



East Broad Street, Westfield, Showing Method of Spreading $1\frac{1}{2}$ in. Locking Stone on Concrete Base.

TWENTY-FIRST ANNUAL REPORT

OF THE

Commissioner of Public Roads

For the Year ending October 31st

1914



TRENTON, N. J.

STATE GAZETTE PUBLISHING CO., PRINTERS.

1914.

OFFICE OF COMMISSIONER OF PUBLIC ROADS,
TRENTON, NEW JERSEY, December 31, 1914.

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

I have the honor to submit the Twenty-First Annual Report of the Commissioner of Public Roads for the fiscal year ending October 31, 1914, with such comments and suggestions as existing circumstances seem to require.

E. A. STEVENS,
Commissioner of Public Roads.
(3)

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FINANCIAL STATEMENT.

Statement of Appropriations—November 1, 1913, to October 31, 1914.

PUBLIC ROAD FUNDS.		<i>Carried forward on Contracts.</i>	<i>Annual Appropriation.</i>	<i>Supplemental Appropriation.</i>	<i>Total Amount Available.</i>	<i>Expended.</i>	<i>Balance forward on Contracts.</i>	<i>Lapsed to State Treasury.</i>
Appropriation Public Roads, 1909-10.....		\$37,141 96			\$37,141 96	\$35,938 33	\$1,203 63	
“ “ “ 1910-11.....		12,726 03			12,726 03	5,108 20	7,617 83	
“ “ “ 1912-13.....		326,107 65			326,107 65	307,239 58	18,868 07	
State Road Fund, 1913-14.....			\$450,000 00	\$175,000 00	625,000 00	209,740 74	362,730 03	\$52,529 23
Totals		\$375,975 64	\$450,000 00	\$175,000 00	\$1,000,975 64	\$558,026 85	\$390,419 56	\$52,529 23
GENERAL APPROPRIATIONS.								
Salary of Commissioner.....			\$5,000 00		\$5,000 00	\$5,000 00		
“ “ State Highway Engineer.....			4,000 00		4,000 00	4,000 00		
“ “ Division Engineers.....			6,600 00		6,600 00	6,600 00		
Clerical and Office Expenses.....			17,000 00	\$1,460 17	18,460 17	17,576 65		\$883 52
Convict Labor			100,000 00		100,000 00	99,980 15		19 85
Totals			\$132,600 00	\$1,460 17	\$134,060 17	\$133,156 80		\$903 37
MOTOR VEHICLE ACCOUNT.								
			<i>Balance forward.</i>	<i>Receipts.</i>	<i>Total Amount Available.</i>	<i>Expended.</i>	<i>Carried forward.</i>	
Motor Vehicle Fund.....			\$238,281 85	\$781,447 88				
Restored to Fund, account of Amboy Bridge maintenance.....				2,884 35	\$1,022,614 08			
Paid on Allotments.....						\$590,226 28		
Appropriated for Salary Assistant Supervisors.....						3,000 00		
“ “ Expenses Assistant Supervisors.....						3,000 00		
“ “ Expenses Motor Vehicle Department.....						83,743 32	\$342,644 48	
Ocean Highway Fund.....			2,968 87		2,968 87		2,968 87	
Totals			\$241,250 72	\$784,332 23	\$1,025,582 95	\$679,969 60	\$345,613 35	

Payments on Roads, 1914

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 is submitted.

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

ATLANTIC COUNTY—Shore road intersections, mileage added in 1913 Report; cost allowed, \$4,585.06; amount of payment, \$1,528.35.

BURLINGTON COUNTY—Brown's Mills—Lakehurst road, 5.514 miles; cost allowed, \$27,722.65; amount of payment, \$10,212.39. Marlton and Evesboro road, 1.744 miles; cost allowed, \$6,466.33; amount of payment, \$2,472.53. Total for county, 7.258 miles; total cost allowed, \$34,188.98; total amount of payments, \$12,684.92.

HUNTERDON COUNTY—Hampton Borough road—Imlaydale bridge, one-half cost allowed, \$4,244.45; amount of payment, \$746.95; for further payments on this bridge, see Warren county. West Portal—Bloomsbury road, mileage to be added in 1915 Report; cost allowed, \$33,441.14; amount of partial payment, \$12,477.37. Total cost allowed for county, \$37,685.59; total amount of payments, \$13,224.32.

MIDDLESEX COUNTY—Noes Creek bridge, cost allowed, \$3,479.82; amount of payment, \$695.96. Perth Amboy—South Amboy bridge, cost allowed, \$20,892.78; amount of payment, \$6,964.26. Total cost allowed for county, \$24,372.60; total amount of payments, \$7,660.22.

MONMOUTH COUNTY—Water Witch Section, Ocean highway, 2.310 miles; cost allowed, \$22,623.41; amount of payment, \$5,000.83; amount of previous payment, \$2,925.12.

OCEAN COUNTY—First section Bay avenue—Stafford township, mileage to be added in 1915 Report; cost allowed, \$10,033.87; amount of partial payment, \$3,542.55. Fox Island bridge, cost allowed, \$1,431.70; amount of payment, \$286.34. South Eighth street, 0.543 mile; cost allowed, \$7,204.26; amount of payment, \$2,764.70. Total for county, 0.543 mile; total cost allowed, \$18,669.83; total amount of payments, \$6,593.59.

PASSAIC COUNTY—Newark and Pompton turnpike, mileage added under 1913 appropriation; cost allowed, \$6,301.88; amount of payment, \$2,520.75; see statement under 1913 appropriation. Valley road, 3.146 miles; cost allowed, \$81,221.85; amount of payment, \$31,813.54. Total for county, 3.146 miles; total cost allowed, \$87,523.73; total amount of payments, \$34,334.29.

SALEM COUNTY—Pedrickstown—Pennsgrove road, 4.097 miles; cost allowed, \$39,720.25; amount of payment, \$15,288.40.

SUSSEX COUNTY—Newton—Branchville road, first section, mileage to be added in 1915 Report; cost allowed, \$5,748.29; amount of partial payment, \$2,299.32.

UNION COUNTY—East Broad street, Westfield, 1.200 miles; cost allowed, \$30,817.27; amount of payment, \$12,125.91. Morris avenue, east section, 2.059 miles; cost allowed, \$25,244.56; amount of payment, \$9,941.62. Morris avenue, west section, 0.779 mile; cost allowed, \$10,048.37; amount of payment, \$3,902.35. Shunpike, end section, mileage added in 1913 Report; cost allowed, \$23,773.31; amount of partial payment, \$3,488.58; amount of previous payment, \$5,543.74; statement of cost published in 1913 Report. Total for county, 4.038 miles; total cost allowed, \$89,883.51; total amount of payments, \$29,458.46; total of previous payments, \$5,543.74.

WARREN COUNTY—Hampton borough road—Imlaydale bridge, one-half cost allowed, \$4,244.44; amount of payment, \$746.94; for further payments on this bridge, see Hunterdon county. Blairstown—Columbia road, 4.487 miles; cost allowed, \$49,665.49; amount of payments, \$19,494.80. Blairstown—Columbia bridges, cost allowed, \$4,060.80; amount of payment, \$812.16. Total for county, 4.487 miles; total cost allowed, \$57,970.73; total amount of payments, \$21,053.90.

MISCELLANEOUS—Amount of payment for general inspection of roads, but not charged against any particular road or county, \$60,614.14. Total for year, 25.879 miles; total cost allowed for year, \$422,971.98; total amount of payments for year, \$209,740.74; total amount of previous payments, \$8,468.86.

PAYMENTS ON ROADS AND BRIDGES, 1914.

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 fiscal year 1914, but paid from the appropriation of 1913:

ATLANTIC COUNTY—Mays Landing—Tuckahoe road, 11.867 miles; cost allowed, \$31,007.01; amount of payment, \$11,319.80.

BERGEN COUNTY—Fort Lee turnpike, second section, 0.947 mile; cost allowed, \$59,942.46; amount of payment, \$23,493.43. Hackensack street, first and third sections, 1.757 miles; cost allowed, \$30,608.82; amount of payment, \$11,916.53. Total for county, 2.704 miles; total cost allowed, \$90,551.28; total amount of payments, \$35,409.96.

BURLINGTON COUNTY—Mt. Holly—Lumberton road, 1.238 miles; cost allowed, \$6,299.49; amount of payment, \$2,257.85. Wrightstown—Pointsville road, 3.099 miles; cost allowed, \$16,453.80; amount of payment, \$6,287.52. Total for county, 4.337 miles; total cost allowed, \$22,753.29; total amount of payments, \$8,545.37.

CAMDEN COUNTY—Blackwood and Clementon road, 4.319 miles; cost allowed, \$65,703.09; amount of payment, \$25,140.64. Blackwood pike, 3.751 miles; cost allowed, \$69,969.31; amount of payment, \$26,946.72. Moorestown and Camden turnpike, not improved, mileage not added; cost allowed on purchase price, \$22,500.00; amount of payment, \$7,500.00. Total for county, 8.070 miles; total cost allowed, \$158,172.40; total amount of payments, \$59,587.36.

CAPE MAY COUNTY—Avalon boulevard, 3.892 miles; cost allowed on purchase price, \$10,000.00; amount of payment, \$3,333.33. Cape May Point boulevard, mileage added in 1912 Report under Cape Island turnpike; cost allowed, \$11,260.03; amount of payment, \$4,006.01. Ocean City road, first section, 2.269 miles; cost allowed, \$88,570.34; amount of payment, \$34,589.64. Total for county, 6.161 miles; total cost allowed, \$109,830.37; total amount of payment, \$41,928.98.

CUMBERLAND COUNTY—Landis avenue, 1.458 miles; cost allowed, \$20,521.03; amount of payment, \$7,729.91.

ESSEX COUNTY—Myrtle avenue, 1.165 miles; cost allowed, \$25,610.80; amount of payment, \$10,109.32.

HUNTERDON COUNTY—Flemington—Frenchtown road, first section, 6.067 miles; cost allowed, \$86,369.23; amount of payment, \$33,160.64. High Bridge—Califon road, first section, 3.319 miles; cost allowed, \$46,647.27; amount of payment, \$18,124.91. Total for county, 9.386 miles; total cost allowed, \$133,016.50; total amount of payments, \$51,285.55.

MIDDLESEX COUNTY—Perth Amboy—South Amboy bridge, cost allowed, \$8,653.05; amount of payment, \$2,884.35.

OCEAN COUNTY—Bay avenue, first section, Long Beach township, partial payment, mileage to be added next year; cost allowed, \$24,292.68; amount of partial payment, \$9,717.07. Bay avenue, second section, Long Beach township, 3.253 miles; cost allowed, \$31,974.16. Amount of payment, \$12,283.86. Western section B,

COMMISSIONER OF PUBLIC ROADS.

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Lakehurst-Brown's Mills road, 1.624 miles; cost allowed, \$10,253.89; amount of payment, \$3,835.81. Total for county, 4.877 miles; total cost allowed, \$66,520.73; total amount of payments, \$25,836.74.

PASSAIC COUNTY—Newark and Pompton turnpike, 2.540 miles; cost allowed, \$62,891.41; amount of payment, \$24,234.62; see statement of this road under list of roads paid for from 1914 appropriation. Newark and Pompton turnpike, second section, 2.116 miles; cost allowed, \$56,231.11; amount of payment, \$21,666.12. Total for county, 4.656 miles; total cost allowed, \$119,122.52; total amount of payments, \$45,900.74.

SALEM COUNTY—Quinton road, 2.656 miles; cost allowed, \$16,224.73; amount of payment, \$5,152.57.

WARREN COUNTY—Lincoln street, 0.379 mile; cost allowed, \$3,582.06; amount of payment, \$1,383.82. Lincoln street bridge, cost allowed, \$572.32; amount of payment, \$114.46. Total for county, 0.379 mile; total cost allowed, \$4,154.38; total amount of payments, \$1,498.28.

MISCELLANEOUS—Amount of payment for general inspection of roads, but not charged against any particular road or county, \$50.65. Total for year, 57.716 miles; total cost allowed for year, \$797,485.04; total amount of payments for year, \$307,239.58.

PAYMENTS ON ROADS, FROM 1911 APPROPRIATION.

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

In the following roads the cost allowed does not include engineering and inspection, and the State's share is one-third of the cost allowed.

The following partial payments have been made during fiscal year 1914, but paid for from the appropriation of 1911:

HUNTERDON COUNTY—Ringoes-Ringoes Station road, 0.554 miles; State's share, final partial payment, \$589.84; see detailed statement for final cost.

MIDDLESEX COUNTY—Franklin Park-Kingston road, 2.594 miles; State's share, final partial payment, \$2,612.04. Perth Amboy and Keasbey road, mileage added in 1910 list; State's share, \$1,441.46; see statement of this road under list of roads paid for from 1910 appropriation; see detailed statement for final cost. Total for county, 2.594 miles; State's share, \$4,053.50.

WARREN COUNTY—Asbury-Washington road, 5.797 miles; State's share on partial payment, \$464.86.

TOTALS—Mileage paid for from 1911 appropriation, 8.945 miles; State's share, partial payments, \$5,108.20.

FROM 1910 APPROPRIATION.

Completed and payment made during fiscal year 1914, but paid for from the appropriation for 1910.

ESSEX COUNTY—Cedar street, 1.666 miles; (a) cost allowed on road, \$20,356.36; State's share, \$6,785.45; (b) cost allowed on bridge, \$1,175.00; State's share, \$235.00. Total cost allowed, \$21,531.36; total State's share, \$7,020.45.

MIDDLESEX COUNTY—Perth Amboy and Keasbey road, 2.364 miles; cost allowed against 1910 appropriation, \$23,836.83; State's share from 1910 appropriation, \$7,945.61; see statement of this road under list of roads paid for from 1911 appropriation; see detailed statement for final cost.

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SUSSEX COUNTY—Franklin Furnace—Stockholm road, 5.476 miles; cost allowed, \$62,916.82; State's share, \$20,972.27.

TOTALS—Mileage paid for from 1910 appropriation, 9.506 miles; cost allowed on contracts paid for from 1910 appropriation, \$108,285.01; State's share on contracts paid for from 1910 appropriation, \$35,938.33.

Total length of improved roads added to mileage during fiscal year ending October 31, 1914, and total amount of money allowed and expended during same period.

	<i>Miles.</i>	<i>Cost allowed.</i>	<i>State's Share.</i>
Paid from 1914 appropriation.....	25.879	\$422,971 98	\$209,740 74
Paid from 1913 appropriation.....	57.716	797,485 04	307,239 58
Paid from 1911 appropriation.....	8.945	*	5,108 20
Paid from 1910 appropriation.....	9.506	108,285 01	35,938 33
	<hr/>	<hr/>	<hr/>
	102.046	\$1,328,742 03	\$558,026 85

The following roads are approaching completion, but were not finished in time to be reported in the preceding lists:

<i>County.</i>	<i>Name of Road.</i>	<i>Miles.</i>	<i>Cost Approximate.</i>
Atlantic	Oyster Creek	3.446	\$19,407 60
Bergen	Market street	2.871	75,253 81
	Andersen avenue	1.760	38,955 67
Essex	Pleasant Valley way.....	3.654	29,624 95
	Clinton avenue	1.300	14,763 85
	Gregory avenue	1.675	14,000 00
	Lindsley road	1.489	21,752 00
Gloucester	Mickelton—Swedesboro	4.079	66,279 45
Hunterdon	Flemington—Frenchtown, second section.....	5.564	72,189 46
	White House—New Germantown	3.590	37,573 75
	Lambertville—County line	0.962	15,022 05
	West Portal—Bloomsbury	3.069	38,342 83
Mercer	Windsor—Newton—Yardville	7.057	64,484 20
Middlesex	Roosevelt—Woodbridge, section 1.....	1.666	27,857 78
	Roosevelt—Woodbridge, section 2.....	0.618	7,383 74
Passaic	Paterson—Hanburg turnpike (Bloomingdale),	0.632	16,562 80
Salem	Pole Tavern—Elmer	2.955	14,558 93
Somerset	Blackwells Mills and Millstone, third section,	0.434	31,004 60
Sussex	Newton—Branchville, second section.....	3.320	28,089 22
Union	Westfield or North avenue.....	1.789	32,831 86

*The amount paid from 1911 appropriation was a partial payment.

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**TOTAL NUMBER OF SQUARE YARDS OF EACH CLASS OF ROAD
BUILT IN EACH COUNTY SINCE THE PASSAGE OF
THE STATE AID LAW.**

MACADAM. A.—Atlantic county, 28,776; Bergen county, 241,561; Burlington county, 1,113,449; Camden county, 628,208; Essex county, 1,066,459; Gloucester county, 239,313; Hudson county, 55,665; Hunterdon county, 229,464; Mercer county, 1,164,462; Middlesex county, 1,156,792; Monmouth county, 517,566; Morris county, 492,181; Passaic county, 597,100; Salem county, 44,124; Somerset county, 766,807; Sussex county, 86,673; Union county, 173,326; Warren county, 417,312. Total, 9,019,238.

MACADAM WITH BITUMINOUS DRESSING. B.—Bergen county, 53,212; Camden county, 19,712; Cumberland county, 24,977; Essex county, 52,328; Hunterdon county, 198,614; Mercer county, 66,677; Middlesex county, 108,416; Morris county, 24,818; Passaic county, 40,040; Somerset county, 36,976; Sussex county, 70,338; Union county, 54,456; Warren county, 118,099. Total, 868,663.

BITUMINOUS MACADAM. C.—Bergen county, 49,575; Sussex county, 103,452. Total, 153,027.

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

HOT MIXED BITUMINOUS CEMENTS :

G-1.—Bergen county, 27,049; Passaic county, 48,550. Total, 75,599.

G-2.—Gloucester county, 69,557; Passaic county, 24,979. Total, 94,536.

G-3.—Essex county, 13,765. Total, 13,765.

G-4.—Salem county, 16,115. Total, 16,115.

COLD MIXED. H.—Atlantic county, 166,721; Bergen county, 67,835; Camden county, 178,263; Gloucester county, 20,357; Hudson county, 8,759; Middlesex county, 36,553; Morris county, 99,230; Passaic county, 30,781; Salem county, 10,409; Union county, 177,953. Total, 796,861.

GRAVEL. I.—Atlantic county, 1,237,861; Burlington county, 501,814; Camden county, 226,656; Cape May county, 875,678; Cumberland county, 260,731; Gloucester county, 494,281; Middlesex county, 248,232; Monmouth county, 659,408; Ocean county, 1,245,079; Salem county, 326,680. Total, 6,076,420.

CONCRETE BASE WITH BITUMINOUS TOP DRESSING. J.—Union county, 10,513. Total, 10,513.

OYSTER SHELLS. K.—Burlington county, 11,620; Salem county, 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 county, 1,433,358; Bergen county, 439,232; Burlington county, 1,626,883; Camden county, 1,052,839; Cape May county, 875,678; Cumberland county, 285,708; Essex county, 1,132,552; Gloucester county, 823,508; Hudson county, 64,424; Hunterdon county, 428,078; Mercer county, 1,231,139; Middlesex county, 1,549,993; Monmouth county, 1,176,974; Morris county, 616,229; Ocean county, 1,245,079; Passaic county, 741,450; Salem county, 589,217; Somerset county, 803,783; Sussex county, 260,463; Union county, 427,542; Warren county, 535,411. Total, 17,339,540.

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NUMBER OF MILES OF ROAD BUILT IN EACH COUNTY IN EACH YEAR
EACH YEAR AND TOTAL

COUNTY.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.
	No. Miles.	No. Miles.	No. Miles.	No. Miles.	No. Miles.	No. Miles.	No. Miles.	No. Miles.	No. Miles.	No. Miles.	No. Miles.
Atlantic				12.00	10.00	6.84	4.03		7.03	20.10	13.00
Bergen										1.02	
Burlington ...	10.54	20.46	9.75	11.02	10.48	15.03	18.36	8.93	17.36	19.131	27.98
Camden	13.62		8.25		4.125	12.79	2.23	1.00	4.48	8.80	9.50
Cape May ...									6.00	5.394	6.20
Cumberland ..											1.22
Essex			6.5	6.00	4.91	6.67	12.07	9.60	9.36	8.723	5.79
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
*Middlesex ...	3.18	2.36	7.68	8.43	4.75	6.164	13.10	9.01	6.12	14.95	9.52
Monmouth ...				3.75	5.00	5.1	14.46	5.64	6.67	13.25	17.67
Morris					6.13	6.3	10.46	6.53	4.306	10.079	7.13
Ocean										3.0	9.97
Passaic					4.79	5.48	8.67	6.73	3.987	6.57	6.09
Salem				2.67			2.17	2.05		2.51	4.61
Somerset ...					6.22	7.27	6.6	6.65	7.93	5.88	6.24
Sussex									0.893		4.03
Union								3.432		2.141	
Warren							0.08		7.43	8.792	3.94
Total	27.34	32.28	46.33	60.82	66.655	81.938	114.46	77.212	109.376	154.005	152.92

* In 1892, Middlesex, 10.55 miles.

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SINCE PASSAGE OF STATE AID LAW, ALSO TOTAL NUMBER BUILT
NUMBER IN EACH COUNTY.

1904.	1905.	1906.	1907.	1908.	1909.	1910.	1911.	1912.	1913.	1914.	* Totals.
No. Miles.	No. Miles.	No. Miles.	No. Miles.	No. Miles.	No. Miles.	No. Miles.	No. Miles.	No. Miles.	No. Miles.	No. Miles.	No. Miles.
1.00	1.51	.....	6.408	13.94	7.24	8.077	.....	.....	11.016	11.867	134.058
9.375	2.22	0.42	1.14	9.595	10.533	.....	.....	3.607	8.776	2.704	49.390
2.48	.....	2.51	3.11	7.55	0.132	.....	2.9	8.095	14.244	11.595	221.657
5.985	1.40	.....	20.51	2.33	2.43	5.113	4.987	.....	2.924	8.070	118.544
0.15	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
8.545	8.24	.....	7.115	12.623	.....	.....	8.157	1.414	3.355	2.831	121.903
.....	.....	.....	.....	5.74	.....	.....	3.594	2.169	3.503	.....	91.331
.....	.....	2.32	.....	.....	.....	.....	.....	0.785	.....	.....	5.545
.....	.....	5.55	5.37	6.478	5.867	1.000	9.207	4.394	5.839	9.940	53.645
7.55	16.18	.....	5.85	7.85	2.25	.....	5.308	5.506	.....	.....	143.308
12.42	8.335	4.981	5.13	17.674	13.613	1.685	5.158	3.470	10.354	4.958	183.592
5.21	7.47	3.36	2.18	11.54	7.085	8.226	9.607	1.173	2.781	2.310	132.482
5.98	3.59	5.94	0.69	.....	.....	6.585	2.938	.....	4.524	.....	81.182
11.83	7.16	.....	6.91	11.006	2.867	.....	5.379	19.675	22.168	5.420	106.285
1.54	5.38	3.88	4.132	4.99	.....	0.789	2.786	0.528	2.969	7.802	77.113
7.477	.....	.....	.....	2.906	7.78	3.31	1.779	5.049	14.540	6.753	63.604
10.68	2.685	5.6	7.284	4.37	5.365	1.268	5.155	10.343	5.038	.....	104.578
1.695	0.98	.....	.....	.....	.....	3.455	3.278	.....	12.628	5.476	32.435
0.63	.....	4.01	2.336	4.232	7.757	.....	4.427	3.520	7.916	4.038	44.439
13.09	.....	.....	.....	7.95	1.92	.....	12.265	.....	.....	10.663	66.130
105.637	67.78	38.571	82.165	134.173	86.709	42.550	86.925	105.678	148.967	102.046	1,935.087

Description and Statement of Cost of Roads Improved in 1914

ATLANTIC COUNTY.

Mays Landing and Tuckahoe Road, 11.867 Miles Long.

This road begins at the county seat of Atlantic county, Mays Landing, and extends southerly through Estelville to Tuckahoe. It connects all the roads to the north and west with Cape May county. The changes in this road are most marked. The original road was nothing more than a crooked wagon track, very narrow and full of holes and dangerous sloughs. Owing to the many changes in the alignment that has been made in the State in recent years. The road was graded to a width of twenty-six feet, and was with gravel for a width of twenty feet, the gravel having a depth of four inches in the center, after consolidation, and four inches on the sides. The great importance of this road lies in the fact, as before mentioned, that it forms practically the only improved highway between Mays Landing and Tuckahoe.

Detailed statement of the cost of the Mays Landing and Tuckahoe Road, 11.867 miles.

Kind of pavement, gravel.	
Width of paved way, 20 feet.	
Length of paved way, 62,579 feet.	
Depth, average 6 inches.	
Width between slopes or curbs, 26 feet.	
Gravel, 23,177 cubic yards, at 71 cents; total.....	
Earth excavation, 28,043 cubic yards, at 33 cents; total.....	
Extra material for embankment, 2,344 cubic yards, at 57 cents; total.....	
Grubbing, 20 acres, at \$7.50; total.....	
Total	
Inspection	
Engineering	
Total cost of road.....	

