep. | Number of cubic yards in road 10 inches deep. | Number of cubic yards in road 11 inches deep. | Number of cubic yards in road 12 inches deep. |
|---|---|---|---|---|---|---|---|---|
| One mile, ..... | 6 feet wide, ..... | 586$^{2}/_{3}$ | 684$^{4}/_{9}$ | 782$^{2}/_{9}$ | 880 | 977$^{7}/_{9}$ | 1,075$^{5}/_{9}$ | 1,173$^{1}/_{3}$ |
| One mile, ..... | 7 feet wide, ..... | 684$^{4}/_{9}$ | 798$^{14}/_{27}$ | 912$^{16}/_{27}$ | 1,026$^{2}/_{3}$ | 1,140$^{20}/_{27}$ | 1,254$^{22}/_{27}$ | 1,368$^{8}/_{9}$ |
| One mile, ..... | 8 feet wide, ..... | 782$^{2}/_{9}$ | 912$^{16}/_{27}$ | 1,042$^{25}/_{27}$ | 1,173$^{1}/_{3}$ | 1,303$^{19}/_{27}$ | 1,434$^{2}/_{27}$ | 1,564$^{4}/_{9}$ |
| One mile, ..... | 9 feet wide, ..... | 880 | 1,026$^{2}/_{3}$ | 1,173$^{1}/_{3}$ | 1,320 | 1,466$^{2}/_{3}$ | 1,613$^{1}/_{3}$ | 1,760 |
| One mile, ..... | 10 feet wide, ..... | 977$^{7}/_{9}$ | 1,140$^{20}/_{27}$ | 1,303$^{19}/_{27}$ | 1,466$^{2}/_{3}$ | 1,629$^{17}/_{27}$ | 1,792$^{16}/_{27}$ | 1,955$^{5}/_{9}$ |
| One mile, ..... | 11 feet wide, ..... | 1,075$^{5}/_{9}$ | 1,254$^{22}/_{27}$ | 1,434$^{2}/_{27}$ | 1,613$^{1}/_{3}$ | 1,792$^{16}/_{27}$ | 1,971$^{23}/_{27}$ | 2,151$^{1}/_{9}$ |
| One mile, ..... | 12 feet wide, ..... | 1,173$^{1}/_{3}$ | 1,368$^{8}/_{9}$ | 1,564$^{4}/_{9}$ | 1,760 | 1,955$^{5}/_{9}$ | 2,151$^{1}/_{9}$ | 2,346$^{2}/_{3}$ |
| One mile, ..... | 13 feet wide, ..... | 1,271$^{1}/_{9}$ | 1,482$^{26}/_{27}$ | 1,694$^{22}/_{27}$ | 1,906$^{2}/_{3}$ | 2,118$^{14}/_{27}$ | 2,330$^{10}/_{27}$ | 2,542$^{2}/_{9}$ |
| One mile, ..... | 14 feet wide, ..... | 1,368$^{8}/_{9}$ | 1,597$^{1}/_{27}$ | 1,825$^{5}/_{27}$ | 2,053$^{1}/_{3}$ | 2,281$^{13}/_{27}$ | 2,509$^{17}/_{27}$ | 2,737$^{7}/_{9}$ |
| One mile, ..... | 15 feet wide, ..... | 1,466$^{2}/_{3}$ | 1,711$^{1}/_{9}$ | 1,955$^{5}/_{9}$ | 2,200 | 2,444$^{4}/_{9}$ | 2,688$^{8}/_{9}$ | 2,933$^{1}/_{3}$ |
| One mile, ..... | 16 feet wide, ..... | 1,564$^{4}/_{9}$ | 1,825$^{5}/_{27}$ | 2,085$^{25}/_{27}$ | 2,346$^{2}/_{3}$ | 2,607$^{11}/_{27}$ | 2,868$^{4}/_{27}$ | 3,128$^{8}/_{9}$ |
| One mile, ..... | 17 feet wide, ..... | 1,662$^{2}/_{9}$ | 1,919$^{7}/_{27}$ | 2,216$^{8}/_{27}$ | 2,493$^{1}/_{3}$ | 2,770$^{10}/_{27}$ | 3,047$^{11}/_{27}$ | 3,324$^{4}/_{9}$ |
| One mile, ..... | 18 feet wide, ..... | 1,760 | 2,053$^{1}/_{3}$ | 2,346$^{2}/_{3}$ | 2,640 | 2,933$^{1}/_{3}$ | 3,226$^{2}/_{3}$ | 3,520 |
| One mile, ..... | 19 feet wide, ..... | 1,857$^{7}/_{9}$ | 2,167$^{11}/_{27}$ | 2,477$^{1}/_{27}$ | 2,786$^{2}/_{3}$ | 3,096$^{8}/_{27}$ | 3,405$^{25}/_{27}$ | 3,715$^{5}/_{9}$ |
| One mile, ..... | 20 feet wide, ..... | 1,955$^{5}/_{9}$ | 2,281$^{13}/_{27}$ | 2,607$^{17}/_{27}$ | 2,933$^{1}/_{3}$ | 3,259$^{7}/_{27}$ | 3,585$^{5}/_{27}$ | 3,911$^{1}/_{9}$ |

# INDEX.

## ILLUSTRATIONS.