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Less sum, contract price.....	\$28,499 06
Amount allowed by State.....	30,907 01
Forty per cent. of above, State's share.....	\$12,362 80
Less credit by cost of inspection already paid by State.....	983 00
Amount due by State.....	\$11,379 80
Maximum grade before.....	3.26 per cent.
Maximum grade after.....	2.8 per cent.

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

E. D. RIGHTMIRE,
Engineer.
GEORGE G. DUKES,
Inspector.

Supplemental Contract.

Statement of the cost of the Street Intersections on the Shore Road under Supplemental Contract.

Earth excavation, 620.7 cubic yards, at 28 cents; total.....

Amiesite, 3,786.5 square yards, at \$1.16½; total.....

Total cost of intersections.....	\$173 79
Engineering expenses.....	4,411 27
Supervisor's salary.....	\$4,585 06
	183 40
	105 00
	\$4,873 46
	\$4,585 06
	1,528 35

E. D. RIGHTMIRE,
Engineer.
FRANK STEELMAN,
Supervisor.

BERGEN COUNTY.

Fort Lee Turnpike, Second Section, .947 Mile Long.

This improvement begins at the Northern Railroad of New Jersey at Onia, and extends westerly across the meadows, for a distance of five thousand feet, to the bridge just east of Bogota.

This is a very important link in the line between the Fort Lee Ferry and Paterson, lying, as it does, on the main line between Edgewater and Hackensack and Paterson. The old road was a meadow level road, and was frequently under water. It was therefore deemed wise, in constructing the new road, to fill it to a height of six feet above the water. This increased weight caused a great deal of settlement, as was noticed, and the road has settled in several places over old, high

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17

water-courses where the surface indications were such that it was impossible to locate the soft meadow, which, in many places, was not encountered until a depth of eight or ten feet below the surface of the meadow had been reached. Thus an apparently firm bottom was found to be only a floating island, as it were, from six to twelve feet deep, raised upon a sea of soft mud. In consequence of the treacherous nature of this mud, there has been a great deal of settlement on the road. Anticipating this, no attempt was made to lay a permanent pavement.

After the fill had been completed, it was covered with water-bound macadam to a depth of seven inches, and to a width of twenty feet. This was treated with heavy bitumen, applied to the surface from a pressure distributor. The width of the entire fill was thirty feet. The grade was very much reduced owing to the height of the fill across the meadows.

Detailed statement of the cost of the Fort Lee Turnpike, Second Section, township of Teaneck and borough of Leonia, county of Bergen. Total length, 5,000 feet, or 0.947 mile.

Kind of pavement, bituminous macadam, type "C."
 Width of paved way, 20 feet.
 Length of paved way, 4,808.25 feet.
 Depth, 7 inches.
 Width between slopes or curbs, 30 feet.

Foundation, type "C," 10,685 square yards, at 65 cents; total.....	\$6,945 25
Surface, type "C," 9,902 square yards, at 90 cents; total.....	8,911 80
Earth excavation, outside road, 39,517 cubic yards, at 98 cents; total..	38,726 66
Excavation, inside road, 2,062 cubic yards, at 60 cents; total.....	1,237 20
24-inch vitrified pipe, 30 lineal feet, at \$2.00; total.....	60 00
12-inch vitrified pipe, 24 lineal feet, at \$1.00; total.....	24 00
Removing trees, 26 trees, at \$5.00; total.....	130 00
Timber bulkhead, 30 M-BM feet, at \$60.00; total.....	1,800 00
Total	\$57,834 91
Inspection	483 55
Engineering	1,624 00
Total cost of road	\$59,942 00
Lump sum, contract price.....	\$47,530 65
Amount allowed by State.....	59,942 46
Forty per cent. of above, State's share.....	\$23,976 98
Less credit by cost of inspection already paid by State.....	483 55
Amount due by State	\$23,493 43

Maximum grade before.....5.52 per cent.
 Maximum grade after.....0.744 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.
 WILLIAM J. LALLY,
Inspector.

Hackensack Street, First and Third Sections, 1.757 Miles Long.

This is a main road leading northerly along the westerly side of the Hackensack meadow from Rutherford to Hackensack, being the main line along the Hackensack river. Passing through several boroughs, the portion improved begins at Erie avenue in Rutherford and extends northerly to the foot of the hill in Carlstadt. The hill section was omitted because the grades were heavier than the State would approve. The third section, therefore, commenced at the other side of the hill and extended northerly to the borough line of Woodridge.

The road is graded to a total width of thirty feet and paved for a width of twenty-four feet and to a total depth of seven inches. The paved surface is a cold mixed bituminous concrete.

Detailed statement of the cost of East Rutherford-Hackensack street, first and third sections, borough of Carlstadt, Woodridge, county of Bergen. Total length, 9,278.03 feet, or 1.757 miles.

Kind of pavement, asphalt concrete, type "H."
 Width of paved way, first section 16 feet; third section, 24 feet generally.
 Length of paved way, 9,278.03 feet.
 Depth, 7 inches.
 Width between slopes or curbs, 30 feet.

Foundation, type crushed stone, 3,250 tons, at \$2.40; total.....	\$7,800 00
Surface, type "H," 16,230 square yards, at \$1.10; total.....	17,853 00
Scarifying, 20,358 square yards, at 6 cents; total.....	1,221 48
Under drain, 6-inch pipe, 2,000 lineal feet, at 35 cents; total.....	700 00
Gutter, concrete, 2,852 square yards, at 25 cents; total.....	713 00
Gutter, new cobble, 59 square yards, at \$1.05 cents; total.....	61 95
Gutter, relaid cobble, 280 square yards, at 18 cents; total.....	50 40
2-foot span iron plate culvert, 100 lineal feet, at \$4.40; total.....	440 00
	<hr/>
Total	\$28,839 83
Inspection	327 00
Engineering, approximately 5 per cent.....	1,441 99
	<hr/>
	\$30,608 82
Extras paid entirely by county, \$13,425.84 plus 5 per cent. engineering,	14,097 13
	<hr/>
Total cost of road.....	\$44,705 95
	<hr/>
Lump sum, contract price.....	\$27,777 83
Amount allowed by State.....	30,608 82
	<hr/>
Forty per cent. of above, State's share.....	\$12,243 53
Less credit by cost of inspection already paid by State.....	327 00
	<hr/>
Amount due by State.....	\$11,916 53
	<hr/>
Maximum grade before.....	4.30 per cent.
Maximum grade after.....	4.30 per cent.



Buck Cove, Brown's Mills, Lakehurst, Burlington County, Before Improvement.



Buck Cove, Brown's Mills, Lakehurst, Burlington County, After Improvement.

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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.
 HENRY C. VAN BUSKIRK,
Inspector.

BURLINGTON COUNTY.

Brown's Mills-Lakehurst Road, 5.514 Miles Long.

This road begins at Brown's Mills in the Pines and extends through a flat section of the county past many cranberry bogs to the Ocean county line. This improvement gives us a smooth and through road across the State from Camden to Lakewood and the seashore, and replaces what was merely a wagon track through the sand and pines.

This road is not as wide as it should be but as it was built by the township they could not raise sufficient funds to build an improved roadway of more than twenty-eight feet in graded width and covered with gravel to a width of only twelve feet in the center. This is the narrowest road built in the State this year, and it is the intention of the township to widen it some time in the near future when their funds permit.

The improvement is most marked. The old road was very narrow and crooked and many places ran along the dams built to flood the cranberry bogs. It is also of great value to the cranberry growers along its line, as it furnishes them a good and convenient method of reaching the railroad station at Brown's Mills.

Detailed statement of the cost of the Brown's Mills-Lakehurst road, township of Pemberton, county of Burlington. Total length, 29,104.7 feet, or 5.514 miles.

Kind of pavement, gravel.
 Width of paved way, 12 feet.
 Length of paved way, 28,944.7 feet.
 Depth, 4 inches.
 Width between slopes or curbs, 28 feet.

Gravel, 4,468.1 cubic yards, at \$2.25; total.....	\$10,053 23
Earth excavation, 22,892.65 cubic yards, at 33 cents; total.....	7,554 57
Extra embankment, 16,151.0 cubic yards, at 35 cents; total.....	5,652 85
Grubbing, 16.5 acres, at \$100.00; total.....	1,650 00
Extra fill made necessary by omission of bridge, 239.0 cubic yards, at 35 cents; total.....	83 65
Extra fill required to raise grade 4 inches, sta. 184 + 00 to sta. 192 + 00, 246.0 cubic yards, at 35 cents; total.....	86 10
Extra gravel made necessary by omission of bridges, 14.0 cubic yards, at \$2.25; total.....	31 50
Total	\$25,111 90
Inspection	810 00
Engineering	800 75
Total cost of road.....	\$26,722 65

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Lump sum, contract price.....	\$24,911 03
Amount allowed by State.....	26,722 65
Forty per cent. of above, State's share.....	\$10,689 06
Less credit by cost of inspection already paid by State.....	810 00
Amount due by State.....	<u>\$9,879 06</u>
Maximum grade before.....	5.5 per cent.
Maximum grade after.....	0.6 per cent.
Inspection	\$57 00
Extras on first contract, 5,263½ excavation, at 19 cents; total.....	\$1,000 00
Total cost	\$1,000 00
Amount allowed by State.....	\$1,000 00
One-third of above, State's share.....	333 33
Amount due by State.....	<u>\$333 33</u>

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

WINFIELD H. ELDRIDGE,
Engineer.
CHARLES KINSLEY,
Inspector.

Marlton and Evesboro Road, 1.744 Miles Long.

This road lies entirely in Evesham township and as Burlington county has not been in financial condition to take up the improvement of roads as a county, this township, recognizing the advantages and benefits of the continuation of the improvement from Moorestown through its borders, constructed the road from the Mount Laurel township line through Evesboro to Marlton, at which point it connects with the Camden, Ellisburg and Marlton turnpike, thus giving the inhabitants of the township living along its line a well graded and paved outlet to the turnpike, and thence over the Marlton, Ellisburg and Camden turnpike into the Camden markets.

The road was graded to a width of from thirty to thirty-three feet, and covered with gravel for a width of sixteen feet and to a depth, after consolidation, of six inches in the center and four inches on either side. This depth was deemed sufficient as the road had already been graveled for a number of years.

The work itself was very well and thoroughly done and is a credit to Evesham township.

Detailed statement of the cost of the Marlton and Evesboro Road, township of Evesham, county of Burlington. Total length, 9,209 feet, or 1.744 miles.

COMMISSIONER OF PUBLIC ROADS.

Kind of pavement, gravel.
 Width of paved way, 16 feet.
 Length of paved way, 9,169 feet.
 Depth, 6 inches at center, 4 inches at sides.
 Width between slopes or curbs, 30 and 33 to 39 feet.

Foundation, type D, gravel B, 1,386.6 cubic yards, at \$1.59 ⁹ / ₁₀ ; total..	\$2,217 17
Surface, type I, gravel A, 924.5 cubic yards, at \$1.67; total.....	1,543 92
Earth excavation, 4,867 cubic yards, at 43.3 cents; total.....	2,107 41
Excavation outside of road, 75 cubic yards, at 43.3 cents; total.....	32 48
Under drain, type, 4 inch tile, 100 lineal feet, at 15.15 cents; total..	15 15
Extra underdrain, 4 inch tile, 530 lineal feet, at 15.15 cents; total..	80 30
Extra grading drives, 85 cubic yards, at 43.3 cents; total.....	36 81
Extra terra cotta pipe, relaying drain and opening ditch.....	1 60
Extra grubbing brush.....	15 00
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Total	\$6,049 84
Inspection	114 00
Engineering	302 49
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Total cost of road.....	\$6,466 33
Lump sum, contract price.....	\$5,916 13
Amount allowed by State.....	6,466 33
Forty per cent. of above, State's share.....	\$2,586 53
Less credit by cost of inspection already paid by State.....	114 00
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Amount due by State.....	\$2,472 53
Maximum grade before.....	5.1 per cent.
Maximum grade after.....	3.655 per cent.

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

G. ALBERT HAINES,
Engineer.
 STACY WILLS,
Inspector.

Mount Holly-Lumberton Road, 1,238 Miles Long.

This improvement begins at the borough line of Mount Holly and extends over the old Lumberton turnpike to the railroad crossing at Lumberton, at which point it connects with the remainder of the turnpike previously improved.

The completion of this improvement finishes the old Lumberton turnpike from one end to the other, and forming, as it does, a portion of the most direct route from Trenton to Atlantic City, its value is of much more than local importance; in fact it forms part of one of our main through lines.

To comply with the wishes of the people along the line of the turnpike, the pavement is constructed of oyster shells, sixteen feet wide and eight inches deep. While this forms a very nice road for light traffic, its value for a through highway is questionable, as is evinced by the rapid

manner in which the surface is being ground up and blown away. Nevertheless, the improvement is most marked, and, in connection with the work which has been done in Mount Holly, we now have a road which is smooth, hard and convenient for travel all the way from Trenton through Mount Holly and Hammonton to Atlantic City.

There was comparatively little change in the original grade of the road, as it had been carefully constructed by the turnpike company, who owned it up to within about eight years.

Detailed statement of the cost of the Mount Holly-Lumberton road, township of Lumberton, county of Burlington. Total length, 6,536 feet, or 1.238 miles.

Kind of pavement, oyster shells.	
Width of paved way, 16 feet.	
Length of paved way, 6,536 feet.	
Depth, 8 inches.	
Width between slopes or curbs, 30 feet.	
Surface, type oyster shells, 11,620 square yards, at 35.5 cents; total..	\$4,125 10
Earth excavation, 5,419 cubic yards, at 22 cents; total.....	1,734 08
Lump sum price.....	\$5,859 18
Inspection	261 95
Engineering	178 36
Total cost of road.....	\$6,299 49
Lump sum, contract price.....	\$5,859 18
Amount allowed by State.....	6,299 49
Forty per cent. of above, State's share.....	\$2,519 80
Less credit by cost of inspection already paid by State	261 95
Amount due by State.....	\$2,257 85
Maximum grade before.....	2.08 per cent.
Maximum grade after.....	1.72 per cent.

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

JAMES LOGAN,
Engineer.
B. S. TEULE,
Inspector.

Wrightstown-Pointville Road, 3.099 Miles Long.

This road begins at the improved road leading from Pemberton to New Egypt, and forms one section of the north and south road leading to Brown's Mills, at which point, when the road is completed, it will connect with the road leading from Camden to Lakewood. The road passes through a very good farming country and is not only of value to the tourists traveling through the State but also to the farmers living along

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the line, as it enables them to reach their markets more quickly and with less expenditure of time and effort. This is another road that was built by the township and not by the county.

There was considerable grading necessary to bring the road to the proper grade, but no very great change was made in the maximum gradient.

The road was commenced in 1913 but was not completed until the spring of 1914. The improvement consists of a graded roadway thirty feet in width, the center, sixteen feet, being covered with gravel to a depth of eight inches in the center and four inches on the sides, after consolidation.

Detailed statement of the cost of the Wrightstown-Pointville road, township of New Hanover, county of Burlington. Total length, 16,363 feet, or 3.099 miles.

Kind of pavement, gravel.
 Width of paved way, 16 feet.
 Length of paved way, 16,363 feet.
 Depth, 8 and 4 inches.
 Width between slopes or curbs, 30 feet.

Foundation, type D, gravel B, 1,773 cubic yards, at \$1.50; total.....	\$2,659 50
Surface, type I, gravel A, 3,523 cubic yards, at \$1.70; total.....	5,989 10
Earth excavation in road, 15,870.5 cubic yards, at 38 cents; total....	6,030 79
Earth excavation outside road, 1,055 cubic yards, at 40 cents; total..	422 00
Grubbing, $\frac{3}{4}$ acre, at \$120.00; total.....	90 00
Turfing embankment, 159.5 square yards, at \$1.25; total.....	199 37
Total	\$15,390 76
Inspection	294 00
Engineering	769 04
Total	\$16,453 80
Advertising for proposals.....	25 50
Total cost of road	\$16,479 30
Lump sum, contract price.....	\$16,427 72
Amount allowed by State.....	16,453 80
Forty per cent. of above, State's share.....	\$6,581 52
Less credit by cost of inspection already paid by State.....	294 00
Amount due by State	\$6,287 52
Maximum grade before.....	4 $\frac{1}{2}$ per cent.
Maximum grade after.....	2 $\frac{1}{2}$ per cent.

NOTE.—Excavation in road was reduced 3,253.5 cubic yards by change of grade authorized by the State Commissioner of Public Roads.

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

EARL THOMSON,
Engineer.
 WILLIAM MILLER,
Inspector.

TWENTY-FIRST ANNUAL REPORT

CAMDEN COUNTY.

Blackwood and Clementon Road, 4.319 Miles Long.

The improvement of this road gives a direct outlet from Blackwood and adjacent territory to the White Horse pike. The new pavement extends from the railroad station in Clementon to the station in Blackwood. Some of the heaviest excavation in South Jersey was done on this road with the result that it is now entirely free from objectionable grades.

The graded width is thirty feet, and the pavement sixteen feet wide. A section at each end where there is a heavy local travel is paved with bituminous concrete on a macadam base; the middle section is of plain water-bound macadam.

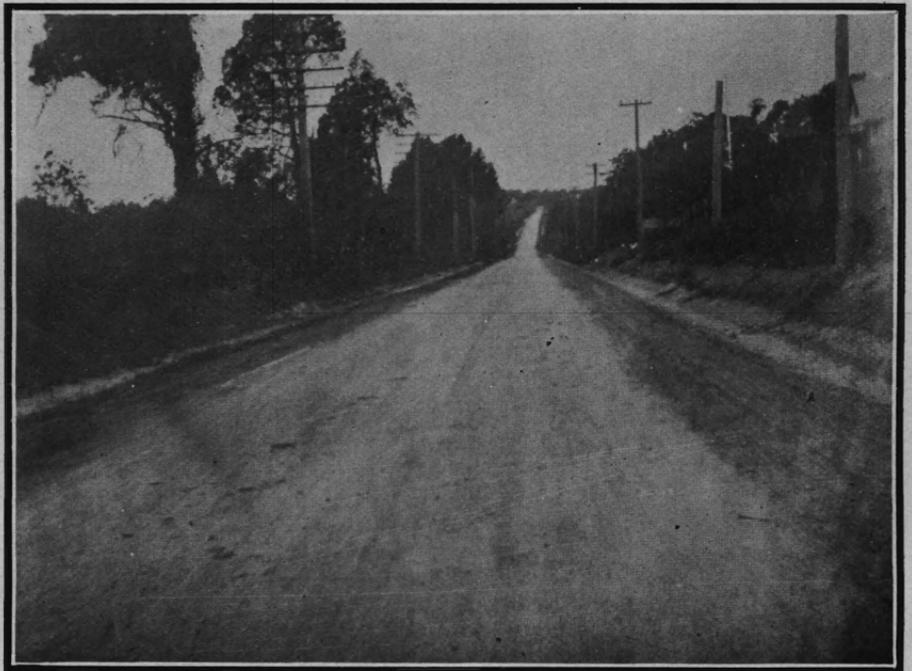
Detailed statement of the cost of the Blackwood and Clementon road, townships of Clementon and Gloucester, county of Camden. Total length, 22,805.5 feet, or 4.319 miles.

Kind of pavement, macadam and macadam base, amiesite surface.
 Width of paved way, 16 feet.
 Length of paved way, 22,805.5 feet.
 Depth, macadam 8 inches with amiesite surface, 6½ inches.
 Width between slopes or curbs, 30 feet.

Foundation, type C, 40,488.9 square yards, at 55 cents; total.....	\$22,268 90
Surface, type A, 26,322.2 square yards, at 53 cents; total.....	13,950 77
Surface, type H, 14,166.7 square yards, at 80 cents; total.....	11,333 36
Earth excavation in road, 26,101.4 cubic yards, at 32 cents; total..	8,352 45
Earth excavation outside road, 1,530 cubic yards, at 40 cents; total..	612 00
Under drain, type tile, 2,853 lineal feet, at 12 cents; total.....	342 36
Cross drain, type (C. I. pipe), 37,071 pounds, at 2 cents; total.....	741 42
Gutter, type concrete, 290.51 cubic yards, at \$7.50; total.....	2,178 83
Guard rail, 4,880 lineal feet, at 35 cents; total.....	1,708 00
Total	\$61,488 09
Inspection	1,140 60
Engineering	3,074 40
Total	\$65,703 09
Extras paid entirely by county.....	61 53
Total cost of road.....	\$65,764 62
Lump sum, contract price.....	\$61,614 16
Amount allowed by State.....	65,703 09
Forty per cent. of above, State's share.....	\$26,281 24
Less credit by cost of inspection already paid by State.....	1,140 60
Amount due by State.....	\$25,140 64



Looking Toward Mt. Ephraim, Blackwood Pike, Camden County, Before Improvement.



Looking Toward Mt. Ephraim, Blackwood Pike, Camden County, After Improvement.

Description and Statement of Cost of Roads Improved in 1914

ATLANTIC COUNTY.

Mays Landing and Tuckahoe Road, 11.867 Miles Long.

This road begins at the county seat of Atlantic county, Mays Landing, and extends southerly through Estelville to Tuckahoe. It connects all the roads to the north and west with Cape May county.

The changes in this road are most marked. The original road was nothing more than a crooked wagon track, very narrow and full of holes and dangerous sloughs. Owing to the many changes in the alignment and grade, there is a more marked change between this road, in its original condition and as it exists to-day, than almost any other improvement that has been made in the State in recent years.

The road was graded to a width of twenty-six feet, and was covered with gravel for a width of twenty feet, the gravel having a depth of eight inches in the center, after consolidation, and four inches on the sides.

The great importance of this road lies in the fact, as before stated, that it forms practically the only improved highway between northern and western New Jersey and Cape May.

Detailed statement of the cost of the Mays Landing and Tuckahoe road, township of Hamilton and Weymouth, county of Atlantic. Total length, 62,660 feet, or 11.867 mles.

Kind of pavement, gravel.
Width of paved way, 20 feet.
Length of paved way, 62,579 feet.
Depth, average 6 inches.
Width between slopes or curbs, 26 feet.

Gravel, 23,177 cubic yards, at 71 cents; total.....	\$16,455 67
Earth excavation, 28,043 cubic yards, at 33 cents; total.....	9,254 19
Extra material for embankment, 2,344 cubic yards, at 55 cents; total..	1,289 20
Grubbing, 20 acres, at \$7.50; total.....	1,500 00
Total	\$28,499 06
Inspection	983 00
Engineering	1,424 95
Total cost of road	\$30,907 01

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Lump sum, contract price.....	\$28,499 06
Amount allowed by State.....	30,907 01
Forty per cent. of above, State's share.....	\$12,362 80
Less credit by cost of inspection already paid by State.....	983 00
	<hr/>
Amount due by State.....	\$11,379 80
Maximum grade before.....	3.26 per cent.
Maximum grade after.....	2.8 per cent.

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

E. D. RIGHTMIRE,
Engineer.
GEORGE G. DUKES,
Inspector.

Supplemental Contract.

Statement of the cost of the Street Intersections on the Shore Road under Supplemental Contract.

Earth excavation, 620.7 cubic yards, at 28 cents; total.....	\$173 79
Amiesite, 3,786.5 square yards, at \$1.16½; total.....	4,411 27
	<hr/>
Total cost of intersections.....	\$4,585 06
Engineering expenses	183 40
Supervisor's salary	105 00
	<hr/>
	\$4,873 46
Total allowed by the State.....	\$4,585 06
One-third of above paid by State.....	1,528 35

E. D. RIGHTMIRE,
Engineer.
FRANK STEELMAN,
Supervisor.

BERGEN COUNTY.

Fort Lee Turnpike, Second Section, .947 Mile Long.

This improvement begins at the Northern Railroad of New Jersey at Leonia, and extends westerly across the meadows, for a distance of five thousand feet, to the bridge just east of Bogota.

This is a very important link in the line between the Fort Lee Ferry and Paterson, lying, as it does, on the main line between Edgewater Ferry, Hackensack and Paterson. The old road was a meadow level road which was frequently under water. It was therefore deemed wise, in constructing the new road, to fill it to a height of six feet above the meadow. This increased weight caused a great deal of settlement, as was expected, and the road has settled in several places over old, hidden

COMMISSIONER OF PUBLIC ROADS.

water-courses where the surface indications were such that it was impossible to locate the soft meadow, which, in many places, was not encountered until a depth of eight or ten feet below the surface of the meadow had been reached. Thus an apparently firm bottom was found to be only a floating island, as it were, from six to twelve feet deep, raised upon a sea of soft mud. In consequence of the treacherous nature of this mud, there has been a great deal of settlement on the road. Anticipating this, no attempt was made to lay a permanent pavement.

After the fill had been completed, it was covered with water-bound macadam to a depth of seven inches, and to a width of twenty feet. This was treated with heavy bitumen, applied to the surface from a pressure distributor. The width of the entire fill was thirty feet. The grade was very much reduced owing to the height of the fill across the meadows.

Detailed statement of the cost of the Fort Lee Turnpike, Second Section, township of Teaneck and borough of Leonia, county of Bergen. Total length, 5,000 feet, or 0.947 mile.

Kind of pavement, bituminous macadam, type "C."
 Width of paved way, 20 feet.
 Length of paved way, 4,808.25 feet.
 Depth, 7 inches.
 Width between slopes or curbs, 30 feet.

Foundation, type "C," 10,685 square yards, at 65 cents; total.....	\$6,945 25
Surface, type "C," 9,902 square yards, at 90 cents; total.....	8,911 80
Earth excavation, outside road, 39,517 cubic yards, at 98 cents; total..	38,726 66
Excavation, inside road, 2,062 cubic yards, at 60 cents; total.....	1,237 20
24-inch vitrified pipe, 30 lineal feet, at \$2.00; total.....	60 00
12-inch vitrified pipe, 24 lineal feet, at \$1.00; total.....	24 00
Removing trees, 26 trees, at \$5.00; total.....	130 00
Timber bulkhead, 30 M-BM feet, at \$60.00; total.....	1,800 00
Total	\$57,834 91
Inspection	483 55
Engineering	1,624 00
Total cost of road	\$59,942 00
Lump sum, contract price.....	\$47,530 65
Amount allowed by State.....	59,942 46
Forty per cent. of above, State's share.....	\$23,976 98
Less credit by cost of inspection already paid by State.....	483 55
Amount due by State	\$23,493 43

Maximum grade before.....5.52 per cent.
 Maximum grade after.....0.744 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.
 WILLIAM J. LALLY,
Inspector.

Hackensack Street, First and Third Sections, 1.757 Miles Long.

This is a main road leading northerly along the westerly side of the Hackensack meadow from Rutherford to Hackensack, being the main line along the Hackensack river. Passing through several boroughs, the portion improved begins at Erie avenue in Rutherford and extends northerly to the foot of the hill in Carlstadt. The hill section was omitted because the grades were heavier than the State would approve. The third section, therefore, commenced at the other side of the hill and extended northerly to the borough line of Woodridge.

The road is graded to a total width of thirty feet and paved for a width of twenty-four feet and to a total depth of seven inches. The paved surface is a cold mixed bituminous concrete.

Detailed statement of the cost of East Rutherford-Hackensack street, first and third sections, borough of Carlstadt, Woodridge, county of Bergen. Total length, 9,278.03 feet, or 1.757 miles.

Kind of pavement, asphalt concrete, type "H."

Width of paved way, first section 16 feet; third section, 24 feet generally.

Length of paved way, 9,278.03 feet.

Depth, 7 inches.

Width between slopes or curbs, 30 feet.

Foundation, type crushed stone, 3,250 tons, at \$2.40; total.....	\$7,800 00
Surface, type "H," 16,230 square yards, at \$1.10; total.....	17,853 00
Scarifying, 20,358 square yards, at 6 cents; total.....	1,221 48
Under drain, 6-inch pipe, 2,000 lineal feet, at 35 cents; total.....	700 00
Gutter, concrete, 2,852 square yards, at 25 cents; total.....	713 00
Gutter, new cobble, 59 square yards, at \$1.05 cents; total.....	61 95
Gutter, relaid cobble, 280 square yards, at 18 cents; total.....	50 40
2-feet span iron plate culvert, 100 lineal feet, at \$4.40; total.....	440 00
Total	\$28,839 83
Inspection	327 00
Engineering, approximately 5 per cent.....	1,441 99
	<hr/>
	\$30,608 82
Extras paid entirely by county, \$13,425.84 plus 5 per cent. engineering,	14,097 13
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Total cost of road.....	\$44,705 95
Lump sum, contract price.....	\$27,777 83
Amount allowed by State.....	30,608 82
Forty per cent. of above, State's share.....	\$12,243 53
Less credit by cost of inspection already paid by State.....	327 00
	<hr/>
Amount due by State.....	\$11,916 53
Maximum grade before.....	4.30 per cent.
Maximum grade after.....	4.30 per cent.



Buck Cove, Brown's Mills, Lakehurst, Burlington County, Before Improvement.



Buck Cove, Brown's Mills, Lakehurst, Burlington County, After Improvement.

COMMISSIONER OF PUBLIC ROADS.

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.
 HENRY C. VAN BUSKIRK,
Inspector.

BURLINGTON COUNTY.

Brown's Mills-Lakehurst Road, 5.514 Miles Long.

This road begins at Brown's Mills in the Pines and extends through a flat section of the county past many cranberry bogs to the Ocean county line. This improvement gives us a smooth and through road across the State from Camden to Lakewood and the seashore, and replaces what was merely a wagon track through the sand and pines.

This road is not as wide as it should be but as it was built by the township they could not raise sufficient funds to build an improved roadway of more than twenty-eight feet in graded width and covered with gravel to a width of only twelve feet in the center. This is the narrowest road built in the State this year, and it is the intention of the township to widen it some time in the near future when their funds permit.

The improvement is most marked. The old road was very narrow and crooked and many places ran along the dams built to flood the cranberry bogs. It is also of great value to the cranberry growers along its line, as it furnishes them a good and convenient method of reaching the railroad station at Brown's Mills.

Detailed statement of the cost of the Brown's Mills-Lakehurst road, township of Pemberton, county of Burlington. Total length, 29,104.7 feet, or 5.514 miles.

Kind of pavement, gravel.
 Width of paved way, 12 feet.
 Length of paved way, 28,944.7 feet.
 Depth, 4 inches.
 Width between slopes or curbs, 28 feet.

Gravel, 4,468.1 cubic yards, at \$2.25; total.....	\$10,053 23
Earth excavation, 22,892.65 cubic yards, at 33 cents; total.....	7,554 57
Extra embankment, 16,151.0 cubic yards, at 35 cents; total.....	5,652 85
Grubbing, 16.5 acres, at \$100.00; total.....	1,650 00
Extra fill made necessary by omission of bridge, 239.0 cubic yards, at 35 cents; total.....	83 65
Extra fill required to raise grade 4 inches, sta. 184 + 00 to sta. 192 + 00, 246.0 cubic yards, at 35 cents; total.....	86 10
Extra gravel made necessary by omission of bridges, 14.0 cubic yards, at \$2.25; total.....	31 50
Total	\$25,111 90
Inspection	810 00
Engineering	800 75
Total cost of road	\$26,722 65

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Lump sum, contract price.....	\$24,911 03
Amount allowed by State.....	26,722 65
Forty per cent. of above, State's share.....	\$10,689 06
Less credit by cost of inspection already paid by State.....	810 00
Amount due by State.....	\$9,879 06
Maximum grade before.....	5.5 per cent.
Maximum grade after.....	0.6 per cent.
Inspection	\$57 00
Extras on first contract, 5,263½ excavation, at 19 cents; total.....	\$1,000 00
Total cost	\$1,000 00
Amount allowed by State.....	\$1,000 00
One-third of above, State's share.....	333 33
Amount due by State.....	\$333 33

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

WINFIELD H. ELDRIDGE,
Engineer.
CHARLES KINSLEY,
Inspector.

Marlton and Evesboro Road, 1.744 Miles Long.

This road lies entirely in Evesham township and as Burlington county has not been in financial condition to take up the improvement of roads as a county, this township, recognizing the advantages and benefits of the continuation of the improvement from Moorestown through its borders, constructed the road from the Mount Laurel township line through Evesboro to Marlton, at which point it connects with the Camden, Ellisburg and Marlton turnpike, thus giving the inhabitants of the township living along its line a well graded and paved outlet to the turnpike, and thence over the Marlton, Ellisburg and Camden turnpike into the Camden markets.

The road was graded to a width of from thirty to thirty-three feet, and covered with gravel for a width of sixteen feet and to a depth, after consolidation, of six inches in the center and four inches on either side. This depth was deemed sufficient as the road had already been graveled for a number of years.

The work itself was very well and thoroughly done and is a credit to Evesham township.

Detailed statement of the cost of the Marlton and Evesboro Road, township of Evesham, county of Burlington. Total length, 9,209 feet, or 1.744 miles.

COMMISSIONER OF PUBLIC ROADS.

Kind of pavement, gravel.
 Width of paved way, 16 feet.
 Length of paved way, 9,169 feet.
 Depth, 6 inches at center, 4 inches at sides.
 Width between slopes or curbs, 30 and 33 to 39 feet.

Foundation, type D, gravel B, 1,386.6 cubic yards, at \$1.59 ⁹ / ₁₀ ; total..	\$2,217 17
Surface, type I, gravel A, 924.5 cubic yards, at \$1.67; total.....	1,543 92
Earth excavation, 4,867 cubic yards, at 43.3 cents; total.....	2,107 41
Excavation outside of road, 75 cubic yards, at 43.3 cents; total.....	32 48
Under drain, type, 4 inch tile, 100 lineal feet, at 15.15 cents; total..	15 15
Extra underdrain, 4 inch tile, 530 lineal feet, at 15.15 cents; total..	80 30
Extra grading drives, 85 cubic yards, at 43.3 cents; total.....	36 81
Extra terra cotta pipe, relaying drain and opening ditch.....	1 60
Extra grubbing brush.....	15 00
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Total	\$6,049 84
Inspection	114 00
Engineering	302 49
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Total cost of road.....	\$6,466 33
Lump sum, contract price.....	\$5,916 13
Amount allowed by State.....	6,466 33
Forty per cent. of above, State's share.....	\$2,586 53
Less credit by cost of inspection already paid by State.....	114 00
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Amount due by State.....	\$2,472 53
Maximum grade before.....	5.1 per cent.
Maximum grade after.....	3.655 per cent.

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

G. ALBERT HAINES,
Engineer.
 STACY WILLS,
Inspector.

Mount Holly-Lumberton Road, 1.238 Miles Long.

This improvement begins at the borough line of Mount Holly and extends over the old Lumberton turnpike to the railroad crossing at Lumberton, at which point it connects with the remainder of the turnpike previously improved.

The completion of this improvement finishes the old Lumberton turnpike from one end to the other, and forming, as it does, a portion of the most direct route from Trenton to Atlantic City, its value is of much more than local importance; in fact it forms part of one of our main through lines.

To comply with the wishes of the people along the line of the turnpike, the pavement is constructed of oyster shells, sixteen feet wide and eight inches deep. While this forms a very nice road for light traffic, its value for a through highway is questionable, as is evinced by the rapid

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manner in which the surface is being ground up and blown away. Nevertheless, the improvement is most marked, and, in connection with the work which has been done in Mount Holly, we now have a road which is smooth, hard and convenient for travel all the way from Trenton through Mount Holly and Hammonton to Atlantic City.

There was comparatively little change in the original grade of the road, as it had been carefully constructed by the turnpike company, who owned it up to within about eight years.

Detailed statement of the cost of the Mount Holly-Lumberton road, township of Lumberton, county of Burlington. Total length, 6,536 feet, or 1.238 miles.

Kind of pavement, oyster shells.
 Width of paved way, 16 feet.
 Length of paved way, 6,536 feet.
 Depth, 8 inches.
 Width between slopes or curbs, 30 feet.

Surface, type oyster shells, 11,620 square yards, at 35.5 cents; total..	\$4,125 10
Earth excavation, 5,419 cubic yards, at 22 cents; total.....	1,734 08
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Lump sum price.....	\$5,859 18
Inspection	261 95
Engineering	178 36
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Total cost of road.....	\$6,299 49
Lump sum, contract price.....	\$5,859 18
Amount allowed by State.....	6,299 49
Forty per cent. of above, State's share.....	\$2,519 80
Less credit by cost of inspection already paid by State	261 95
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Amount due by State.....	\$2,257 85
Maximum grade before.....	2.08 per cent.
Maximum grade after.....	1.72 per cent.

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

JAMES LOGAN,
Engineer.
 B. S. TEULE,
Inspector.

Wrightstown-Pointville Road, 3.099 Miles Long.

This road begins at the improved road leading from Pemberton to New Egypt, and forms one section of the north and south road leading to Brown's Mills, at which point, when the road is completed, it will connect with the road leading from Camden to Lakewood. The road passes through a very good farming country and is not only of value to the tourists traveling through the State but also to the farmers living along

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the line, as it enables them to reach their markets more quickly and with less expenditure of time and effort. This is another road that was built by the township and not by the county.

There was considerable grading necessary to bring the road to the proper grade, but no very great change was made in the maximum gradient.

The road was commenced in 1913 but was not completed until the spring of 1914. The improvement consists of a graded roadway thirty feet in width, the center, sixteen feet, being covered with gravel to a depth of eight inches in the center and four inches on the sides, after consolidation.

Detailed statement of the cost of the Wrightstown-Pointville road, township of New Hanover, county of Burlington. Total length, 16,363 feet, or 3.099 miles.

Kind of pavement, gravel.
Width of paved way, 16 feet.
Length of paved way, 16,363 feet.
Depth, 8 and 4 inches.
Width between slopes or curbs, 30 feet.

Foundation, type D, gravel B, 1,773 cubic yards, at \$1.50; total.....	\$2,659 50
Surface, type I, gravel A, 3,523 cubic yards, at \$1.70; total.....	5,989 10
Earth excavation in road, 15,870.5 cubic yards, at 38 cents; total....	6,030 79
Earth excavation outside road, 1,055 cubic yards, at 40 cents; total..	422 00
Grubbing, $\frac{3}{4}$ acre, at \$120.00; total.....	90 00
Turfing embankment, 159.5 square yards, at \$1.25; total.....	199 37
Total	\$15,390 76
Inspection	294 00
Engineering	769 04
Total	\$16,453 80
Advertising for proposals.....	25 50
Total cost of road	\$16,479 30
Lump sum, contract price.....	\$16,427 72
Amount allowed by State.....	16,453 80
Forty per cent. of above, State's share.....	\$6,581 52
Less credit by cost of inspection already paid by State.....	294 00
Amount due by State	\$6,287 52
Maximum grade before.....	4 $\frac{1}{2}$ per cent.
Maximum grade after.....	2 $\frac{1}{2}$ per cent.

NOTE.—Excavation in road was reduced 3,253.5 cubic yards by change of grade authorized by the State Commissioner of Public Roads.

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

EARL THOMSON,
Engineer.
WILLIAM MILLER,
Inspector.

CAMDEN COUNTY.

Blackwood and Clementon Road, 4.319 Miles Long.

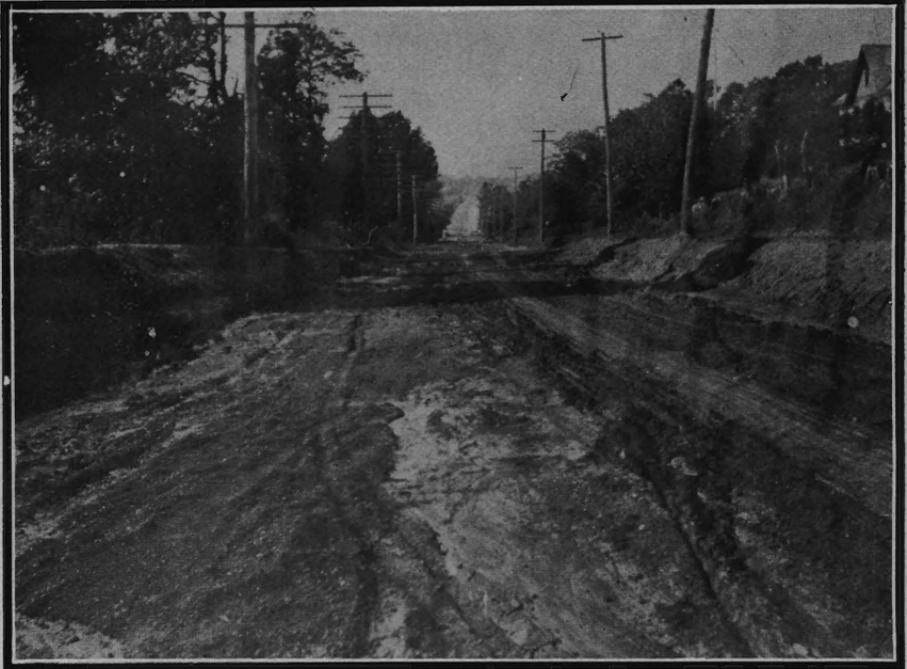
The improvement of this road gives a direct outlet from Blackwood and adjacent territory to the White Horse pike. The new pavement extends from the railroad station in Clementon to the station in Blackwood. Some of the heaviest excavation in South Jersey was done on this road with the result that it is now entirely free from objectionable grades.

The graded width is thirty feet, and the pavement sixteen feet wide. A section at each end where there is a heavy local travel is paved with bituminous concrete on a macadam base; the middle section is of plain water-bound macadam.

Detailed statement of the cost of the Blackwood and Clementon road, townships of Clementon and Gloucester, county of Camden. Total length, 22,805.5 feet, or 4.319 miles.

Kind of pavement, macadam and macadam base, amiesite surface.
 Width of paved way, 16 feet.
 Length of paved way, 22,805.5 feet.
 Depth, macadam 8 inches with amiesite surface, 6½ inches.
 Width between slopes or curbs, 30 feet.

Foundation, type C, 40,488.9 square yards, at 55 cents; total.....	\$22,268 90
Surface, type A, 26,322.2 square yards, at 53 cents; total.....	13,950 77
Surface, type H, 14,166.7 square yards, at 80 cents; total.....	11,333 36
Earth excavation in road, 26,101.4 cubic yards, at 32 cents; total...	8,352 45
Earth excavation outside road, 1,530 cubic yards, at 40 cents; total..	612 00
Under drain, type tile, 2,853 lineal feet, at 12 cents; total.....	342 36
Cross drain, type (C. I. pipe), 37,071 pounds, at 2 cents; total.....	741 42
Gutter, type concrete, 290.51 cubic yards, at \$7.50; total.....	2,178 83
Guard rail, 4,880 lineal feet, at 35 cents; total.....	1,708 00
Total	\$61,488 09
Inspection	1,140 60
Engineering	3,074 40
Total	\$65,703 09
Extras paid entirely by county.....	61 53
Total cost of road.....	\$65,764 62
Lump sum, contract price.....	\$61,614 16
Amount allowed by State.....	65,703 09
Forty per cent. of above, State's share.....	\$26,281 24
Less credit by cost of inspection already paid by State.....	1,140 60
Amount due by State.....	\$25,140 64



Looking Toward Mt. Ephraim, Blackwood Pike, Camden County, Before Improvement.



Looking Toward Mt. Ephraim, Blackwood Pike, Camden County, After Improvement.

COMMISSIONER OF PUBLIC ROADS.

Maximum grade before..... 5.6 per cent.
 Maximum grade after..... 4.25 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.
 JAMES R. DUFF,
 ABRAHAM JOHNSTONE,
Inspectors.

Blackwood Pike, 3.751 Miles Long.

By the improvement of the Blackwood pike one of the oldest roads leading into Camden has been put in excellent condition. This thoroughfare was maintained as a toll road for nearly fifty years until it was acquired by the county in 1903.

The work under this contract extends from the Camden city line to Bellmawr. It has been graded to a uniform width of thirty feet and paved to a width of sixteen feet, with two and one-half inches of bituminous concrete on a four-inch Portland cement concrete base.

This link gives a continuous good road from Camden to Blackwood, and, with the contemplated extension to Grenloch, will complete the route to the Gloucester county line.

Detailed statement of the cost of the Blackwood Pike road, boroughs of Woodlyn and Audubon, townships of Haddon and Center, county of Camden. Total length, 19,808 feet, or 3.751 miles.

- Kind of pavement, amiesite on concrete.
- Width of paved way, 16 feet.
- Length of paved way, 19,759 feet.
- Depth, 6½ inches.
- Width between slopes or curbs, 30 feet.

Foundation, type A, 3,602 cubic yards, at \$5.90; total.....	\$21,251 80
Surface, type H (15 feet wide), 32,931.67 square yards, at 86 cents; total	28,321 24
Stone shoulders, 174.77 tons, at \$1.00; total.....	174 77
Earth excavation in road, 20,017 cubic yards; at 33 cents; total..	6,605 61
Earth excavation outside road, 445 cubic yards, at 40 cents; total....	178 00
Under drain, type tile, 3,902 lineal feet, at 20 cents; total.....	780 40
Cinders with tile, 83 yards, \$1.25; total.....	103 75
Gutter, type concrete, 376.73 cubic yards, at \$6.20; total.....	2,335 73
Guard rail, 10,638.5 lineal feet, at 30 cents; total.....	3,191 55
Cross drains (C. I. pipe), 60,165 pounds, at 2 cents; total.....	1,203 30
Stone fill on 800 feet tile, at 50 cents; total.....	400 00
Extra excavation outside road for drainage, 2,598.3 yards, at 40 cents; total	1,039 32
Stone rip rap on sides of causeways, 550 tons, at \$1.85; total.....	
Raising retaining walls, Budds Bridge, 39.0 yards, at \$7.10; total....	
Total	\$65,585 46

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Inspection		1,041 00
Engineering		3,342 85
		<hr/>
Total		\$69,969 31
Extras paid entirely by county.....		3,894 29
		<hr/>
Total cost of road.....		\$73,863 60
Lump sum, contract price.....		\$63,524 07
Amount allowed by State.....		69,969 31
Forty per cent. of above, State's share.....		\$27,987 72
Less credit by cost of inspection already paid by State..	\$1,041 00	
Previously paid by State.....	14,943 70	
		<hr/>
		15,984 70
		<hr/>
Amount due by State.....		\$12,003 02
Maximum grade before.....		5.1 per cent.
Maximum grade after.....		3.8 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.

Moorestown and Camden Turnpike.

This is the last remaining portion of the old turnpike into Camden. The section purchased begins at the Camden county line, up to which point the turnpike had already been purchased by Burlington county and thrown open to public use, and extends thence westerly to Cooper river in Camden. The turnpike was purchased subject to the easement of the trolley over it.

The old pavement consisted of rubble, was very rough and unpleasant for travel, and the demands of the traveling public had become so great and insistent that the county could no longer resist the importunities and therefore asked the State to enter with them in the purchase of this turnpike and in taking down the toll gates. This is now accomplished and a free road into Camden from Moorestown is an accomplished fact.

It is the intention of the county during the coming year to improve this turnpike with a modern form of pavement.

Detailed statement of the cost of the Moorestown and Camden Turnpike road, townships of Delaware, Pensauken, and borough of Merchantville, county of Camden. Total length, 25,689.4 feet, or 4.865 miles.

COMMISSIONER OF PUBLIC ROADS.

Kind of pavement, rubble.
 Width of paved way, 18± feet.
 Length of paved way, 25,689.4 feet.
 Depth, 6± inches.
 Width between slopes or curbs, 38 and 40 feet.

Total cost of road, purchased from Turnpike Co. for.....	\$22,500 00
Amount allowed by State	22,500 00
One-third of above, State's share	7,500 00

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

J. J. ALBERTSON,
Engineer.

CAPE MAY COUNTY.

Avalon Boulevard, 3.892 Miles Long.

This road begins at the Main Shore road in Swainton and extends southeasterly to Ingram's Thorofare in the borough of Avalon.

This turnpike was built by the Avalon Turnpike Company to connect the rapidly growing borough of Avalon on the seashore with the mainland. The development on the beach has been so rapid and the increase in population so great that it was necessary to furnish these people with an outlet to the mainland by some other means than that furnished by the railroad or by boats.

Appreciating this necessity, the turnpike company constructed this boulevard and the same was later purchased by the county, in order that the people of Cape May might have a free and unobstructed highway to the beach at this point.

Detailed statement of the cost of the Avalon Boulevard, township of Middle, county of Cape May. Total length, 3.892 miles.

Kind of pavement, gravel.
 Width of paved way, 20 feet.
 Length of paved way, 20,550 feet.
 Depth, 8 to 4 inches.
 Width between slopes or curbs, 30 feet.

Purchase price of road.....	\$10,000 00
Amount allowed by State.....	10,000 00
One-third of above, State's share.....	3,333 33

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

L. M. RICE,
Engineer.

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Cape May Point Boulevard, 2.368 Miles Long.

This gravel highway begins at the Main Shore road in Cape May city and extends westerly to the old steamboat dock at Cape May Point, which for generations was the only steamboat landing at Cape May.

The road is graded to a width of thirty feet, and, owing to the very heavy summer traffic, it was graveled for the entire width; this gravel having a depth, after consolidation, of eight inches in the center and five inches on either side.

The completion of this road gives the inhabitants of Cape May a good, smooth and convenient highway from that city to Cape May Point, and it also furnishes a drive that has long been wished for in this section.

Detailed statement of the cost of the Cape May Point Boulevard, township of Lower, county of Cape May. Total length, 12,505 feet, or 2.368 miles.

- Kind of pavement, gravel.
- Width of paved way, 30 feet.
- Length of paved way, 12,505 feet.
- Depth, 8 to 5 inches.
- Width between slopes or curbs, 30 feet.

Gravel, 7,600 cubic yards, at \$1.25; total.....	\$9,500 00
Earth excavation, 4,090 cubic yards, at 29 cents; total.....	1,186 10
Grubbing, 2½ acres, at \$45.00; total.....	112 50
Total	\$10,798 60
Less 400 yards gravel deducted at \$1.25; total.....	500 00
Total	\$10,298 60
Inspection	498 00
Engineering	463 43
Total cost of road	\$11,260 03
Lump sum, contract price.....	\$10,798 60
Amount allowed by State.....	11,260 03
Forty per cent. of above, State's share.....	\$4,504 01
Less credit by cost of inspection already paid by State.....	498 00
Amount due by State	\$4,006 01
Maximum grade before.....	1.2 per cent.
Maximum grade after.....	0.6 per cent.

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

L. M. RICE,
Engineer.
LEVI DICKINSON,
Inspector.



Ocean City Road, Cape May County, Before Improvement.



Ocean City Road, Cape May County, After Improvement.

COMMISSIONER OF PUBLIC ROADS.

Ocean City Road, First Section, 2.269 Miles Long.

The Ocean City road is the only public highway leading from the mainland across the meadows to Ocean City. Its construction furnished a much shorter route from Atlantic City to Cape May by way of the toll bridge from Somers Point, thereby avoiding the long detour by way of Mays Landing and Tuckahoe.

This road is another of those heavy fills which we have been compelled to construct from the mainland across the meadows, the first of which was the Atlantic City boulevard, and it is found that though the first cost is much greater, the final cost is reduced to a minimum.

The Ocean City road was graded to a width of forty feet, and paved for this entire width with gravel varying in thickness from eight inches in the center to five inches on either edge. The draw-bridge which, with its approaches, forms a considerable part of the road, was one of the first to be built under State aid.

The road connects with the Main Shore road at Marmora.

Detailed statement of the cost of the Ocean City Road, First Section, township of Upper, county of Cape May. Total length, 11,982 feet, or 2.269 miles.

- Kind of pavement, gravel.
- Width of paved way, 40 feet.
- Length of paved way, 11,474 feet.
- Depth, 8 to 4 and 8 to 5 inches.
- Graded width—meadow section, 87 feet; upland section, 40 feet.

Gravel, 9,345 cubic yards, at \$3.06 ⁷⁸¹⁰ / ₉₄₀₅ ; total.....	\$28,672 80
Earth excavation, 5,598 cubic yards, at 32 ²⁸⁴⁵ / ₅₅₀₈ cents; total.....	1,819 81
Extra embankment, 215,970 cubic yards, at 18 ²¹⁷⁵⁰ / ₄₃₃₀₈ cents; total...	39,958 16
Banking, 18,720 lineal feet, at 25 ⁷⁰² / ₂₃₁₅ cents; total.....	4,736 76
Railing, 18,920 lineal feet, at 48 ⁴¹¹ / ₁₇₉₂₀ cents; total.....	9,085 94
Trestle in lieu of retaining walls.....	3,680 00
Total	\$87,953 47
Less difference in itemized bid and lump sum bid.....	\$478 03
Less retaining walls not allowed.....	\$87,475 44
Less trestle in lieu of retaining walls.....	3,680 00
Total	\$83,795 44
Inspection	838 50
Engineering	3,936 40
Total	\$88,570 34
Total cost of road.....	\$92,250 34
Lump sum, contract price.....	87,986 63
Amount allowed by State.....	88,570 34
Forty per cent. of above, State's share.....	\$35,425 14
Less credit by cost of inspection already paid by State.....	838 50
Amount due by State	\$34,589 64

Maximum grade before..... 2.5 per cent.
 Maximum grade after..... 1.6 per cent.

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

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

CUMBERLAND COUNTY.

Landis Avenue, 1.458 Miles Long.

This improvement extends about one and one-half miles east from the Vineland borough line. The work was done by the township of Landis with State aid.

This avenue is a part of the direct road from Vineland station to the Home for Feeble-Minded Women and to the Training School at Vineland. It is also a link in the contemplated through route from Bridgeton to the shore resorts by way of Mays Landing.

The avenue is graded and paved thirty-four feet wide. The pavement is macadam on a gravel base, and has a bituminous surface applied by the penetration method.

Detailed statement of the cost of the Landis avenue road, township of Landis, county of Cumberland. Total length within township to Spring road, 7,700 feet, or 1.458 miles.

Kind of pavement, macadam with gravel foundation and bitulithic surfacing.
 Width of paved way for 4,622 feet, 34.15 feet; remainder 34 feet.
 Length of paved way, 7,700 feet.
 Depth—surfacing, $\frac{3}{4}$ inch; rolled, $\frac{1}{2}$ inch; macadam, 4 inches; rolled to 3 inches.
 Width between slopes or curbs, including trolley paving, 34.15 feet.

Foundation, type—See below under gravel.

Surface, type macadam bit. top, 24,977 square yards, at 63 cents; total,	\$15,735 51
Gravel, foundation, 842 cubic yards, at 69 cents; total.....	580 98
Earth excavation, 2,764 cubic yards, at 35 cents; total.....	967 40
Under drain, type four-inch, 3,000 lineal feet, at 10 cents; total.....	300 00
Under drain, type six-inch, 382 lineal feet, at 15 cents; total.....	57 30
Storm sewer, vit. pipe, 18-inch, 520 lineal feet, at 97 cents; total....	504 40
Culverts, coated C. I. pipe, 10-inch, 540 lineal feet, at 96 cents; total..	518 40
Culverts, coated C. I. pipe, 16-inch, 64.50 lineal feet, at \$1.90; total..	122 55
Catch basins, complete and grating, 4, each, at \$30.00; total.....	120 00
Catch basins, supplemental, state design, 2, each, at \$52.18; total..	104 36

Total	\$19,010 90
Less 2 catch basins, no orders.....	104 36

Total	\$18,906 54
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Inspection between October, 1912, and October, 1913.....	478 50
Engineering allowed by State.....	1,135 99
Total	\$20,521 03
Two catch basins extra.....	104 36
Extras paid entirely by township.....	561 50
Total cost of road.....	\$21,186 89
Lump sum, contract price (excluding engineering, inspection and extras)	\$18,933 19
Amount allowed by State.....	20,521 03
Forty per cent. of above, State's share.....	\$8,208 41
Less credit by cost of inspection already paid by State.....	478 50
Amount due by State.....	\$7,729 91

Maximum grade before..... 1.60 per cent.
 Maximum grade after..... 1.40 per cent.

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

W. W. YOUNG,
Engineer.
 J. E. PAYNE,
Inspector.

ESSEX COUNTY.

Myrtle Avenue, 1.165 Miles Long.

This improvement begins at Bay avenue in the town of Bloomfield and ends at Watchung avenue in the same town. It is built through a section that has been undeveloped for some time and is now fast being built up and improved.

The road was graded to a width of thirty-eight feet, and in the center a pavement twenty feet wide and eight inches deep, composed of hot mixed bituminous concrete, was laid.

The change on this road is most marked, as what was nothing much more than a back country dirt road is transformed into a fine, smooth and well finished paved highway.

Detailed statement of the cost of the Myrtle avenue road, township of Bloomfield, county of Essex. Total length, 6,152 feet, or 1.165 miles.

Kind of pavement, G3.
 Width of paved way, 20 feet.
 Length of paved way, 6,152 feet.
 Depth, 8 inches.
 Width between slopes or curbs, 38 feet.

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Foundation, type C, 9,676 square yards, at 55 cents; total.....	\$5,321 80
Surface, type G3, 9,676 square yards, at \$1.25; total.....	12,095 00
Surfacing, type resurfacing, 4,089 square yards, at \$1.40; total.....	5,724 60
Earth excavation, 3,454 cubic yards, at 50 cents; total.....	1,727 00
Earth embankment, 1,152 cubic yards, at 20 cents; total.....	230 40
Lowering C. B.—Cleaning Culvert.....	12 00
<hr/>	
Total	\$25,110 80
Inspection	135 00
Engineering	365 00
<hr/>	
Total cost of road.....	\$25,610 80
Lump sum, contract price.....	\$24,697 30
Amount allowed by State.....	25,610 80
Forty per cent. of above, State's share.....	\$10,244 32
Less credit by cost of inspection already paid by State.....	135 00
<hr/>	
Amount due by State.....	\$10,109 32
Maximum grade before.....	1.90 ± 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.

FREDK. A. REIMER,
Engineer.
JAMES A. CARROLL,
Inspector.

Cedar Street, 1.666 Miles Long.

This improvement begins at Roseland avenue, Livingston, and bears easterly and southerly to the Northfield road. It is a cut-off from Livingston to Millburn, and through a greater portion of its length follows the top of the Second Mountain until it meets the improved road in Millburn.

An idea of the amount of work that was done in the improvement of this road may be gleaned from the fact that the maximum grade was reduced from 11.7 per cent. to 6.7 per cent.

The graded width was thirty feet, and that of the pavement was sixteen feet, with a depth of eight inches.

A great deal of this excavation was through rock; as a result, although the road was commenced in 1910, it was not paid for until this year.

Detailed statement of the cost of Cedar street, township of Livingston, county of Essex. Total length, 8,800 feet, or 1.666 miles.

Width of stone-bed, 16 feet.
Length of stone-bed, 8,800 feet.
Depth of stone-bed, 8 inches.

COMMISSIONER OF PUBLIC ROADS.

Bituminous dressing "B," 15,787 square yards, at 63 cents; total....	\$9,945 81
Earth excavation, 21,244.12 cubic yards, at 45 cents; total.....	9,559 85
Rock excavation, 8 cubic yards, at \$11.50; total.....	92 00
Drain, 445 lineal feet, at 30 cents; total.....	133 50
Cast iron pipe, 24 lineal feet, at \$1.60; total.....	38 40
Cobble-stone gutter, 978 square yards, at 60 cents; total.....	586 80
Total	\$20,356 36
Inspection	870 00
Engineering, approximately	1,116 00
Extension to steel I-beam bridge.....	1,175 00
Total cost of road	\$23,517 36
Lump sum, contract price.....	\$21,200 82
Amount paid by the State—	
On road, one-third of \$20,385.46.....	6,795 15
On bridge, one-fifth of \$1,175.00.....	235 00
	7,030 15
Maximum grade before.....	11.70 per cent.
Maximum grade after.....	6.70 per cent.

FREDK. A. REIMER,
Engineer.
W. E. ASHLY,
Supervisor.

HUNTERDON COUNTY.

Flemington-Frenchtown Road, First Section, 6.067 Miles Long.

This road begins at the bridge in Frenchtown and extends thence easterly through Baptistown to Croton. As this road runs directly across the ridges, a great deal of excavation was necessary. In order to complete its improvement and in cutting down this series of sharp hills and filling in the hollows, it was necessary to leave the old line of the road and lay out a new line over the portion just east of Frenchtown, in order to avoid the excessive grading that would have been necessary on the old road.

The maximum grade was reduced from 11 per cent. to 5 per cent., and the improvement is one of the most marked that has been completed during the past year.

The value of this road is enhanced by the fact that it connects the roads previously improved along the Delaware river between Milford and Frenchtown and the county seat of Flemington.

The graded width through both earth and rock is thirty feet, the paved width is sixteen feet and the depth nine inches.

As this country was principally rock, it was deemed wise to use a little more of it in the pavement than is usual. After the macadam had

been thoroughly rolled and compacted, it was treated with a coating of light bituminous binder.

The completion of the second section, which is now graded throughout its entire length, will open up a section of country that has long been without improved highways.

Detailed statement of the cost of the Flemington-Frenchtown road, First Section, township of Kingwood and borough of Frenchtown, county of Hunterdon. Total length, 32,031 feet, or 6.067 miles.

Kind of pavement, macadam with bituminous surface.	
Width of paved way, 16 feet.	
Length of paved way, 31,969 feet.	
Depth, 9 inches.	
Width between slopes or curbs, 30 feet.	
Foundation, type B, 37,239 square yards, at 23.7 cents; total.....	\$8,825 64
Surface, 59,732 square yards, at 56.2 cents; total.....	33,569 38
Earth excavation, 41,847 cubic yards, at 70 cents; total.....	29,292 90
Excavation outside of road, 2,516 cubic yards, at 70 cents; total....	1,761 20
Under drain, 8,571 lineal feet, at 37 cents; total.....	3,171 27
12-inch C. I. pipe, 300 lineal feet, at \$2.00; total.....	600 00
16-inch C. I. pipe, 294 lineal feet, at \$3.00; total.....	882 00
12-inch Vitrified pipe, 712 lineal feet, at 72.6 cents; total.....	517 15
12-inch corrugated, 20 lineal feet, at \$1.50; total.....	30 00
Concrete, 291.9 cubic yards, at \$8.00; total.....	2,335 20
Dry masonry wall, 427.8 cubic yards, at \$4.00; total.....	1,711 20
Expanded metal, 965 square feet, at 4 cents; total.....	38 60
Total	\$82,734 54
Less difference between items and lump sum.....	2 36
Total	\$82,732 18
Inspection	1,387 05
Engineering	2,250 00
Total cost of road.....	\$86,369 23
Lump sum, contract price.....	\$77,712 24
Amount allowed by State.....	86,369 23
Forty per cent. of above, State's share.....	\$34,547 69
Less credit by cost of inspection already paid by State.....	1,387 05
Amount due by State.....	\$33,160 64
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 compliance with the plans and specifications.

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

COMMISSIONER OF PUBLIC ROADS.

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High Bridge-Califon Road, 3.319 Miles Long.

This construction begins at High Bridge and extends along the north-westerly side of the South Branch valley to Hoffmans. It is the first section of an improved highway that will connect the stone roads of Hunterdon with those of Morris, and will, when the remaining section is completed, give the people of Hunterdon their first outlet to the northeast.

The grading and draining of this road were 55 per cent. of the cost, and therefore constitute a permanent addition to the roads of Hunterdon.

An idea of the great improvement made on this old road may be had when the fact is known that the maximum grade was reduced from 12.5 per cent. to 5.6 per cent., as this improvement more than doubles the weight that may be transported on the road with the same power.

Detailed statement of the cost of the High Bridge-Califon road, township of Lebanon, county of Hunterdon. Total length, 17,526 feet, or 3.319 miles.

Kind of pavement, macadam with bituminous surface.
Width of paved way, 14 feet.
Length of paved way, 17,526 feet.
Depth, 6 and 9 inches.
Width between slopes or curbs, 28 feet.

Foundation, type B, 16,180 square yards, at 26 cents; total.....	\$4,206 80
Foundation, type C, 11,239 square yards, at 30 cents; total.....	3,371 70
Surface, type B, 29,043 square yards, at 44 cents; total.....	12,778 92
Excavation outside of road, 1,027 cubic yards, at 60 cents; total.....	616 20
Earth excavation, 20,382 cubic yards, at 50 cents; total.....	10,191 00
Rock excavation, 6,268 cubic yards, at \$1.40; total.....	8,775 20
Under drain, type French, 1,250 lineal feet, at 25 cents; total.....	312 50
Under drain, type stone, 3,500 lineal feet, at 20 cents; total.....	700 00
Gutter, type rubble, 949 square yards, at \$1.00; total.....	949 00
12-inch C. I. pipe, 228 lineal feet, at \$1.75; total.....	399 00
16-inch C. I. pipe, 108 lineal feet, at \$2.50; total.....	270 00
20-inch C. I. pipe, 108 lineal feet, at \$3.50; total.....	378 00
Concrete, 126.9 cubic yards, at \$8.00; total.....	1,015 20
Rubble masonry, 115.8 cubic yards, at \$6.25; total.....	723 75
Dry slope wall, 19 cubic yards, at \$4.00; total.....	76 00
Total	\$44,763 27
Inspection	534 00
Engineering	1,350 00
Total cost of road	\$46,647 27
Lump sum, contract price.....	\$44,240 86
Amount allowed by State.....	46,647 27
Forty per cent. of above, State's share.....	\$18,658 91
Less credit by cost of inspection already paid by State.....	534 00
Amount due by State	\$18,124 91
Maximum grade before.....	12.5 per cent.
Maximum grade after.....	5.6 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.
HARRY P. SNYDER,
Inspector.

Ringoes—Ringoes Station Road, .554 Mile Long.

This is a short branch constructed from the county improved road through Ringoes to the railroad station. Its completion enables the farmers to haul their freight to and from the railroad at all seasons of the year, thus adding greatly to the local value of the through line improvement. The road before it was stoned was almost impassable in the spring. Now this is all changed and the way to and from the station is good at all times.

Detailed statement of the cost of the Ringoes-Ringoes Station road, township of East Amwell, county of Hunterdon, State of New Jersey. Total length, 2,924 feet, or 0.554 mile.

Width of stone-bed, 16 feet.	
Length of stone-bed, 2,924 feet.	
Depth of stone-bed, macadam, 6 inches; telford, 9 inches.	
Macadam wings, length, 1,550 feet; width, 4 & 4 feet; depth, 3 inches.	
Macadam, 3,903 square yards, at 60 cents; total.....	\$2,341 80
Telford, 1,422 square yards, at 70 cents; total.....	995 40
Macadam wings, 1,378 square yards, at 32½ cents; total.....	447 85
Earth excavation, 1,097 cubic yards, at 40 cents; total.....	438 80
Extra excavation, 540 cubic yards, at 40 cents; total.....	216 00
Asphaltum oil surface, 5,325 cubic yards, at 2.929 cents; total.....	156 00
Drain, called for 600 lineal feet; extra, 500 lineal feet, at 20 cents; total	220 00
Cobble stone gutter, 75 square yards, at 50 cents; total.....	37 50
Application of ugrite.....	571 00
Total	\$5,424 35
Supervisor's salary	201 00
Engineering expenses	131 50
Digging ditch from culvert to railroad.....	22 02
Placing pipe in front Odd Fellows' Hall.....	3 10
Total cost of road.....	\$5,782 77
Lump sum, contract price.....	\$4,766 15
Total allowed by the State.....	5,424 35
One-third of above, total amount paid by the State.....	1,808 12
Maximum grade before	6 per cent.
Maximum grade after	3.6 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.
JACOB PHILHOWER,
Supervisor.

COMMISSIONER OF PUBLIC ROADS.

MIDDLESEX COUNTY.

Franklin Park and Kingston Road, 5.189 Miles Long.

This might be properly called the second section of the New Brunswick and Kingston road, the first portion having been commenced at the New Brunswick city line and carried to Franklin Park some years ago. The present improvement begins at the end of the old macadam at Franklin Park and extends along the old turnpike to Ten Mile Run and thence it turns southerly and runs over Little Rocky Hill to Kingston.

This is the old stage route between New Brunswick, Princeton and Trenton, and its importance in the early days is very readily gleaned from the fact that it was adopted as the division line between Somerset and Middlesex counties and has so remained for a number of years.

The road itself was graded from the line of the old turnpike to a width of forty feet, and over Little Rocky Hill to Kingston for a width of twenty-eight feet. The pavement, however, was laid fourteen feet wide and eight inches deep throughout the entire length of the road. This pavement consisted of water-bound macadam.

The changes in grade on this road were most marked, as the grades over Little Rocky Hill had for years been a bugbear to the traveling public. The maximum grade was reduced from 8.5 per cent. to 4.39 per cent.

Detailed statement of the cost of the Franklin Park and Kingston road, townships of South Brunswick and Franklin, counties of Middlesex and Somerset. Total length, 27,400 feet, or 5.189 miles.

Kind of pavement, water-bound macadam.
 Width of paved way, 14 feet.
 Length of paved way, including approach, 27,516 feet.
 Depth, 8 and 12 inches.

Macadam, 39,425 square yards, at 57 cents; total.....	\$22,472 25
Telford, 4,511 square yards, at \$1.00; total.....	4,511 00
4-inch macadam, 2,326 square yards, at 50 cents; total.....	1,163 00
Drain, 13,566 lineal feet, at 20 cents; total.....	2,713 20
Earth excavation, 37,346 cubic yards, at 80 cents; total.....	29,876 80
Under drain, type 36-inch C. I. pipe, 48 lineal feet, at \$9.37; total....	449 76
Under drain, type 12-inch C. I. pipe, 36 lineal feet, at \$1.42; total...	51 12
Total	\$61,237 13
Less difference between items and lump sum.....	1,326 72
Total	\$59,910 41
Inspection, supervisor's salary.....	1,404 90
Engineering expenses	1,223 63
Total	\$62,538 94
Extras paid entirely by county, concrete, culverts, walls, &c.....	2,830 99
Total cost of road.....	\$65,369 93

Lump sum, contract price.....	\$55,297 72
Amount allowed by State.....	59,910 41
Of above, State's share, paid Middlesex county, 1914, \$2,612.04; paid Middlesex county, 1913, \$7,373.03; paid Somerset county, 1913, \$7,373.03; due Somerset county, \$2,612.04.....	19,970 14
Maximum grade before.....	8.5 per cent.
Maximum grade after.....	4.39 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.
GEORGE A. WOOLF,
Inspector.

Perth Amboy-Keasbey Road, 2.364 Miles Long.

This road begins at the car barns at Perth Amboy and extends thence northerly through Keasbey and easterly to Logan's Corner on the Perth Amboy-Metuchen road. It is graded to a width varying from twenty-one to twenty-eight feet, and the center is paved with cold mixed bituminous concrete for a width of fourteen to sixteen feet, and a total depth, including the foundation, of eight inches.

This road leads from the business center of Perth Amboy through Keasbey toward Metuchen, and furnishes a more direct route into Perth Amboy and to the Perth Amboy bridge.

It was built over the old clay pits, and owing to the very many obstacles which were met with, though the road was commenced in 1910, it was not finally completed and paid for until this year.

The maximum grade was reduced from 7 per cent. to 5 per cent.

Detailed statement of the cost of the Perth Amboy-Keasbey road, city of Perth Amboy, township of Woodbridge, county of Middlesex. Total length, 12,480 feet, or 2.364 miles.

Width of stone-bed, 14 and 16 feet.
Length of stone-bed, 12,480 feet.
Depth of stone-bed, 8 inches.

Macadam, with Amiesite, 20,572 square yards, at \$1.10; total.....	\$22,629 20
Filler, 20,572 square yards, at 12 cents; total.....	2,468 64
Earth excavation, 11,007 cubic yards, at 47 cents; total.....	5,173 29
Drain, 400 lineal feet, at 21 cents; total.....	84 00
Belgian block gutter, 88 square yards, at \$3.00; total.....	264 00
Cobble stone gutter, 217 square yards, at \$1.30; total.....	282 10
Macadam on lake bridge, 83 square yards, at 61 cents; total.....	50 63
Total	\$30,951 86
Less difference in calculation by quantities over lump sum bid.....	2,790 65
Total	\$28,161 21

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Supervisor's salary	1,456 30
Engineering expenses	1,198 14
Extras, paid by county, culvert pipe.....	265 94
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Total cost of road.....	\$31,081 59
Lump sum, contract price.....	\$23,962 84
Total allowed by the State.....	28,161 21
One-third of above, amount paid by the State.....	9,387 07
Maximum grade before.....	7.0 per cent.
Maximum grade after.....	5.0 per cent.

FRED. SIMONS,

Engineer.

MICHAEL F. LEAHEY,

Supervisor.

MONMOUTH COUNTY.

Water Witch Section, Ocean Highway, 2.31 Miles Long.

This is the finest scenic section of the Ocean Highway in the State of New Jersey. It consists of practically a new line cut along the brow of the hill, beginning at Auditorium avenue in Atlantic Highlands, and extending to the promontory overlooking Sandy Hook and the ocean, thence in a wide sweep down the hill to Navesink avenue, Water Witch. The view obtained on this drive is the finest and most extensive to be found anywhere along the New Jersey coast.

The road was graded to a width of thirty feet, and covered with gravel for a width of eighteen feet and to a depth of eight inches.

This is the most northerly section of the Ocean Highway. At Water Witch it connects with the improved highway leading down to the Highlands of Navesink, thence along the improved road skirting the bridge through Normandie, Seabright, and thence down the coast to Asbury Park.

This road might truly be called the gateway to the Ocean Highway, and its improvement makes the whole of the Ocean Highway to the south of greater value.

Detailed statement of the cost of the Water Witch section of Ocean Highway, township of Middletown, county of Monmouth.

Total length, 12,197 feet, or 2.31 miles.
 Kind of pavement, gravel.
 Width of paved way, 18 feet.
 Length of paved way, 12,197 feet.
 Depth, 8 inches.
 Width between slopes or curbs, 30 feet.

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Foundation, type I "C" (compacted), 2,710 cubic yards, at \$1.10; total	\$2,981 00
Surface, type I "E" (compacted), 2,710 cubic yards, at \$2.45; total,	6,639 50
Earth excavation, 33,150 cubic yards, at 30 cents; total.....	9,945 00
Grubbing, 7 acres, at \$75.00; total.....	525 00
Total	\$20,090 50
Less difference between items and lump sum.....	90 50
Total	\$20,000 00
Inspection	1,123 41
Engineering	1,500 00
Total cost of road.....	\$22,623 41
Lump sum, contract price.....	\$20,000 00
Amount allowed by State.....	22,623 41
Forty per cent. of above, State's share.....	\$9,049 36
Less credit by cost of inspection already paid by State.....	1,123 41
Total	\$7,925 95
Less previous payment.....	2,925 12
Amount due by State.....	\$5,000 83
Maximum grade before	15 per cent.
Maximum grade after	7.5 per cent.

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

GEORGE D. COOPER,
Engineer.
R. J. DELANEY,
Inspector.

OCEAN COUNTY.

South Eighth Street, .543 Mile Long.

This road begins at Bay avenue, just described, and extends northwesterly to the Long Beach turnpike bridge. It is graded to a width of thirty-three feet, and covered with gravel in the center for a width of twenty-four feet and to a depth of eight inches in the center and four inches on either side.

The completion of this work gives the inhabitants of Beach Haven and Long Beach, as far as the line of Surf City, an easy and convenient mode of reaching the mainland over the toll bridge. Until the completion of this road to the bridge, the inhabitants of Long Beach had no means of reaching the mainland except by railroad or by boat. By the completion of this improvement this is all changed, and now vehicles may freely pass to and fro from the mainland to the bridge.

COMMISSIONER OF PUBLIC ROADS.

The freeholders of Ocean county very wisely presumed that the building of roads by the State and county between the mainland and the beaches increases the ratables of the county more rapidly than any other means that they can employ.

Detailed statement of the cost of the South Eighth street road, township of Long Beach, County of Ocean.

- Total length, 2,867 feet, or .543 mile.
- Kind of pavement, gravel.
- Width of paved way, 24 feet.
- Length of paved way, 2,867 feet.
- Depth, 8 inches at crown; 4 inches at shoulders.
- Width between slopes or curbs, 33 feet.

Foundation, type, salt hay covering, 11,692 square yards, at 2 cents; total	\$233 84
Surface, type "I," gravel "A," 1,660 cubic yards, at \$2.20; total....	3,652 00
Earth excavation, 842 cubic yards, at 50 cents; total.....	421 00
Foreign material for sub-grade, 3,230 cubic yards, at 48 cents; total,	1,550 40
Sod retaining walls, 623 cubic yards, at \$1.00; total.....	623 00
Six-inch vitrified pipe culverts, 90 lineal feet, at 35 cents; total....	31 50
Twelve-inch vitrified pipe culverts, 112 lineal feet, at 75 cents; total,	84 00
2,287 feet B. M. L. L. Y. pine for railroad crossings, at 7½ cents; total	171 52
Grubbing, one-third acre, at \$60.00.....	20 00
Total	\$6,787 26
Inspection	117 00
Engineering	*300 00
Total cost of road.....	\$7,204 26
Lump sum, contract price.....	\$6,787 26
Amount allowed by State.....	7,204 26
Forty per cent. of above, State's share.....	2,881 26
Less credit by cost of inspection already paid by State.....	117 00
Amount due by State.....	2,764 70
Maximum grade before	1 per cent.
Maximum grade after	1 per cent.

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

WM. H. FORD,
Engineer.
SAMUEL STRATTON,
Inspector.

* On account of other work at the same place a special price of \$275 was made, to which \$25 was added on account of grade crossing hearings.

TWENTY-FIRST ANNUAL REPORT

Bay Avenue, First Section, 3.258 Miles Long. Bay Avenue, Second Section, 3.253 Miles Long. Long Beach Township.

This improvement extends along Long Beach and connects the thriving borough of Beach Haven with the Long Beach turnpike bridge. The improvement covered by these two sections begins at the northeast borough line of Beach Haven and extends thence northeasterly to the south borough line of Surf City.

The demands of the rapidly growing population of Beach Haven made the construction of this road almost a necessity, as Long Beach is composed of nothing but sand and the natural soil is practically impassable for automobiles or, in fact, any other vehicle except a very light horse-drawn one.

The road was graded to a width of thirty-three feet, and was covered with gravel for a width of twenty-four feet and to a depth of eight inches in the center and four inches at either side.

What was an almost impassable wagon track is now converted into a smooth, hard highway, and is of very great value to the whole beach.

First section not yet paid for.

Detailed statement of the cost of the Bay avenue, Second Section, road, township of Long Beach, county of Ocean. Total length, 17,175 feet, or 3.253 miles.

Kind of pavement, gravel.
Width of paved way, 24 feet.
Length of paved way, 17,175 feet.
Depth, 8 to 4 inches.
Width between slopes or curbs, 33 feet.

Embankment, 22,531 cubic yards, at 35 cents; total.....	\$7,885 85
Sod retaining wall, 2,116 cubic yards, at 50 cents; total.....	1,058 00
Grubbing, 5.6 acres, at \$35.00; total.....	196 00
Salt hay covering, 62,975 square yards, at 1½ cents; total.....	944 63
Gravel, type "A," 8,479 cubic yards, at \$1.99; total.....	16,873 21
Earth excavation, 8,313 cubic yards, at 35 cents; total.....	2,909 55
Under drain, type (cross) 12-inch, 40 lineal feet, at 25 cents; total..	10 00
Under drain, type (cross) 6-inch, 920 lineal feet, at 25 cents; total..	230 00
Total cost by items.....	\$30,107 24
Plus difference between sum of items and lump sum.....	444 57
Total	\$30,551 81
Inspection	505 80
Engineering	916 55
Total cost of road.....	\$31,974 16
Lump sum, contract price.....	\$30,551 81
Amount allowed by State.....	31,974 16
Forty per cent. of above, State's share.....	\$12,789 66
Less credit by cost of inspection already paid by State.....	505 80
Amount due by State.....	\$12,283 86

COMMISSIONER OF PUBLIC ROADS.

Maximum grade before..... per cent.
 Maximum grade after..... .25 per cent.

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

I. H. CRAMER,

Engineer.

SAMUEL C. STRATTON,

Inspector.

Lakehurst-Brown's Mills Road, Western Section B, 1.624 Miles Long.

This is the completion of the Lakehurst-Brown's Mills road in Ocean county, and begins at the western end of the eastern section and extends thence westerly to the Burlington county line. It is graded to a width of thirty-three feet, and is paved with gravel for a width of twenty-four feet, with a consolidated depth of nine inches in the center and three inches on either side.

This is the last link in the through line from Camden to Lakehurst and the seashore by way of Mount Holly and Pemberton.

This road marks a very great change in the highways of the pine section of the State. The old road was nothing more than a wagon track through the pines and it was almost impassable for automobiles. Now this is all changed and we have a smooth, hard and convenient surface over which travel is practically unimpeded.

The maximum grade was reduced from 2.8 per cent. to .8 per cent. This was caused by the cutting down of a number of short, sharp hills and the filling of several old bogs.

Detailed statement of the cost of the Lakehurst-Brown's Mills, Western Section B, township of Manchester, county of Ocean. Total length, 8,574 feet, or 1.624 miles.

- Kind of pavement, gravel.
- Width of paved way, 24 feet.
- Length of paved way, 8,574 feet.
- Depth, 9 to 3 inches.
- Width between slopes or curbs, 33 feet.

Gravel, 3,763 cubic yards, at \$1.85; total.....	\$6,961 55
Earth excavation, 4,135 cubic yards, at 40 cents; total.....	1,654 00
Under drain, type tile, 100 lineal feet, at 30 cents; total.....	30 00
Turfing slopes, 154 square yards, at 20 cents; total.....	30 80
Grubbing, 6½ acres, at \$100.00; total.....	650 00
Plus the difference between items and lump sum bid.....	400 00
	<hr/>
Contract price	\$9,726 35
Less amount for tile drain not laid.....	30 00
	<hr/>
Total	\$9,696 35

TWENTY-FIRST ANNUAL REPORT

Extras paid entirely by the county—	
Gravel, 27 cubic yards, at \$1.85; total.....	\$86 95
Earth excavation, 2,329 cubic yards, at 40 cents; total	931 60
Turfing slopes, 742 square yards, at 20 cents; total	148 40
	\$1,166 95
Inspection	265 75
Engineering	291 79
	Total
	\$10,253 89
Extras paid entirely by county.....	1,166 95
	Total cost of road.....
	\$11,420 84
Lump sum, contract price.....	\$9,726 35
Amount allowed by State.....	10,253 89
Forty per cent. of above, State's share.....	\$4,101 56
Less credit by cost of inspection already paid by State.....	265 75
	Amount due by State.....
	\$3,835 81
Maximum grade before.....	$2\frac{1}{10}$ per cent.
Maximum grade after.....	$\frac{8}{10}$ 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.
WM. PITTIS,
Inspector.

PASSAIC COUNTY.

Valley Road, 3.146 Miles Long.

This road begins at the city line of Paterson and extends south-westerly to the Essex county line at Montclair Heights. The road is one of great importance as a through line between Paterson, Montclair and the Oranges. It follows along the lower slopes of the First Watchung Mountain and ends at the grounds of the State Normal School at Upper Montclair. The road itself is a very fine piece of work, being composed, as it is, of a heavy macadam base, with a hot mixed bituminous concrete top.

The width of the graded roadway is thirty feet, and that of the pavement twenty feet, and the thickness of the finished pavement is six inches.

The maximum grade was reduced from 7 per cent. to 5 per cent. As many of these 5 per cent. grades were very long, it was necessary to pave the gutters, in order to protect them from the wash.

COMMISSIONER OF PUBLIC ROADS.

Detailed statement of the cost of the Valley road, township of Acquackanonk, county of Passaic. Total length, 16,612 feet, or 3.146 miles.

Kind of pavement, type "G."
 Width of paved way, 20 feet.
 Length of paved way, 16,612 feet.
 Depth, 6 inches.
 Width between slopes or curbs, 30 feet.

Foundation, type "C," 6,910 square yards, at \$2.25; total.....	\$15,547 50
Foundation, type filler, 2,000 square yards, at \$1.69; total.....	3,380 00
Surface, type "G," 38,225.5 square yards, at \$1.05; total.....	40,136 77
Dry walls, 628.5 cubic yards, at \$4.50; total.....	2,828 25
Earth excavation for drains, 857 cubic yards, at 79 cents; total.....	677 03
Earth excavation outside road, 366 cubic yards, at 59 cents; total..	215 94
Earth excavation, 13,711 cubic yards, at 59 cents; total.....	8,089 49
Rock excavation, 100 cubic yards, at \$2.00; total.....	200 00
Corrugated metal pipe, 24-inch, 108 lineal feet, at \$3.00; total.....	324 00
Corrugated metal pipe, 12-inch, 60 lineal feet, at \$1.50; total.....	90 00
Gutter, type cobble, 1,340.4 square yards, at 79 cents; total.....	1,058 92
Gutter, type concrete, 6,271 square yards, at \$1.25; total.....	7,838 75
Plain concrete, 20 cubic yards, at \$8.00; total.....	160 00
Total	\$80,546 65
Inspection	675 20
Total	\$81,221 85
Engineering, paid entirely by county.....	3,450 00
Extras paid entirely by county for culverts and drains.....	8,874 64
Total cost of road	\$93,546 49
Lump sum, contract price.....	\$68,886 43
Amount allowed by State.....	81,221 85
Forty per cent. of above, State's share.....	\$32,488 74
Less credit by cost of inspection already paid by State.....	675 20
Amount due by State	\$31,813 54
Maximum grade before.....	7 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.

GARWOOD FERGUSON,
Engineer.
 THOMAS ARRASTIBIA,
Inspector.

Newark and Pompton Turnpike, First Section, 2.54 Miles Long.

This old turnpike had reached such a state that the freeholders of Passaic county were compelled to do something with it. As the road is a long, level stretch over the Passaic meadows, being straight and level, it was very much used, and, in consequence of this constant use, the county was spending from \$3,000 to \$6,000 per year in spreading stone upon the road, and yet the surface was never good for more than a few weeks at a time. Consequently, they decided to place a bituminous concrete top upon the road, at the same time widening the fill across the Passaic meadows. In many places this fill was not over twenty feet wide. It was therefore entirely too narrow to accommodate the travel; therefore, the whole roadway was widened to a minimum width of thirty feet, and upon it was placed a pavement of macadam covered with two inches of cold mix bituminous concrete.

The improvement begins at the Essex county line and extends to a point between Greenwood avenue and Beartown road just south of the Morris canal.

Detailed statement of the cost of the Newark and Pompton turnpike, First Section, road, township of Little Falls and Wayne, county of Passaic. Total length, 13,412 feet, or 2.54 miles.

Kind of pavement, type H, concrete asphalt.
 Width of paved way, 20 feet.
 Length of paved way, 13,412 feet.
 Depth, 6 inches.
 Width between slopes or curbs, 30 feet.

Foundation, type C, 7,238.6 cubic yards, at \$2.40; total.....	\$17,372 64
Surface, type H, 30,780.7 square yards, at \$1.08; total.....	33,243 16
Surface, type A, 743.39 square yards, at 40 cents; total.....	297 36
Dry rubble, 40 cubic yards, at \$3.00; total.....	120 00
Reinforced concrete, 36.7 cubic yards, at \$12.00; total.....	440 40
Earth excavation, 414 cubic yards, at 50 cents; total.....	207 00
Extra embankment, 7,838 cubic yards, at 70 cents; total.....	5,486 60
Under drain, type stone, 319 lineal feet, at 40 cents; total.....	127 60
Railing, 4,337.5 lineal feet, at 40 cents; total.....	1,735 00
Gutter, type cobbles, 16.6 square yards, at 80 cents; total.....	13 28
Small culvert, 1, at \$350.00; total.....	350 00
Jock joint, 48-inch pipe, 1,429 lineal feet, at \$5.40; total.....	7,716 60
Concrete, 1.7 cubic yards, at \$8.00; total.....	13 60
Extra fill, 583 cubic yards, at 70 cents; total.....	408 10
Manholes, 9, at \$45.00; total.....	405 00
Laying corrugated 48-inch pipe, 80 lineal feet, at \$2.75; total.....	220 00
Hemlock planking, 2,300 feet, B. M., at \$50.00; total.....	115 00
Total	\$68,271 34
Inspection	921 95
Total	\$69,193 29

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Engineering, paid entirely by county.....	2,550 00
Extras paid entirely by county, including 12-inch pipe, opening ditches, basins, fencing	738 10
Total cost of road.....	\$72,481 39
Lump sum, contract price.....	\$51,647 68
Amount allowed by State.....	69,139 29
Forty per cent. of above, State's share.....	\$27,677 32
Less credit by cost of inspection already paid by State.....	921 95
Amount due by State.....	\$26,755 37
Maximum grade before.....	3.5 per cent.
Maximum grade after.....	3 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.
THOMAS L. FARLEY,
Inspector.

Newark and Pompton Turnpike, Second Section, 2.116 Miles Long.

This road begins 600 feet north of the improvement just described, the intervening space being occupied by the approach to a bridge over the Morris canal and the Lackawanna railroad crossing. From this point it extends northerly along the valley of the Pompton river to the bridge across this river, marking the boundary between the counties of Passaic and Morris.

This road was graded to a width of thirty feet. The widening was also quite great in some places, owing to the fact that ledge rock and boulders had encroached very much upon the traveled way.

The pavement is of hot mix bituminous concrete, laid upon a macadam base, the total thickness of the completed pavement being six inches, composed of four inches of consolidated macadam, and two inches of bituminous concrete. The width of this pavement is twenty feet. As this road practically received the same amount of travel throughout its entire length, the comparative value of the hot and cold mix pavements can be most readily gained by an observation of the road under practically the same conditions of traffic.

These two sections complete the improvement of the Newark and Pompton turnpike for its entire length through Passaic county, with the exception of the 600 feet omitted at the canal and railroad crossing. This portion was omitted intentionally with the idea that eventually an overhead crossing would be constructed over the Lackawanna railroad, and also that it was extremely probable that in the near future the Morris canal bridge might be lowered or abandoned.

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Detailed statement of the cost of the Newark and Pompton turnpike, second section, township of Wayne, county of Passaic.

Total length, 11,175 feet, or 2.116 miles.
 Kind of pavement, bituminous concrete.
 Width of paved way, 20 feet.
 Length of paved way, 11,075 feet.
 Depth, 6 inches.
 Width between slopes or curbs, 30 feet.

Foundation, type "C," 5,620 square yards, at \$2.50; total.....	\$14,050 00
Surface, type "G," 24,978.5 square yards, at \$1.07; total.....	26,726 99
Surface, type entrances "A," 376.6 square yards, at 50 cents; total,	188 30
Earth excavation, 4,750 cubic yards, at 55 cents; total.....	2,612 50
Rock excavation, 501 cubic yards, at \$2.15; total.....	1,077 15
Under drain, type (stone), 5,491 lineal feet, at 55 cents; total.....	3,020 05
Under drain, type (tile), 5,105 lineal feet, at 8 cents; total.....	408 40
Gutter, type (cobble), 1,068 square yards, at 75 cents; total.....	801 00
Plain concrete, 64.4 cubic yards, at \$8.75; total.....	563 50
Reinforced concrete, 32.8 cubic yards, at \$12.00; total.....	393 60
Catch basins, 7; total.....	215 00
Vitrified pipe (24-inch), 82 lineal feet, at \$2.00; total.....	164 00
Vitrified pipe (12-inch), 826 lineal feet, at 85 cents; total.....	702 10
Cement pipe (18-inch), 594 lineal feet, \$2.20; total.....	1,306 80
Sawed railing, 1,957 lineal feet, at 45 cents; total.....	880 65
Small culverts, 2, at \$375.00; total.....	750 00
Sand binder, 593 cubic yards, at 75 cents; total.....	444 75
Total	\$54,304 79
Inspection	826 32
Engineering	1,100 00
Total	\$56,231 11
Extras paid entirely by county.....	1,290 00
Total cost of road	\$57,521 11
Lump sum, contract price.....	\$44,620 74
Amount allowed by State.....	56,231 11
Forty per cent. of above, State's share.....	\$22,492 44
Less credit by cost of inspection already paid by State.....	826 32
Amount due by State	\$21,666 12
Maximum grade before	7 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.

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

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SALEM COUNTY.

Pedricktown-Pennsgrove Road, 4.097 Miles Long.

This road begins at Pedricktown and extends to Pennsgrove, thus completing the chain of improved roads along the Delaware river from Camden to Pennsgrove, from which point the ferry crosses the Delaware river to Wilmington. The road is, therefore, of much more than local importance; in fact, it might be a portion of a through State line, furnishing, as it does, the completion of an improved outlet from Delaware through New Jersey to the seacoast.

The portion in Pedricktown, 4,100 feet long, is paved for a width of sixteen feet and to a depth of five inches, with pavement consisting of a concrete base covered with a one-inch bituminous top. The remainder of the road is graveled to a width of twenty feet, and to a consolidated depth of eight inches. The entire road was graded for a width of thirty feet.

There were a few sharp hills on this road which it was necessary to eliminate. This was done and the maximum grade, in consequence, was reduced from 10.37 per cent. to 1.50 per cent.

Detailed statement of the cost of the Pedricktown-Pennsgrove road, townships of Oldmans and Upper Penns Neck, county of Salem. Total length, 21,630.9 feet, or 4.097 miles.

Kind of pavement, concrete base, "EE" top, 0 to 41; gravel, 41 to 216 + 76 (end.)		
Width of paved way, concrete base, "EE" top, 16 feet; Gravel, 20 feet.		
Length of paved way, 21,593 feet.		
Depth, concrete base, 4 inches; "EE" top, 1 inch; gravel, 12 inches loose, 8 inches compacted.		
Width between slopes or curbs, 30 feet.		
Foundation, type "AA," 7,999 square yards, at 85 cents; total.....		\$6,799 15
Surface, type "EE," 7,999 square yards, at 40 cents; total.....		3,199 60
Gravel, 8,771 cubic yards, at \$1.95; total.....		17,103 45
Earth excavation, 16,168 cubic yards, at 44 cents; total.....		7,113 92
Underdrains, cast iron pipe as follows:		
48-inch pipe, 34 feet, at \$14.40; total.....	\$489 60	
Added to make lump sum bid.....	28 80	
		518 40
42-inch pipe, 42 feet, at \$11.25; total.....		472 50
36-inch pipe, 6 feet, at \$8.45; total.....		50 70
24-inch pipe, 112 feet, at \$4.50; total.....		504 00
14-inch pipe, 78 feet, at \$2.05; total.....		159 90
12-inch pipe, 34 feet, at \$1.70; total.....	\$57 80	
Added to make lump sum bid.....	3 40	
		61 20
6-inch pipe, 36 feet, at 80 cents; total.....		28 80
Concrete walls, 19.23 cubic yards, at \$7.00; total,		134 61
Gutters, concrete, 80 lineal feet, 4.16 cubic yards, at \$7.00; total....		29 12
Grubbing, $\frac{40}{100}$ acres, at \$200.00; total.....		80 00

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Materials for maintenance—	
200 tons, 1½ inch stone, at \$2.40; total.....	480 00
400 tons, ¾-inch stone, at \$2.40; total.....	960 00
200 tons screening, at \$2.40; total.....	480 00
Bituminous binder, 2,000 gallons, at 17 cents; total.....	340 00
Lump sum contract price.....	\$38,515 35
Extra pipe for drainage at station, 188 + 40 (orders 9-5-13)—	
36 feet of 6-inch pipe, at 80 cents per lineal foot; total....	\$28 80
Extra excavation and pavement at intersection of Railroad avenue (orders 10-3-13)—	
8.28 cubic yards, extra excavation, at 44 cents; total	\$3 64
49.67 square yards, "AA" base, at 85 cents; total,	42 21
49.67 square yards, "EE" top, at 40 cents; total..	19 86
	65 71
Extra strainers and intake at station, 8 + 66 (orders 10-3-13)—	
2 strainers, at \$11.39; total.....	\$22 78
2.58 cubic yards concrete, at \$7.00; total.....	18 06
	40 84
Extra stone shoulders, station 0 to 41 (orders 10-28-13)—	
4,009 lineal feet, at 20 cents; total.....	801 80
Extra ugite binder on part of concrete, approximately, station 3 to 41 (orders 10-31-13)—	
7,401 square yards, at .05 cents; total.....	370 05
Total	\$39,822 55
No maintenance materials to be furnished as required by contract (order 11-14-13)—	
200 tons, 1½-inch stone, at \$2.40; total.....	\$480 00
400 tons, ¾-inch stone, at \$2.40; total.....	960 00
200 tons screening, at \$2.40; total.....	480 00
2,000 gallons bituminous binder, at 17 cents; total,	340 00
	2,260 00
Total amount due or paid contractor.....	\$37,562 55
Inspection	599 70
Engineering	1,558 00
Total cost of road.....	\$39,720 25
Lump sum contract price.....	\$38,515 35
Amount allowed by State.....	39,720 25
Forty per cent. of above, State's share.....	\$15,888 10
Less credit by cost of inspection already paid by State.....	599 70
Total	\$15,288 40
Less credit by amount already paid by State.....	9,613 42
Amount due by State.....	\$5,674 98
Maximum grade before.....	10.37 per cent.
Maximum grade after.....	1.50 per cent.

COMMISSIONER OF PUBLIC ROADS.

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We do hereby certify that the above road is finished in all respects in practical compliance with the plans, specifications, and the orders issued by the engineer and approved by the State Commissioner of Public Roads and accepted by the contractor.

H. B. KEASBEY,
Engineer.
JOS. P. BARRETT,
LEVI C. JUSTICE,
Supervisors.

Quinton Road, 2.656 Miles Long.

This road begins at the Salem city line and extends to Quinton. It runs through a very fine fertile farming country. The surface had been kept in repair by the people of the township for a number of years, but the growing travel became so great that they felt that the county should take the road over and maintain it. This was consequently done and work was commenced in 1913, but it was not completed in time to report in 1913.

The road as graded has a width of thirty feet, and is covered with oyster shells for a width of eighteen feet and to a depth of twelve inches.

The road was originally improved with oyster shells and, as a consequence, the natives felt that they would prefer to have it improved with the same material. One reason for this desire was that oyster shells are very easily obtainable at the wharf in Salem, and though the road is not as durable as those covered with some other material, the lower first cost decided them to use this material in preference to any other in the improvement of the road.

Detailed statement of the cost of the Quinton road, township of Quinton and city of Salem, county of Salem.

Total length, 14,025 feet, or 2.656 mles.
Kind of pavement, shell.
Width of paved way, 18 feet.
Length of paved way, 13,698 feet.
Depth, 12 inches, loose measure.
Width between slopes or curbs, 36 feet.

Surface, type K, 27,396 square yards, at 51½ cents; total.....	\$14,108 94
Earth excavation, 1,440 cubic yards, at 40 cents; total.....	576 00
Extra material for fill, 1,242 cubic yards, at 40 cents; total.....	496 80
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Lump sum, contract price.....	\$15,181 74
Extra material (sand for drainage). orders 3-8-13.....	18 75
Extra material (curve at Quinton), orders 5-20-13.....	257 24
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Total	\$15,457 73
Inspection	387 00
Engineering	380 00
<hr/>	
Total cost of road.....	\$16,224 73
<hr/>	
Lump sum, contract price.....	\$15,181 74
Amount allowed by State.....	15,457 73

One-third of above, State's share.....	\$5,152 57
Less credit by amount already paid by State.....	3,709 85
	\$1,442 72
Amount due by State.....	\$1,442 72
Maximum grade before	2.20 per cent.
Maximum grade after	2.20 per cent.

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

H. B. KEASBEY,
Engineer.
J. EMMOR ROBINSON,
Inspector.

SOMERSET COUNTY.

Franklin Park and Kingston Road.

For description of above road see Middlesex county.

SUSSEX COUNTY.

Franklin Furnace-Stockholm Road, 5.476 Miles Long.

This road begins at Munson's Corner on the improved road extending from Hardyston township and thence follows a ravine up and over the Hamburg mountain to Stockholm. The road was commenced in 1910, but, owing to the many physical difficulties to be overcome, it was not completed and finally paid for until the early part of 1914.

The road as improved follows an entirely new line through the greater portion of its length, and, by so doing, avoids numerous grade crossings. This with the additional fact that the Erie railroad constructed a long overhead bridge at Beaver Lake over its tracks, and also a shorter overhead bridge about one mile further east, enabled us to eliminate six grade crossings, at the same time reducing the maximum grade over the mountain from 17½ per cent. to 6 per cent.

This, from a scenic standpoint, is one of the most beautiful roads improved by the State in recent years.

Detailed statement of the cost of the Franklin Furnace-Stockholm road, township of Hardyston, county of Sussex.

- Total length, 28,913 feet, or 5.476 miles.
- Kind of pavement, asphalt macadam.
- Width of paved way, 14 feet.
- Length of paved way, 28,849 feet.
- Depth, 7 inches.
- Width between slopes or curbs, 24 feet.

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Foundation, pavement, 4,421 square yards, at 77 cents; total.....	\$3,404 17
Foundation, pavement, 39,124 square yards, at 79½ cents; total....	31,103 58
Extra asphalt re-surfacing, lump sum; total.....	400 00
Earth excavation, 29,900 cubic yards, at 35 cents; total.....	10,465 00
Earth excavation, outside, 9,622 cubic yards, at 45 cents; total....	4,329 90
Rock excavation, 10,283 cubic yards, at \$1.00; total.....	10,283 00
Under drain, type, stone, 11 lineal feet, at 15 cents; total.....	1 65
Concrete, type, masonry, 43.64 cubic yards, at \$5.50; total.....	240 02
12-inch corrugated pipe, 1,044 lineal feet, at \$1.20; total.....	1,252 80
16-inch corrugated pipe, 170 lineal feet, at \$1.75; total.....	297 50
18-inch corrugated pipe, 146 lineal feet, at \$2.00; total.....	292 00
24-inch corrugated pipe, 54 lineal feet, at \$3.00; total.....	162 00
30-inch corrugated pipe, 68 lineal feet, at \$3.90; total.....	265 20
48-inch corrugated pipe, 60 lineal feet, at \$7.00; total.....	420 00
Total	\$62,916 82
Inspection	2,693 95
Engineering	2,700 00
Extras paid entirely by county.....	4,485 54
Total cost of road	\$72,796 41
Lump sum, original contract price.....	\$55,868 00
Amount allowed by State.....	62,916 82
Thirty-three and one-third per cent. of above, State's share.....	20,972 27
Maximum grade before	15 per cent.
Maximum grade after	6 per cent.

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

A. H. KONKLE,

Engineer.

EATON S. HALL,

MICHAEL J. HYDE,

Inspectors.

UNION COUNTY.

East Broad Street, Westfield, 1.20 Miles Long.

This improvement begins at Chestnut street in the town of Westfield and extends northeasterly to Springfield avenue. This is a different type of pavement from any that we have laid in the past, the foundation being of concrete, sixteen feet wide, over which was spread seventy-five pounds of one-inch stone per square yard before the concrete had set, thus forming a base into which the fine bituminous cement became thoroughly interlocked. This surface consists of fine half-inch stone coated with bitumen, carefully spread over the prepared concrete surface and thoroughly rolled and consolidated into place. This pavement has been completed nearly a year now and is in very fine condition. The width of the pavement thus described is sixteen feet, and its total thickness six inches. The road itself was graded to a width of thirty-six feet.

The importance of this improvement lies in the fact that it furnishes an outlet from the main street of Westfield towards Springfield and thence to Chatham and Morristown.

The change of this road is very marked as a portion of the old road, which was built over very swampy ground, was always in bad condition and full of ruts and holes. This is all changed and the pavement is now smooth, hard and convenient for travel at all seasons of the year.

Detailed statement of the cost of East Broad street, town of Westfield, county of Union. Total length, 6,300 feet, or 1.20 miles.

Kind of pavement, concrete with bituminous mortar surface.
 Width of paved way, 16 feet.
 Length of paved way, 6,300 feet.
 Depth, 6 inches.
 Width between slopes or curbs, 36 feet.

Foundation, type A-A, 1,883 cubic yards, at \$6.90; total.....	\$12,992 70
Foundation, type C, 300 square yards, at 45 cents; total.....	135 00
Foundation, paving entrances, 357 square yards, at 45 cents; total....	160 65
Surface, type E-E, 11,294 square yards, at 35 cents; total.....	3,952 90
Surface, type A, 300 square yards, at 25 cents; total.....	75 00
Earth excavation, 17,582 cubic yards, at 40 cents; total.....	7,032 80
Under drain, type French, 7,724 lineal feet, at 35 cents; total.....	2,703 40
Gutter, type cobble, 2,052 square yards, at 60 cents; total.....	1,231 20
Gutter, type stone block, 61 $\frac{1}{8}$ square yards, at \$2.00; total.....	122 67
Grubbing, lump sum.....	250 00
New culvert at station 14, lump sum.....	\$290 00
Repairing old culvert, lump sum.....	280 00
Relaying C. I. pipe culvert, station 37 + 7, lump sum....	20 32
Laying 12-inch C. I. pipe, 108 feet, at 25 cents; total..	27 00
Laying 12-inch T. C. pipe, 40 feet, at 30 cents; total....	12 00
Plain concrete for catch basins, 32.4 cubic yards, at \$7.50; total	243 00
Reinforced concrete for catch basins, 2.5 cubic yards, at \$8.00; total	20 00
C. I. covers for culverts and basins, 4,096 pounds, at 2.5 cents; total	102 40
Steel reinforcement for basins, 388 $\frac{1}{8}$ pounds, at 3 cents; total	11 65
Grouted cobble, 13.3 square yards, at \$1.00; total.....	13 30
New catch basins at cemetery entrance, 2, at \$25.00; total	50 00
	1,069 67
Total	\$29,725 99
Inspection	201 00
Engineering	890 28
	\$30,817 27
Total cost of road.....	\$30,817 27
Lump sum, contract price.....	\$28,960 15
Amount allowed by State.....	30,817 27
Forty per cent. of above, State's share.....	\$12,326 91
Less credit by cost of inspection already paid by State.....	201 00
	\$12,125 91
Amount due by State.....	\$12,125 91

COMMISSIONER OF PUBLIC ROADS.

Maximum grade before.....	8 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.

A. W. VARS,
Engineer.
EDWARD G. PINK,
Inspector.

Morris Avenue, East Section, 2.059 Miles Long.

The rebuilding of this old county road was made necessary by the great increase of traffic. The pavement was originally of telford and was laid in 1889. The old foundation was still good and was, therefore, used as the base of the new pavement. The pavement is of bituminous concrete and is laid twenty-one feet wide, but as there is a trolley track on either side, eighteen inches adjoining the rails was paid for by the trolley company, leaving eighteen feet as the portion paid for by the county and State.

This improvement begins at Stuyvesant avenue at the end of the pavement laid in 1912, and extends to a point near Battle Hill avenue, Springfield, at the end of a section formerly improved by the county. The bituminous concrete is eighteen feet wide, and the roadway is graded to a width of forty feet. There was no change made in the grade.

Detailed statement of the cost of the Morris avenue, East Section, townships of Union and Springfield, county of Union.

- Total length, 10,868.3 feet, or 2.059 miles.
- Kind of pavement, cold mixed (amiesite).
- Width of paved way, 18 feet.
- Length of paved way, 10,868.3 feet.
- Depth, 3 inches.
- Width between slopes or curbs, 40 feet more or less.

State and county's share of—

Roadway, scarified, 10,868 lineal feet, at 12½ cents; total..	\$1,358 50
Amiesite, 18,114½ square yards, at \$1.07; total.....	19,382 16
Crushed stone, 1,705½ tons, at \$1.80; total.....	3,070 20
Culvert at station 77+08, complete.....	135 00
Culvert at station 96, complete.....	225 00
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Total	\$24,170 86
Inspection	156 20
Engineering	317 50
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Total cost of road.....	\$25,244 56
Lump sum, contract price.....	\$23,002 66
Amount allowed by State.....	25,244 56
Forty per cent. of above, State's share.....	\$10,097 82
Less credit by cost of inspection already paid by State.....	156 20
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Amount due by State.....	\$9,941 62

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Maximum grade before.....	2.70 per cent.
Maximum grade after.....	2.70 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.
CONRAD HARTENSTEIN,
Inspector.

Morris Avenue, West Section, .779 Mile Long.

This is the last section of the old Morris turnpike, with the care and maintenance of which Union county is charged. The work of repaving commenced at the pavement laid last year and extends through Springfield to the trolley crossing, which marks the end of the portion assigned to Union county to maintain. From this point to the top of the Second Watchung Mountain the road belongs to Essex county, and it is hoped that it will repave the road the coming year, at the same time reducing the grade up the mountain.

Detailed statement of the cost of the Morris avenue, West Section, road, township of Springfield, county of Union. Total length, 4,115 feet, or 0.779 mile.

Kind of pavement, Type "H," amiesite.
Width of paved way, 14.6 to 21.4 feet.
Length of paved way, 4,115 feet.
Depth, 3 inches or more.

Crushed stone, 741.417 tons, at \$1.75; total.....	\$1,297 47	
Roadway scarified, 4,115 lineal feet, at .08½ cents; total.....	342 92	
Surface, type "H," amiesite, 6,907½ square yards, at \$1.04; total.....	7,183 63	
Two new basins, station 2 + 53 for drainage.....	52 50	
One pipe gutter, entrance altered, station 17 + 20.....	7 50	
Twenty-nine stone drains from pavement to gutter, at \$2.00; total..	58 00	
Excavating for widening foundation—		
274 hours labor, at 0.22½ cents; total.....	\$61 65	
36 hours, foreman, at 40 cents; total.....	14 40	
30½ hours, teams, at 61 cents; total.....	18 60	
Total	\$94 65	
Add 15 per cent. for profit.....	14 20	
		108 85
Old stone used for widening foundation, 387.5 tons, at \$1.00; total...	387 50	
Two manhole heads raised, \$6.00; 4 feet of 12-inch vit. pipe drain, \$2.00; total	8 00	
Total	\$9,446 37	
Inspection	117 00	
Engineering	485 00	
Total cost of road.....	\$10,048 37	
Lump sum, contract price.....	\$8,289 02	
Amount allowed by State.....	10,048 37	

COMMISSIONER OF PUBLIC ROADS.

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Forty per cent. of above, State's share.....	\$4,019 35
Less credit by cost of inspection already paid by State.....	117 00
	\$3,902 35

Grade unchanged.

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

J. L. BAUER,

Engineer.

MICHAEL CONNELLY,

Inspector.

WARREN COUNTY.

Blairstown-Columbia Road, 4.487 Miles Long.

This improvement begins at Blairstown and extends along a valley toward Columbia. The section completed forms about one-half of that necessary to reach the Delaware river and is of great value to the residents of Blairstown. When the whole work as projected is finished, it will form one of the main inlets to New Jersey from Pennsylvania.

The roadway is graded to a width of thirty feet, and sixteen feet in the center is macadamized to a depth of six inches. The improvement in alignment on this road is most marked. This, together with the cutting down of grades, has converted a crooked, hilly country road into a fine highway.

Detailed statement of the cost of the Blairstown-Columbia road, township of Blairstown, county of Warren. Total length, 23,691 feet, or 4.487 miles.

- Kind of pavement, macadam, gravel base.
- Width of paved way, 16 feet.
- Length of paved way, 23,691 feet.
- Depth, 6 inches.
- Width between slopes or curbs, 30 feet.

Foundation, type D, 42,118 square yards, at 27 cents; total.....	\$11,371 86
Surface, type A, 42,118 square yards, at 27 cents; total.....	11,371 86
Extra excavation outside road, 150 cubic yards, at 50 cents; total....	75 00
Earth excavation, 37,793 cubic yards, at 44 cents; total.....	16,628 92
Rock excavation, 4,960 cubic yards, at \$1.00; total.....	4,960 00
Under drain, type stone, 4,491 lineal feet, at 15 cents; total.....	673 65
Gutter, type cobble stone, 137 square yards, at 75 cents; total.....	102 75
768 lineal feet, 12-inch C. I. pipe, at \$1.60; total.....	1,228 80
476 lineal feet, 12-inch vit. tile, at 65 cents; total.....	309 40
72 lineal feet, 10-inch vit. tile, at 60 cents; total.....	43 20
4 lineal feet, 18-inch vit tile, at \$1.00; total.....	4 00
4 lineal feet, 16-inch vit. tile, at 80 cents; total.....	3 20
Extra concrete in culvert, 4 cubic yards, at \$6.50; total.....	26 00

Cost of road.....	\$46,798 64
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TWENTY-FIRST ANNUAL REPORT

Bridge, No. 1.....	\$2,550 00	
Bridges, Nos. 2 and 3.....	1,038 90	
Bridge, No. 4.....	471 90	
Station 186	26 00	
Cost of bridges		4,060 80
Total	\$50,859 44	
Inspection	371 40	
Engineering	2,495 45	
Total	\$53,726 29	
Extras paid entirely by county.....		344 08
Total cost of road.....		\$54,070 37
Lump sum, contract price.....	\$49,278 09	
Amount allowed by State on road and bridge.....	53,726 29	
Forty per cent. of above, State's share on road.....	\$19,866 20	
Twenty per cent. of above, State's share on bridge.....	812 16	
Total	\$20,678 36	
Less credit by cost of inspection already paid by State.....	371 40	
Amount due by State.....		\$20,306 96
Maximum grade before.....		15 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.

F. W. SALMON,
Engineer.
ISAIAH LANCE,
Inspector.

Lincoln Street, .379 Mile Long.

This is the connecting link between the Morris turnpike and the Belvidere road. It runs west from the Morris turnpike, just north of Phillipsburg and thus enables travelers up the Delaware valley to avoid the very steep hill at the Phillipsburg end of the Belvidere road.

The chief value of this improvement lies in the fact that it forms an easy, safe and convenient terminus to the River road up the Delaware, due to the fact that the maximum grade was reduced from 8 per cent. to 5 per cent.

Detailed statement of the cost of Lincoln street, townships of Morris and Po-hatcong, county of Warren. Total length, 2,000 feet, or .379 mile.

- Kind of pavement, water-bound macadam.
- Width of paved way, 16 feet.
- Length of paved way, 2,000 feet.
- Depth, 6 inches.
- Width between slopes or curbs, 30 feet.

COMMISSIONER OF PUBLIC ROADS.

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Foundation, type C, 3,695.5 square yards, at 37 cents; total.....	\$1,367 33
Surface, type A, 3,695.5 square yards, at 26 cents; total.....	960 83
Earth excavation, 2,322 cubic yards, at 45 cents; total.....	1,044 90
Total	\$3,373 06
Inspection	49 00
Engineering	160 00
Total cost of road	\$3,582 06
Lump sum, contract price.....	\$3,357 88
Amount allowed by State.....	3,582 06
Forty per cent. of above, State's share.....	\$1,432 82
Less credit by cost of inspection already paid by State.....	49 00
Total	\$1,383 82
Twenty per cent. (State's share of bridge)—\$572.32=\$114.46.....	114 46
Amount due by State	\$1,498 28
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.

F. W. SALMON,
Engineer.
JOHN J. STANLEY,
Inspector.

Asbury-Washington Road, 5.797 Miles Long.

This road improvement was commenced in 1911, but was not completed until too late last year to be reported. The work began at the Washington borough line and extended southerly to the bridge over the Musconetcong at Hunterdon county line at Imlaydale, with a longer branch westerly to Asbury. Much of the material which, on the surface appeared to be earth, was found to be rock when the excavation was carried a few feet below the surface. This added greatly to the cost and also to the time necessary to complete the job. It is one of the important sections of the improved line from central New Jersey to the Delaware Water Gap. The importance of the line was recognized seventy-five years ago, when the Spruce Run turnpike was incorporated to meet the demands of through travel. The value of the road was much increased by reducing the maximum grade from 9 per cent. to 5 per cent. Forty-five per cent. of the cost of this improvement was for grading and drainage.

Detailed statement of the cost of the Washington-Asbury road, townships of Washington and Franklin, county of Warren. Total length, 30,609 feet, or 5.797 miles.

Width of stone bed, 14 feet.
Length of stone bed, 30,499 feet.
Depth of stone bed, 6 inches.

TWENTY-FIRST ANNUAL REPORT

Macadam (with asphaltum binder), 47,569 square yards, at 77 cents; total,	\$36,628 13
Earth excavation, 30,588 cubic yards, at 32 cents; total.....	9,788 16
Rock excavation, 10,918 cubic yards, at \$1.60; total.....	17,468 80
Cobble stone gutter, 3,312 square yards, at 75 cents; total.....	2,484 00
Underdrain, 7,251 lineal feet, at 12 cents; total.....	870 12
18-inch cast iron pipe, 30 lineal feet, at \$2.15; total.....	64 50
16-inch cast iron pipe, 90 lineal feet, at \$2.00; total.....	180 00
12-inch cast iron pipe, 90 lineal feet, at \$1.50; total.....	135 00
<hr/>	
Total	\$67,618 71
Inspection	1,014 00
Engineering	3,380 00
Extras paid by county.....	622 00
<hr/>	
Total cost of road.....	\$72,634 71
Lump sum, contract price.....	\$49,306 80
Total allowed by State.....	67,618 71
One-third cost of road, amount paid by the State.....	\$22,539 57
Bridge at Imlaydale, one-fifth, cost of Warren county's, one-half of \$8,285	828 50
<hr/>	
Total paid by State.....	\$23,368 07
Maximum grade before.....	9 per cent.
Maximum grade after.....	5 per cent.

F. W. SALMON,
Engineer.

Description and Statement of Cost of Bridges Constructed in 1914

HUNTERDON COUNTY.

Imlaydale Bridge.

This bridge over the Musconetcong river joins the Hampton borough road of Hunterdon county with the Warren county road leading to Asbury. The bridge is a reinforced concrete structure of two spans of seventy-five feet each, and a clear roadway of twenty-four feet four inches.

Detailed statement of the cost of the Imlaydale bridge over the Musconetcong river, connecting counties of Hunterdon and Warren.

Kind of bridge, reinforced concrete arch.
Width of paved way, 24 feet 4 inches.
Length of span, 75 feet.
Number of spans, two.

Details of extras on Imlaydale bridge—

2 spandrel walls.....	46.3	cubic yards.	
2 footings in wing walls, Hunterdon county side...	12.25	" "	
2 wing walls, Hunterdon county side	9.75	" "	
1 wing wall, Warren county side	2.25	" "	
1 wing wall, Warren county side	6.8	" "	
Coping	1.8	" "	
Posts .....	.5	cubic yard.	
	79.65	cubic yards, at \$6.50; total,	\$517 72
In foundation, 90.41 cubic yards concrete, at \$11.00; total.....			994 51
42 feet, 6 inches railing, at \$1.00; total.....			42 50
Extra name plate.....			50 00
Extra reinforcement, 2,000 pounds, at 3 cents; total.....			60 00
Oiling macadam, 334 square yards, at 12 cents; total.....			40 08
			\$1,704 81
Extras paid entirely by county.....			8,285 00
Lump sum, contract price of bridge.....			\$9,989 81
			\$8,285 00
Lump sum, contract price of bridge.....			203 89
Inspection			\$8,488 89
Amount allowed by State.....			(61)

TWENTY-FIRST ANNUAL REPORT

Twenty per cent. of above, State's share.....	\$1,697 78
Less credit by cost of inspection already paid by State.....	203 89
	\$1,493 89

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

GRANT DAVIS,
Hunterdon County Engineer.
F. W. SALMON,
Warren County Engineer.
JAMES W. BOGART,
Inspector.

MIDDLESEX COUNTY.

Noe's Creek Bridge.

Forming a part of the Roosevelt-Woodbridge road, this bridge was constructed over Noe's creek in the borough of Roosevelt. The construction is of I-beams, encased in concrete with a slab floor, supporting the full pavement of the road.

The foundation is of piling firmly driven, upon which the concrete abutments are constructed.

The span is twenty-six feet, with a clear roadway of thirty feet.

Detailed statement of the cost of the Noe's Creek bridge, on the Roosevelt-Woodbridge road, borough of Roosevelt, county of Middlesex. Total length of bridge, 29 feet 8 inches.

- Kind of pavement over bridge, bituminous mortar, same as road to be built by road contractor.
- Width of bridge, 30 feet, clear.
- Length of span, 26 feet, clear.
- Number of spans, 1.

Type of bridge—concrete slab, encased I beams.	
Contract price	\$3,479 82
Extra	
	\$3,479 82
Total cost	\$3,479 82
Inspection	120 00
	\$3,599 82
Total cost of bridge.....	\$3,599 82
Lump sum, contract price.....	\$3,479 82
Amount allowed by State.....	3,479 82
Twenty per cent. of above, State's share.....	695 96

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

ALVIN B. FOX,
Engineer.
FREDERICK F. SIMONS,
Inspector.

COMMISSIONER OF PUBLIC ROADS.

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 1, 1912, to October 1, 1913,	\$22,366 79
State's share	7,455 59
Total cost of repairs and maintenance October 1, 1913, to October 31, 1914	\$20,892 78
State's share	6,964 26

OCEAN COUNTY.

Fox Island Bridge.

Owing to the poor foundation, this bridge is constructed on heavy piling and consists of two short spans of eight feet six inches each, with a clear width of roadway of thirty feet. The full pavement of the road is carried on a reinforced concrete slab floor.

Detailed statement of the cost of the Fox Island bridge, Bay avenue (sec. 1), township of Stafford, county of Ocean. Total length, 19 feet.

- Width clear, 30 feet.
- Length of wing walls, each, 28 feet.
- Width at end of wing walls, 33 feet.
- Materials—
 - Foundation, piles, 18, 12 inches x 16 feet.
 - Foundation, piles, 20, 8 inches x 16 feet.
 - Triangular mesh reinforcement, 2,110 pounds.
 - Three-quarter-inch steel rods, 862 pounds.
 - Concrete, 68.5 cubic yards.

Contract price, by lump sum bid only.....	\$1,390 00
Engineering	41 70
<hr/>	
Total cost of bridge.....	\$1,431 70
Lump sum, contract price.....	\$1,390 00
Amount allowed by State.....	1,431 70
Twenty per cent. of above, State's share.....	286 34

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

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

WARREN COUNTY.

Bridges on Blairstown-Columbia Road.

There were three new bridges erected in the improvement of the Blairstown-Columbia road and one small addition in width to a stone arch bridge.

The largest of the new bridges is the single concrete arch over Jacksonburg brook. This is of reinforced concrete, with a span of thirty-five feet. The two small bridges each have a span of six feet, and are of the reinforced slab type. All have a clear width of thirty feet, with the full pavement of the roadway. These bridges formed a part of the road contract.

The cost of this bridge is included with the statement of cost of above road.

Bridge on Lincoln Street.

This small bridge of ten feet span is a part of the improvement of Lincoln street, connecting the Morris turnpike with the Belvidere road. The construction is a reinforced concrete slab, with a clear roadway of thirty feet. This bridge was a part of the road contract.

Detailed statement of the cost of the bridge at Station No. 10, on Lincoln street, connecting the Morris turnpike with the Belvidere road, county of Warren. Total length of bridge, 12 feet.

- Kind of pavement, macadam.
- Width of bridge, 30 feet.
- Length of span, 10 feet.
- Number of spans, 1.

Bridge	\$445 90	
Bridge railing	34 02	
Railroad rails	92 40	
	\$572 32	
Bridge included in road contract.		
Lump sum, contract price.....		\$572 32
Amount allowed by State.....		572 32
Twenty per cent. of above, State's share.....		114 46

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

F. W. SALMON,
Engineer.

NEW JERSEY STATE LIBRARY

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, 1913, to October 31, 1914, has been sent to the various authorities for repairs on the following roads:

<i>Name of Road.</i>	<i>County.</i>	<i>Amount.</i>
Adelphia-Asbury; Farmingdale-Lakewood; Manasquan-Belmar road	Monmouth	\$6,000 00
Adelphia-Southard-Lakewood road	Monmouth	200 00
Allamuchy road	Warren	2,000 00
Alloway-Quinton road	Salem	2,500 00
Approaches to Overhead Crossing, Midvale.....	Passaic	5,850 08
Basking Ridge road.....	Somerset	251 72
Bedminster-Bernardsville-Van Doren's Mills road.....	Somerset	2,000 00
Belleville turnpike	Hudson	15,000 00
Belleville turnpike	Hudson	3,529 79
Blackwell street, Dover.....	Morris	2,500 00
Bloomfield, Eagle Rock, Fairview, and Northfield avenues	Essex	25,000 00
Bordentown-Chamber's Corner road.....	Burlington	624 11
Bordentown-Crosswick's creek road.....	Burlington	1,906 71
Bound Brook-Somerville; Somerville-North Branch-Hunterdon county line road.....	Somerset	2,500 00
Bridgeboro-Westfield road	Burlington	4,482 18
Browning lane	Camden	1,200 00
Browning road and Kaighn avenue.....	Camden	2,200 00
Brunswick pike	Mercer	6,000 00
Brunswick pike	Mercer	4,000 00
Burlington pike	Burlington	1,238 06
Burlington-Camden county line.....	Burlington	8,867 29
Buttville, grade elimination.....	Warren	2,000 00
Canton-Hancock's Bridge road.....	Salem	1,000 00
Cedar Brook road.....	Camden	4,500 00
Centertown pike	Burlington	305 00
Church road, Blackwood pike, River road, Coffin's Corner road, and Ashland road.....	Camden	14,500 00
Clifton avenue	Passaic	1,800 00
Colling's road, West end.....	Camden	2,000 00
County roads	Cumberland	500 00
Cranbury turnpike	Middlesex	108 00
Cranbury turnpike, New Brunswick-Mercer county line	Middlesex	4,500 00
Crosswick's Creek-Bordentown	Burlington	750 00
Crown Point road.....	Gloucester	5,000 00
Delanco road	Burlington	30 00

<i>Name of Road.</i>	<i>County.</i>	<i>Amount.</i>
Denville-Pine Brook road.....	Morris	8,000 00
Denville-Pine Brook road.....	Morris	5,000 00
East State street.....	Mercer	1,000 00
Eatontown-Long Branch; Cedar avenue; Monmouth Boulevard; Westwood road; Park avenue.....	Monmouth	6,000 00
Flemington-White House road.....	Hunterdon	2,000 00
Flemington-White House road.....	Hunterdon	2,000 00
Franklin Furnace-Stockholm	Sussex	1,000 00
Franklin turnpike, fifth section.....	Bergen	13,400 00
Franklin turnpike, fifth section.....	Bergen	13,000 00
Franklin Park-Three Mile Run.....	Middlesex	2,000 00
Franklin-Ogdensburg	Sussex	1,000 00
Freehold-Adelphia; Freehold-Manalapan; Freehold- Smithburg	Monmouth	6,000 00
Freehold-Eatontown road.....	Monmouth	500 00
Freehold-Manalapan-County line.....	Monmouth	2,000 00
Freehold-Matawan; Tinton Falls-Colts Neck.....	Monmouth	5,000 00
Frenchtown-Milford-Spring Mills	Hunterdon	1,000 00
German Valley-Hackettstown road.....	Morris	4,000 00
Grand avenue, borough of Montvale.....	Bergen	500 00
Grand avenue and Middletown road, Montvale.....	Bergen	250 00
Greenwich roads	Cumberland	500 00
Gravel roads	Gloucester	600 00
Hackensack-Carlstadt road	Bergen	1,100 00
Hackettstown-Danville	Warren	2,000 00
Hamburg turnpike	Morris	500 00
Hancock's Bridge-Canton road.....	Salem	5,000 00
Hancock's Bridge-Canton road.....	Salem	5,000 00
Hancock's Bridge-Canton road.....	Salem	5,000 00
Highland Park-Metuchen road.....	Middlesex	1,000 00
Hill near Court House.....	Sussex	200 00
Holly Beach turnpike.....	Cape May	1,325 00
Holly Beach turnpike.....	Cape May	2,461 06
Holmdel road extension.....	Monmouth	500 00
Keyport-Holmdel-Middletown	Monmouth	500 00
Kings Highway-Haddon Heights, Westville.....	Camden	2,500 00
Kingston-Franklin Park	Somerset	500 00
Kingston-Somerville	Somerset	3,000 00
Kingston-Somerville; Bernardsville-Van Doren's Mills	Somerset	4,000 00
Knights Run road.....	Gloucester	2,000 00
Lafayette and Pascack road, Washington township..	Bergen	500 00
Lakewood-Toms River-Tuckerton road to county line..	Ocean	1,650 00
Lambertville-Flemington road	Hunterdon	3,507 20
Lambertville-Flemington road	Hunterdon	2,000 00
Landing-Port Norris road.....	Morris	2,000 00
Landis avenue extension.....	Cumberland	1,000 00
Landis township roads.....	Cumberland	250 00
Lawrence township	Cumberland	250 00
Lexington avenue	Passaic	3,000 00
Little Falls turnpike.....	Passaic	888 00
Liverpool avenue, Egg Harbor.....	Atlantic	500 00
Madison avenue	Morris	10,000 00
Main Shore road.....	Cape May	1,410 62
Main Shore road.....	Cape May	2,000 00
Main Shore road.....	Cape May	500 00
Main street	Passaic	4,203 11
Main street, borough of Woodstown.....	Salem	800 00

COMMISSIONER OF PUBLIC ROADS.

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<i>Name of Road.</i>	<i>County.</i>	<i>Amount.</i>
Main street, borough of Woodstown.....	Salem	200 00
Mansfield Square to Columbus.....	Burlington	1,999 84
Maple Shade School House-White Horse road extension	Mercer	700 00
Marlton pike	Camden	1,600 00
Mays Landing-Pleasantville road.....	Atlantic	18 00
Mays Landing-Pleasantville-Oil	Atlantic	750 00
Mendham-Morristown	Morris	2,000 00
Mercer county line-Bordentown.....	Burlington	5,933 54
Mercerville-Edinburgh	Mercer	1,850 00
Mercerville-Edinburgh road	Mercer	500 00
Metlars lane to New Market road.....	Middlesex	2,230 10
Metuchen-Menlo Park-Iselin-Rahway	Middlesex	6,000 00
Metuchen-Perth Amboy	Middlesex	2,500 00
Midvale and Greenwood Lake road.....	Passaic	302 00
Midvale and Greenwood Lake road.....	Passaic	3,500 00
Millstone-New Brunswick	Somerset	1,000 00
Mine Brook road, Smith contract, Bernards township..	Somerset	2,806 08
Mine Brook road, Pine contract, Bernards township..	Somerset	2,353 74
Approach to Morgan station bridge.....	Middlesex	2,500 00
Morris Plains road.....	Morris	5,000 00
Morristown and Bernardsville road.....	Morris	5,000 00
Morristown and Bernardsville.....	Morris	1,000 00
Morristown-Mendham road	Morris	2,000 00
Morristown-New Vernon	Morris	2,000 00
Morris turnpike	Warren	6,000 00
Morris turnpike	Morris	2,623 42
Mountain View road.....	Passaic	2,000 00
Mount Holly-Moorestown	Burlington	3,970 47
Mount Holly-Moorestown	Burlington	7,284 43
Mount Kip road.....	Hunterdon	2,901 38
Mount Laurel end Hartford-Fairview road.....	Burlington	1,000 00
Mullica river-Ocean county line.....	Burlington	935 21
Neshanic road	Somerset	500 00
Newark turnpike	Hudson	2,509 32
Newark turnpike	Hudson	7,500 00
Newark turnpike	Hudson	3,000 00
Newark turnpike	Hudson	2,185 93
New Brunswick turnpike.....	Warren	3,000 00
Newton-Branchville	Sussex	5,000 00
Newton-Stanhope road	Sussex	2,000 00
North avenue	Union	7,000 00
North avenue	Union	11,000 00
North avenue	Union	6,000 00
Ocean Highway	Burlington	485 80
Oceanic-Navesink bridge approach.....	Monmouth	1,000 00
Ocean View-Seaville	Cape May	1,000 00
Park avenue, Metuchen to Plainfield.....	Middlesex	2,000 00
Passaic avenue	Hudson	8,798 53
Passaic avenue	Hudson	3,700 00
Passaic avenue	Hudson	4,800 00
Paterson and Hamburg turnpike.....	Passaic	6,522 88
Paterson and Hamburg turnpike.....	Passaic	3,728 00
Paulsboro and Swedesboro road.....	Gloucester	2,000 00
Peapack-Gladstone	Somerset	1,000 00
Penns Neck-Princeton road.....	Mercer	1,500 00
Pennsville road	Salem	500 00
Pennsville-Penns Grove	Salem	1,000 00

<i>Name of Road.</i>	<i>County.</i>	<i>Amount.</i>
Petersburg-Ocean City road.....	Cape May	432 04
Phillipsburg-Belvidere	Warren	2,000 00
Pole Tavern-Malaga road.....	Salem	515 50
Polify road (Terrace avenue).....	Bergen	200 00
Repair bids, advertising.....		13 52
Ringoes-Woodsville	Hunterdon	1,000 00
River road	Passaic	4,000 00
River road-Beverly and Delanco.....	Burlington	5,000 00
River road	Burlington	2,000 00
River road	Bergen	750 00
River road	Mercer	1,000 00
River road, Edgewater borough.....	Bergen	2,000 00
River road, New Brunswick to Bound Brook.....	Middlesex	3,000 00
Rivervale road, borough of Rivervale.....	Bergen	1,600 00
Rockaway-Dover	Morris	2,000 00
Shrewsbury avenue, Middletown tpk., Water Witch Hill, Valley Drive, Red Bank-Rumson road.....	Monmouth	6,000 00
Smithville-Mullica river	Atlantic	500 00
Somerville-Bedminster	Somerset	2,000 00
South Amboy-Morgan road.....	Middlesex	502 06
South Amboy-Old Bridge road.....	Middlesex	2,000 00
South avenue	Union	7,000 00
South Amboy-Morgan Station road.....	Middlesex	575 70
Spring street, town of Newton	Sussex	200 00
State Highway, Southern division.....		3,042 89
State Highway, Central division.....		377 95
State Highway, Southern division.....		4,633 11
St. George's avenue, Rahway to Perth Amboy.....	Middlesex	5,000 00
Stanhope road	Sussex	1,100 00
Shelton-New Market road.....	Middlesex	1,000 00
Stevens' avenue, South Amboy.....	Middlesex	5,000 00
Stone roads, seal coat on stone.....	Gloucester	3,500 00
Stone roads	Gloucester	3,000 00
Stult's Corner-Prospect Plains road.....	Middlesex	2,000 00
Trenton-Allentown turnpike	Mercer	4,000 00
Trenton-Pennington-Hopewell	Mercer	4,000 00
Trenton-Princeton-Kingston	Mercer	2,000 00
Tuckahoe-Marmora	Cape May	1,000 00
Tuckahoe-Port Elizabeth road.....	Cape May	674 47
Tuttle's Corner-Layton and Branch.....	Sussex	1,900 00
Two Bridges road.....	Passaic	2,500 00
Union avenue	Passaic	1,000 00
Union avenue, Manchester township.....	Passaic	3,000 00
Union avenue	Middlesex	1,000 00
Union avenue	Middlesex	1,500 00
Union avenue, River road, Rogan's Corner, Perth Amboy	Middlesex	4,496 30
Union street, borough of Lodi.....	Bergen	1,400 00
Valley road	Morris	348 00
Washington avenue, Pleasantville.....	Atlantic	150 00
Washington street, Princeton.....	Mercer	2,000 00
Watchung road	Morris	47 50
Westville and Glassboro road.....	Gloucester	1,800 00
Westville and Glassboro road.....	Gloucester	4,000 00
White Horse pike, near Audubon.....	Camden	782 85
White Horse pike-Berlin-Waterford.....	Camden	8,000 00
White Horse pike.....	Camden	5,000 00
White Horse pike, Atco.....	Camden	1,000 00

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<i>Name of Road.</i>	<i>County.</i>	<i>Amount.</i>
White Horse pike, Smithville.....	Atlantic	500 00
Williamstown road	Gloucester	412 65
Road and bridge approach at Wreck pond.....	Monmouth	1,500 00
Wyckoff road, borough of Ramsey.....	Bergen	899 84
Wyckoff road	Bergen	1,000 00
Wyckoff road	Bergen	1,500 00
Wyckoff road	Bergen	2,550 00
Convict labor—Maintenance of prisoners (special).....		8,495 50
Total		<u>\$590,226 28</u>

REPAIRS FROM COUNTY FUNDS DURING THE YEAR 1914.

In some counties it is difficult to secure full returns; consequently, the figures in this table are approximate only. The amounts by counties are:

Atlantic, \$109,760.32; Bergen, \$138,846.44; Burlington, \$10,378.63; Camden, \$29,979.94; Cape May, \$30,050.16; Cumberland, \$2,190.25; Essex, \$210,941.16; Gloucester, \$20,747.17; Hudson, \$229,472.76; Hunterdon, \$16,844.04; Mercer, \$86,448.16; Middlesex, \$86,097.01; Monmouth, \$111,055.88; Morris, \$133,171.08; Ocean, \$6,141.79; Passaic, \$133,455.37; Salem, \$7,500.00; Somerset, \$21,782.92; Sussex, \$6,263.04; Union, \$34,546.81; Warren, \$29,568.26. Total, \$1,455,241.19.

Report

The work of the department during the past year is covered by the reports of the State Highway Engineer, the Division Engineers and the Chemist to the Geological Survey.

The requirements of the requisition laws have made necessary changes in the department's methods, which have resulted in some delays. These, however, have not been an excessive price for the safeguards and co-ordination secured by the new statute.

The importance of the road problem to the State, which was pointed out in the last report, and the changes in administrative methods needed to meet the ever increasing traffic on our roads, have been the subject of much careful study. A thorough revision of our road law has been attempted, under many difficulties, by this department, the last legislature having failed to provide a commission for the purpose. The work involved in the analysis of our own very voluminous legislation and in studying that of other states and nations has been very great. No funds were available for this purpose.

The system of reports from counties mentioned in the department's last report, while of some advantage, showed such various methods of accounting that general statistics, derived therefrom, lose much of their value. Such statistics are sorely needed in determining the efficiency of work done, in eliminating waste and in furnishing the data needed for proper design.

The business handled by the department is increasing daily, and for some time has exceeded in amount that which can be handled by the present force and in the present quarters. Any increase in office force would be unwise and unproductive without more room in which to do the work and to care for the ever increasing mass of samples, drawings, papers and documents. The necessary work of the department has increased very greatly in the last few years. Our work is now more extensive and more thoroughly done than in the past. The preliminary examination of details to avoid the very excessive extras, that were only too frequent some time ago, the system of allotting

motor vehicle money to certain special roads, of inspecting all work thus done and of auditing all accounts therefor before payment, instead of merely sending the money to the counties to be spent for road repairs without inspection of work or audit, the preliminary work on the State Highway System, the increase in bookkeeping needed to furnish a proper record as well as to meet the requirements of the law as to requisitions, and the work devolved on the department in connection with prison labor on roads, would have more than doubled the work done four years ago, even had there been no increase in the amount of money spent. This amount has about doubled in that time.

Such an increase as would be involved in the taking over of the State Highway System is beyond the physical capacity of the present office. It has become clearly evident that any such taking over will involve a considerable expense, if efficient maintenance is to be the rule. This expense will entail either a more or less complete withholding of State aid, both in improvement and repair, as heretofore given, or some considerable additional appropriations, as contemplated when the State Highway act was drawn.

Chemical and physical analyses are becoming more and more frequent and necessary. The laboratory in which this work has been done for some years is placed at the disposal of the Geological Survey and of the Road Department by the kindness of Colonel W. A. Roebling. It is, however, entirely inadequate for the work of to-day. The tests as now made of materials and products show the need not only of these examinations, but of extending them to other materials than those heretofore regularly tested. The building now used could not properly house the apparatus needed, much of which is of a very heavy type. The storage and proper care of samples on which contracts are based is physically impossible.

The last legislature was asked to legalize a system of inviting bids which would have allowed of obtaining offers on several kinds of pavement, the advertisement stating the exact preference which would be allowed to each type. Such a policy would have secured the widest possible competition, and its effect would have been specially felt in the so-called bituminous concretes. This measure failed of passage in the last hours of the session.

The department then adopted the plan of grouping all of the pavements of this type into one class and inviting bids on them in competition with each other. On account of the variations in the in-

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redients and physical structure, the attorney-general has advised the department that such a practice does not yield the competition required by law. The result is that the department either must exclude at least two of the most desirable types, make use of a closed specification or omit bituminous concretes entirely. All of these courses are objectionable.

Convict labor on roads has been carried on during the past year under unfavorable conditions. Several bills were introduced in the legislature to reform prison conditions, one of which concerned the special needs of convict work on roads. This bill was an important one, much needed by this department, and should have become a law, but it did not. The passage of the other bills and the failure of this one resulted in a conflict of authority and served but to aggravate the heretofore unsatisfactory conditions under which the road work was carried on, prevented the establishment of camps, and reduced the work largely to such as could be done from the prison and the existing camps. It is to be borne in mind that whatever loss of efficiency was thus involved was less costly on the whole than what would have probably ensued on an abandonment of the work and its resumption at some later date. Our experience shows clearly that for efficiency this class of road work must be done on the honor system. This plan has been successful elsewhere and can be made to give good results in this State, but further legislation is needed to provide the conditions necessary for its success.

The above, it is submitted, shows the need of new legislation. We are doing either too much or too little work in the department. We should either greatly reduce our force, limit the work and responsibility of the department to the mere distribution of State road moneys to the local governing bodies, and devolve on them the whole responsibility for the expenditure as well as for design and construction, or make the control exercised by the State more effective. The former seems a step in the wrong direction. The whole tendency of road legislation in this and other states is towards a more centralized control. Roads have become matters of general and no longer of merely local interest. Their importance and the large sums needed for improvement and upkeep render economy and efficiency in administration necessary. At the same time, due regard must be given to the principle of local self government.

State Highway Engineer's Report

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

DEAR SIR—There is one question that is demanding more and more attention as traffic increases, and that is what must we do to insure the safety of the traveling public. The department has long had this subject before it and has spent much time and thought on the solution of this problem. We were the first to establish a maximum percentage of grade, which should never be exceeded if it were economically practicable. This maximum was fixed at five per cent., for the purpose of not only facilitating traffic and the moving of the heaviest weights with the minimum expenditure of power, but also to promote the safety of the traveling public by reducing to a minimum the possibility of the vehicle becoming uncontrollable either in ascending or descending such grades. Two ascending grades are never permitted to intersect at an angle, but are connected by a vertical curve, in order to give the traveler upon the highway a view for some distance ahead and thus enable him to avoid a possible collision, thereby greatly increasing the safety of the road using public.

Increasing traffic demands wider pavements and roadways. The old rule of eight feet of width for each vehicle is no longer sufficient, and, with the advent of wider vehicles, it has been found necessary to increase this factor to nine feet; hence, as every pavement must be laid to accommodate travel in opposite directions at the same time, it has been found necessary to increase the width on roads used for heavy traffic to eighteen feet. A fact that is often lost sight of is that many accidents, especially to motor-driven vehicles, are caused by one of the front wheels running off of the hard pavement on to the soft shoulder, not only endangering the occupants of the vehicle, but also injuring the road.

In addition to the width of the pavement, the graded width of the roadway is also of prime importance in protecting life and limb. Many possible collisions have been avoided by the means afforded by a wide carriage-way. This is especially true at road intersections and at sharp changes of direction in the road. To reduce the possibility to a minimum, we have established a maximum degree of allowable curvature at six degrees, or the arc of a circle having a radius of 955 feet. This curve permits a clear view of 350 feet ahead on a road graded to a width of thirty feet. Where it was not possible to obtain this alignment, we have widened the pavement and roadway at these angle points, thereby greatly promoting the safety of the traveling public.

When we recall the many serious accidents that have occurred on steep hills, narrow roads, at road intersections and at sharp turns, it does not require much argument to prove the necessity for and wisdom of the rules laid down by the Department of Public Roads for the design of new roads or the improvement of old ones.

There is another problem to which the department is devoting constant attention; that is, railroad grade crossings. Upon every road presented for improvement, where the present highway crosses at grade, the problem of eliminating such grade crossings is carefully studied, and, wherever it is economically possible, the highway is carried under or over the railroad. The result of this work thus far is as follows:

In Sussex county seven grade crossings have been eliminated on State Aid roads.

In Passaic county one crossing has been eliminated, two widened and brought more nearly in line with the highway. The bringing of these bridges into closer alignment with the highway has added greatly to the safety and convenience of the traveling public.

In Warren county one grade crossing was removed and the highway carried under the railroad.

In Hunterdon county a narrow, crooked underneath crossing was replaced with one of double the width and in better conformity with the alignment of the highway.

In Union county the old line of the road was abandoned, a new line established and the highway carried underneath the railroad.

In Somerset county a grade crossing was replaced with a fine through truss bridge over the railroad.

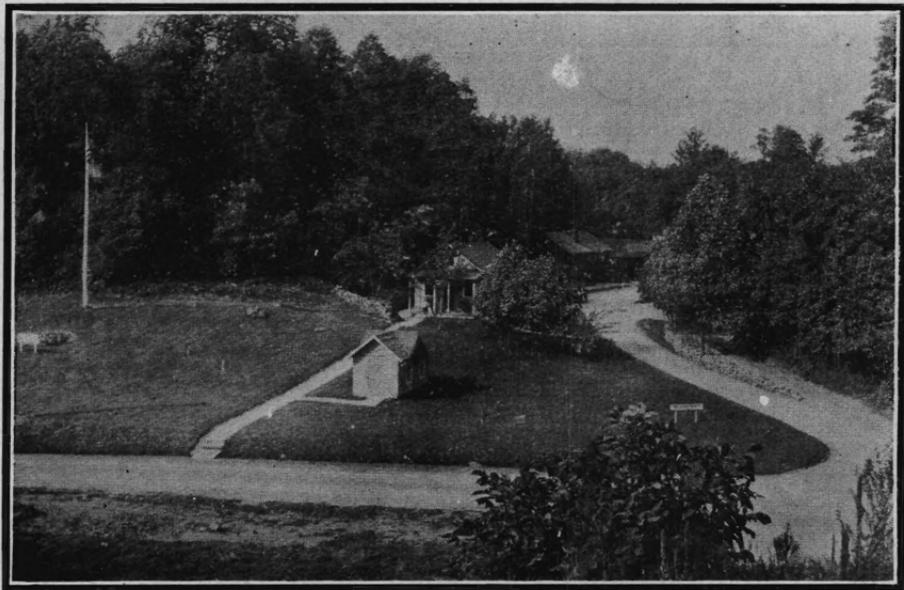
The plans for a road in Atlantic county have just been approved and arrangements entered into with the railroad company, whereby the highway will be carried over the railroad.

Thus the motto of this department in road design of safety first is being carried into execution.

Respectfully submitted,

R. A. MEEKER,

Engineer.



State Road Camp No. 1, Springdale, Sussex County.

Report from Northern Division

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

DEAR SIR—The wealthiest section of North Jersey, and, in fact, of any part of the State, is divided north and south by the meadows lying between the Hackensack and the Passaic rivers. These meadows are, in many places, thin crusts of earth under which lies a body of fluid material several feet deep.

The people of Bergen, Essex and Hudson have for several generations been endeavoring to build smooth roads running east and west upon these old swamps, and, were it not for the extensive resources of these counties and the extremely heavy traffic that passes daily over these roads, the amount expended would hardly be considered a good investment; but any person closely studying the situation will be convinced that it is necessary, in order to keep busy the thousands of factories that ship at least a part of their goods by these trucking roads.

Traffic counts on three of these roads show three thousand to fourteen thousand tons during the sixteen hours from 6 A. M. to 10 P. M., while traffic compiled in the same way for many of the State aid roads in outlying districts is less than two hundred tons.

Under these conditions of sub-foundation and traffic, the problem becomes like that which the railroads crossing these same meadows had to meet and overcome. The experience on these roads showed that the only permanent solution was to continue filling until a final settlement was reached and a sub-foundation provided for the road-bed at a level of not less than four feet above high water.

Essex and Hudson counties have finished the reconstruction of the old plank road on such a plan, and renamed it the Lincoln Highway.

Now, Hudson, likewise, has commenced a three or four year job raising the elevation of the Newark turnpike, which will also be relieved by the Belleville turnpike, already put in condition.

One of Bergen county's main meadow roads, the Paterson Plank road, is being put in order entirely by the county this year. Work is being done on the Fort Lee turnpike, also crossing meadow land and connecting Hackensack with New York City, but this road will not be opened to traffic through Fort Lee until the latter part of 1915. The Franklin turnpike is now completed from the New York State line to the Paramus Church south of Hohokus. Market street is open to traffic, completing the line from Hackensack to Paterson, but has not yet been accepted.

Passaic county has rebuilt a few stretches this year, mostly with asphaltic concrete. Much of the resurfacing on main roads is done by contract. Well-organized gangs of repair men are on the go from one road to another and keep them in fair condition all the year.

Essex county is endeavoring to improve the trunk lines leading out of Newark, all of which are being reconstructed on concrete foundations, with stone block, wooden block, and, further out into the country, asphalt concrete surfaces, with some of the latter laid on telford or crushed stone bases.

The patrol system tried out in 1913 has proven so successful that it is made permanent. The men work singly or in pairs and, as a rule, have a cart and one horse.

Union county has widened and resurfaced a few more miles of the old telford macadam roads with asphalt concrete, and is keeping all roads in good condition.

In Morris county there is a large mileage of thin pavements, only partially underdrained, which take about all the county and State moneys to keep them in passable condition. This is the result of trying, in the past, to get a large mileage instead of a few miles of well laid out and carefully built roads. Realizing this, the present county authorities have done remarkably well in fixing up the roads, and have also rebuilt underdrains and widened roads that had become dangerous through increasing traffic.

Warren county citizens were divided in opinion as to the most desirable roads to build next, so that nearly all of the road money went for repairs, which fact made it possible to do a little widening and to reduce the crowns on old pavements.

Sussex county has the stretch from Newton to Branchville under construction, and tourists may expect to travel it by next Fourth of July.

The men of State Road Camp No. 1 are doing good work in widening and improving the line of sight on the Newton-Stanhope road, but the work is of necessity slow, because a large part of the excavation is solid rock. A force of about forty-two men is maintained at the camp and only one man has escaped since January 1, 1914. This man was captured and returned to Trenton two days later.

In North Jersey the matter of shoulder work and the trimming of trees needs and receives constant attention from the State Department. Effort is being made, in the more progressive districts, to rid the gutters of obstructions such as pipes and bridges of various kinds at the entrances to private property. This frequently meets with violent opposition at the time, but after the work is finished all are pleased with the change. Wherever the counties can afford to do so, the open gutter intakes are removed and basins with side inlets are placed.

Summarizing the above, I would point out that the work, especially in the northeastern portion of the State, is practically confined to the reconstruction of roads heretofore partially improved; the removal of obstructions; the correction of alignment; the reduction of grades and the increasing of width. These, while unobjectionable in the past, have, under present day conditions, become dangerous.

The roads connecting such important centers as Paterson, Elizabeth, Newark and Jersey City will probably have to be ultimately paved with some type of block pavement on concrete or other firm foundation.

In such districts as Morris county the choice seems to lie between a bituminous concrete on a crushed stone or telford base and a Portland cement concrete. The former construction we have tested and found satisfactory. The latter has not been used extensively enough under our

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conditions to warrant general adoption. The limestone of northwestern New Jersey, for the present, seems to answer the general needs of travel in that portion of the State. Near the large towns, such roads should have some kind of a yearly dressing as a binding material to prevent raveling and dust.

The scientific solution of the problem can only be arrived at by thorough traffic census, carefully analyzed and compared with corresponding data, kept on a uniform and accurate system. Even in those counties where care is taken, the basis of accounting varies, and results obtained in one county are not comparable with those furnished by another.

Respectfully submitted,

E. M. VAIL,
Division Engineer.

Report from Central Division

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

DEAR SIR—The following is a report of some of the more important work accomplished in the Central Division during the past year:

In Hunterdon county the first section of the Flemington-Frenchtown road has been completed and work has been commenced on the second section. This is an important road, connecting Flemington with the Delaware river. The road has been completed from Lambertville, along the river, southerly to a point near the Mercer county line, and will be carried to the latter point when construction is started on the Mercer county section. A survey has been made of the road along the river in Mercer county from Washington's Crossing to the Mercer-Hunterdon county line, and construction will no doubt be started in 1915.

Several years ago, through the efforts of the Commissioner, a patrolman was placed on the Mercerville-Edinburgh road in Mercer county. I believe this has been instrumental in having the county adopt the patrol system, on a small scale, for the maintenance of its roads during the past year. They now have four (4) patrolmen in different sections of the county.

In Middlesex county a concrete road has been completed near the borough of Roosevelt. The construction was as follows: Concrete pavement, sixteen feet wide, eight inches deep in the center and six inches at sides; graded width, thirty feet. The mix was one—one and one-half—three, with expansion joints of three-ply tar paper fifty feet apart. The price for the concrete, exclusive of excavation, was ninety-five cents per square yard.

There has also been completed in this borough a bituminous concrete road of the Topeka type. The pavement was not less than two inches on a six-inch concrete base of one—two and one-half—five mix. The price for concrete foundation was sixty-eight cents per square yard, exclusive of excavation. The price of bituminous surface was sixty-nine cents per square yard.

In Ocean county some very important work was done; namely, the construction of the road from the upland near Manahawkin across the meadows to a toll bridge built by private capital, and from there to Long Beach and along Long Beach to Beach Haven. This is a very important piece of construction and is of great convenience to the many people traveling to this beach, as the only means of reaching it heretofore has been by a railroad, the service of which has not been extremely satisfactory.

Accompanying this report is a detailed statement of the work done at Convict Labor Road Camp No. 2, situated near Princeton. This is the work done from the time the work commenced at the camp, September, 1913, until October 31, 1914.

When the department was in charge of the feeding of the men, there were 28,114 portions served for a total cost of \$2,933.18, which is an average cost of ten and one-half cents per man per meal. The men were given wholesome and nourishing food, each man receiving a plentiful supply, and although the daily menus were alternated, the variety served at each individual meal was not great, as the following list might imply. The foods were served in diversified forms, such as soups, roasts, &c., and comprised potatoes, cabbage and other fresh and canned vegetables; oatmeal, corn meal, eggs and various kinds of fresh and salt meats and fish, as well as occasional desserts, such as pies, stewed prunes and apples, bread pudding, &c.

CONVICT LABOR CAMP No. 2—STATEMENT TO OCTOBER 31, 1914.

Princeton—Bolmer's Corner road, \$34,862.94; Blawenburg—Bolmer's Corner road, \$1,250.00; repairs and snow removal, \$316.20; value of materials unused, \$800.00. Total, \$37,229.14.

Road equipment cost, \$16,962.89; less 10 per cent. depreciation, 1 year, \$1,696.29. Total, \$15,266.60.

Camp equipment cost, \$5,966.06; labor, \$2,142.00. Total, \$8,108.06; less 5 per cent. depreciation, 1 year, \$405.40. Total, \$7,702.66.

Present value of equipment, \$22,969.26.

* Operating expense, as per statement, \$35,332.47.

Value received for above, \$37,229.14.

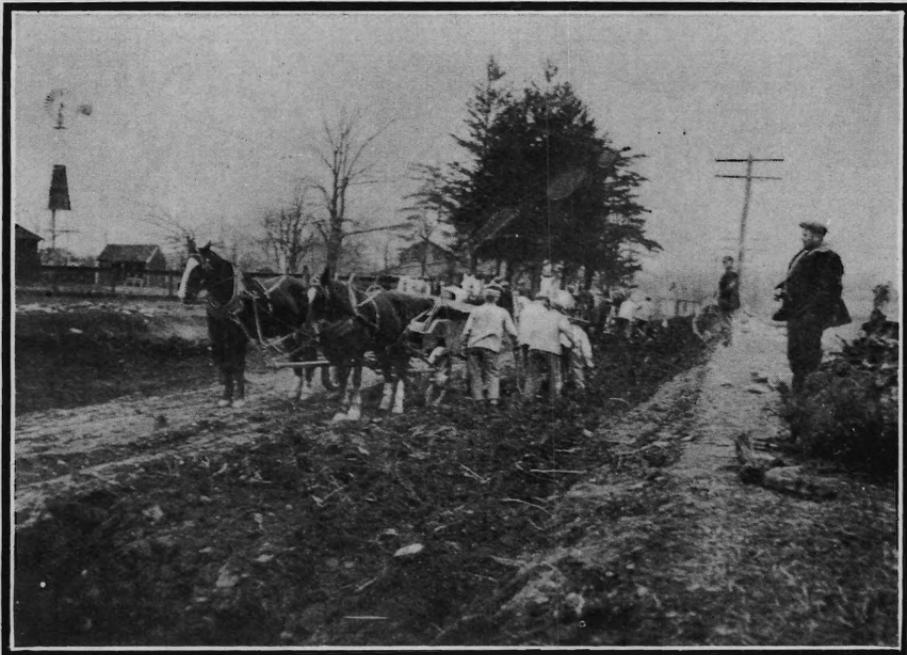
During the winter of 1913-1914, the department maintained the convicts at the camp and was under the expense of guarding, feeding and housing the men, when it was impossible to do any road work.

* This does not include charges for depreciation and other overhead debts, which amount to \$6,523.25, but which do not appear above. This is more than balanced by road work done which cannot be shown on detailed statement because of lack of engineering force to accurately determine quantities during progress of the work. Final quantities will be shown when work is completed.

STATEMENT OF THE CONVICT LABOR ON PRINCETON-BOLMER'S CORNER ROAD.

Value of road work done to October 31, 1914, at prevailing contract prices for similar work:

1,100 feet ditching in water, 18 inches x 2 feet, at 10 cents, \$110.00; 2,744 feet drainage through rock, 18 inches x 3 feet, at 35 cents, \$960.40; 163 cubic yards ditching, 4 feet x 5 feet, at 70 cents, \$114.10; 10,550 cubic yards excavation, shale and clay, at 70 cents, \$7,385.00; 7,450 cubic yards excavation, rock, at \$2.50, \$18,625.00; 13,000 lineal feet rough grade, 3,556 square yards sub-grade, 5,333 square yards foundation course macadam, 4 inches compacted, at 46 cents, \$2,453.18; 2,733 square yards surface course macadam, 4 inches compacted, at 50 cents, \$1,366.50; 1,640 lineal feet new wire fence (wire furnished), at 1 cent, \$16.40; 5¼ acres grubbing, heavy work, at \$250, \$1,437.50; 200 feet clearing ditches, 4 feet wide, at 5 cents, \$10.00; 2,643 tons trap rock, crushed and delivered



Princeton—Bolmer's Corner Road During Construction by State with Convict Labor.

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(figured in foundation and surface); 800 tons trap rock, crushed and unused, at 90 cents, \$720.00; 60 feet 6-inch pipe placed, at 40 cents, \$24.00; 60 feet 18-inch pipe placed, at \$1.25, \$75.00; 430 feet 24-inch pipe placed, at \$1.80, \$774.00; 82.2 cubic yards ditching for pipe, at .65 cents, \$53.43; 685 feet fence removed, at .00½ cent, \$3.43; 400 feet fence re-set, at 1 cent, \$4.00; 111 feet 8-inch iron pipe placed, at \$1.00, \$111.00; 33 cubic yards concrete bridge, at \$8.00, \$264.00; 7¼ cubic yards reinforced concrete, at \$10.00, \$71.00; 95 feet dry wall, at \$3.00, \$285. Total, \$34,862.94.

1,000 cubic yards excavation on Blawenburg-Bolmer's Corner road, at \$1.25, \$1,250.00; value of repairs and snow removal on Princeton-Rocky Hill road, \$316.20; value of road materials purchased and unused to date, including cement, tile, culverts and dynamite, \$800. Total, \$37,229.14.

**OPERATING EXPENSES FROM ESTABLISHMENT OF CAMP No. 2
TO OCTOBER 31, 1914.**

Total, May, 1913, to October 31, 1913: Gasoline, \$182.85; rent, \$49.00; convict hire, \$318.25; advertising, \$201.54; kerosene, 85 cents; hard coal, \$10.08; groceries, \$108.21; meat, \$35.87; bread, \$14.59; tobacco, \$19.38; medicine, \$13.50; guarding, \$352.00. Total, \$1,104.58.

Total, May, 1913, to May, 1914: Gasoline, \$456.28; phone, \$33.71; rent, \$109.00; soft coal, \$62.10; explosives, \$222.25; road building material, \$132.65; team hire, \$1,645.25; convict hire, \$2,401.75; advertising, \$207.52; kerosene, \$36.20; hard coal, \$208.37; groceries, \$958.10; meat, \$902.29; bread, \$209.75; tobacco, \$123.02; medicine, \$51.50; guarding, \$2,760.54. Total, \$10,312.76.

Total, May, 1913, to October 31, 1914: Gasoline, \$856.63; phone, \$77.22; rent, \$169.00; soft coal, \$226.30; explosives, \$828.08; road building material, \$1,432.18; team hire, \$10,620.04; convict hire, \$13,760.51; advertising, \$207.52; kerosene, \$48.96; hard coal, \$259.60; groceries, \$1,341.25; meat, \$1,304.90; bread, \$287.03; tobacco, \$169.68; medicine, \$103.03; guarding, \$3,640.54. Total, \$35,332.47.

The road equipment referred to above includes the following: Road roller, scarifier, sprinklers, sweepers, scrapers, drag scrapers, dump wagons, rock crushers and equipment, motor truck, hand and gasoline pumps and engines, kitchen wagon, plows, forge, air compressor and equipment, hammer drills and equipment, asphalt heaters and pouring kettles, shovels, hammers, hatchets, picks, axes, mattocks, brushhooks, scythes, tampers, rakes, and handles for above tools; wrenches, saws, chisels, crow bars, trowels, files, brace and bits, paint brushes, anvil, vise, grindstone, wheel barrows, road lanterns, levels, squares, tents and tarpaulins, rope, chain, mason line, plumbers' tools, typewriter and office stationery, pails, canvas gloves and small hardware.

The camp equipment consists of the following: Lumber used in all forms of construction, miscellaneous supplies, building hardware and materials, paint, plumbing, including water plant and well drilling; beds and bedding, chairs, tables, towelings and cloth, stove and connections, coat and hat hooks, alarm bell outfit, barbers' tools and supplies, hanging lamps, sewing supplies, laundry machine and general equipment, fire extinguishers, clocks, all tableware and cutlery, cooking and kitchen utensils and equipment, dippers and pails, wash basins, refrigerator, hotel ranges and stoves, &c.

From August to November inclusive, convicts were taken from the prison in Trenton and conveyed by motor truck and horse-drawn wagons to nearby roads in Mercer county, where they worked, and were returned to the institution in the afternoon.

The work done in co-operation with Mercer county was as follows:

Princeton avenue, from Spruce street to Harney's Corner; new construction, length 0.7 miles, graded 30 feet, plain macadam construction, 16 feet wide 6 inches and 8 inches deep; culvert work, driveways, underdraining; total cost, \$10,211.00. Brunswick pike, from blacksmith shop at Slackwood to creek bridge at Weller's woods; a penetration macadam road, which was very wavy, was scarified and the surface materials used to widen the road 4 feet on each side; new stone was then spread making a road 23 feet wide, 4 inches deep compacted and 3,150 feet long. The cost was \$3,790 or 47 cents per square yard completed.

Similar work was done on the White Horse road. The completed road was 6,150 feet long, 18 feet wide, 4 inches deep compacted, with two 4-foot shoulders 6 inches deep, made of old material; total cost, \$7,634 or 62 cents per square yard, figured on a basis of 18 feet wide. This road will be resurfaced with bituminous concrete in 1915, because the traffic over it is too severe for plain macadam construction.

Liberty street, from Olden avenue to Hamilton avenue was graded 30 feet wide. From Olden avenue to Chambers street the city line runs along the centre of the street, and with the co-operation of the city, county and Public Service Corporation, the street was graded and paved with macadam 34.8 feet wide 3,300 feet long and 6 inches deep compacted. The construction of this road was made more difficult because of a trolley track near the centre between Olden avenue and Chambers street. The cost of finished pavement including excavation, realignment, regrading and tamping of trolley track was 90 cents per square yard.

The cost of grading between Olden avenue and Hamilton avenue was 41 cents per cubic yard.

The costs above mentioned include the following prices: Foreman, \$5.00; teams, \$5.00; roller, \$10.00; men, \$1.75 and \$1.50 per day of eight hours; stone, 90 cents per ton (on Liberty street, city portion, \$1.65 per ton delivered); materials, supplies and some tools.

At Camp No. 2, supplies were purchased on contract after competitive bidding and also in the open market. We secured cheaper prices in open market by first obtaining prices from various dealers on the supplies required and taking the lowest prices.

It is very necessary to have a light motor delivery wagon for transporting groceries, supplies and equipment. We are now using our 3-ton truck for this purpose and it is too expensive.

There is an abundant supply of very good well water at Camp No. 2, obtained from our bored well 220 feet deep.

In the spring of 1914 the foreman of the camp, Mr. John T. Carr, planted an extensive vegetable garden and maintained it. On July 1, the Board of Inspectors of the New Jersey State Prison assumed charge of feeding the men and therefore reaped the benefits of the vegetable garden. From July 1, 1914, to August 31, 1914, the cost to the prison authorities for feeding was 8½ cents per meal per man, as against 10½ cents, the cost to the road department previously and without the advantages of the garden. During the two months accounted to the prison, the produce from the vegetable garden constituted a large portion of the meals served, and in addition to that a much more economical and efficient cook had been assigned to the work from the prison.

During the period from September 1, 1913, to August 31, 1914, the cost of guarding the prisoners amounted to \$3,640.54, which was \$464.54 more than the cost of road, quarry and camp supervision and clerical work.

Respectfully submitted,

EDWARD E. REED,
Division Engineer.

NEW JERSEY STATE LIBRARY

Report from Southern Division

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

DEAR SIR—The number of miles of new road constructed in the Southern Division during the past year has considerably exceeded the average of previous years. Although the southern counties of the State on the whole have a greater average road mileage than the central and northern counties, the amount of road work done is limited in the majority of cases by the amount available for the State's forty per cent., rather than by the counties' inability to pay their share.

The more important roads in this division are being paved with high class surfaces, but the widespread occurrence of good road gravel throughout South Jersey makes it the most popular material for this section of the State. The specifications for gravel should be given much more attention than they have heretofore had. At the present state of advancement in the practice of gravel road construction there is much room for disagreement concerning the value of a given sample of gravel, and I would recommend that some move be made in the department to make a systematic study, with a view to gravel classification.

The administration of road affairs in the various counties and the relation of the county officials to the members of this department, although showing improvement, still leave much to be desired. I believe that under the present arrangement for building new roads, the State and county should work together for a common interest and consider themselves virtually, although not actually, a joint party in the contract. The attitude adopted by most county officials with whom I come in contact, seems to be that the contract is a three cornered instrument in which the State, the county and the contractor have antagonistic interests. My suggestion for remedying this undesirable antagonism is to be at all times consistent in reporting to the counties on inspection; to make no unfavorable criticism unless actually warranted; to be specific in all complaints, and to insist on immediate compliance with instructions.

The county road supervisors should be given more independence from the governing bodies in managing the repair work, and should be given sufficient compensation to enable them to devote their entire time to county business. In some of the counties the supervisor appears to have very little authority in road matters, and in at least one county, being elected by the Board of Freeholders, he in turn is practically required to employ the individual members of the board as foremen in their respective districts. This county has a Statewide reputation for the poor condition of its roads. Partisan influence in road administration need be mentioned only to be condemned; it is at work in a varying degree in all the counties, but for the most part in such a way as to be of minimum detriment to the work.

At the end of this fiscal year there is prospect of considerable activity for the coming year throughout the whole division. Atlantic county will advertise for bids on upwards of twenty miles of gravel roads during November. Burlington as a county has undertaken no new road work for a number of years, but several of the townships in the county have plans ready for about ten miles of road. Camden county is advertising for about ten miles, half of which will be bituminous surface on concrete base, and there is prospect of more in the immediate future. Cape May has gone ahead with about fifteen miles of gravel road without waiting for State aid, and Cumberland is making surveys for seventeen miles of gravel road. In Gloucester the owners of teams have volunteered their services without compensation to build several miles of road, and have asked the State to furnish nothing except a foreman to direct the work. Construction under direction of the municipalities and that anticipated to be done by convicts in Salem county will bring the total proposed work to be done in this division to about eighty-five miles.

I wish to call to your attention the satisfactory manner in which nearly all the members of the department connected with this division have handled the work entrusted to them. I believe that it would be to the best interest of the organization if a graduated rate of compensation could be adopted, so that the men could be advanced according to their ability and aptitude for the work.

Respectfully submitted,

ROY MULLINS,
Division Engineer.

Report on State Aid Bridges

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

DEAR SIR—An effort has been made during the past year to standardize, to some extent, the construction of highway bridges. Although the first cost of the structure has largely governed the selection of the particular type of bridge, the problem of maintenance has been equally important. The greatest difficulty has been encountered in the design of the bridge floor, which, as far as possible, has been constructed of concrete, allowing the full pavement of the roadway to be carried over the structure. However, in the southern counties, the foundation problem has made this type of flooring impossible, with the result that, on pile trestle and draw-bridge construction, the use of creosoted timber with block flooring is replacing the untreated wooden floors.

This construction will reduce to a marked degree the bills for maintenance.

The question as to the minimum clear width was a debatable one, as different counties had regulated the width of bridges in proportion to the importance of the road of which the bridge formed a part. A minimum clear width of thirty feet is recommended for all types, and no bridge of less width is approved unless local conditions render such construction practically impossible.

The average width of loads, particularly in the case of motor trucks, has increased to such an extent that the multiple for width, which was formerly six, has increased to eight, thus making the necessary bridge width greater.

The increase in the first cost of bridge construction due to this requirement for width is more than offset by the degree of safety obtained, as most motor vehicle accidents occur either at a curve or on a narrow bridge. All State highways, including the bridges forming a part of such a system, should be of sufficient width to allow the passing of vehicles traveling at the legal rate of speed.

Owing to the great variety of designs used at the present time in the construction of concrete bridges for highway work, a study is being made of the various slab and arch types. This work has been taken up in order to determine the most economical designs that can be adapted to meet the varying local conditions.

Up to the present time the inspection on bridge work has been taken care of by the appointment of local inspectors, who, as a rule, are altogether unfamiliar with bridge construction. In most cases, in spite of their lack of experience, these inspectors have obtained better results than could be expected. Some of them become very efficient by the time their work is about completed, but, as it rarely happens that they can be placed on successive jobs, the benefit from their educational ex-

perience, obtained at the expense of their State service, cannot be derived. A very much better result could be obtained by the appointment of experienced men as permanent inspectors for bridge work, as was provided for road inspection in the Road law of 1912. The numerous delays and misunderstandings in bridge construction would be largely eliminated if some trained inspectors could replace the present temporary men.

In addition to the State aid bridge work, an attempt has been made to obtain accurate data on the present existing bridges which form a part of the proposed State Highway System, in order that some estimate of the proposed cost of the necessary repairs to these structures might be arrived at, in view of the State supervision of the roads forming the State Highway System.

Progress in this direction has been very slow owing to the lack of existing information regarding the many old bridges erected on these highways. In many cases, all plans of these bridges have been lost and the only available data is that which can be obtained from the structures. It will require a larger engineering force to properly take up this work.

Respectfully submitted,

L. McENTIRE,

Division Engineer in Charge of Bridges.

STATE AID BRIDGES.

COMPLETED BRIDGES, 1912-1913.—Burlington county, 1; Cumberland county, 4; Middlesex county, 1; Monmouth county, 1; Union county, 3. Total, 10.

COMPLETED BRIDGES, 1913-1914.—Hunterdon county, 1; Middlesex county, 1; Ocean county, 1; Somerset county, 1; Warren county, 5. Total, 9.

BRIDGES UNDER CONSTRUCTION.—Atlantic county, 6; Camden county, 2; Cape May county, 1; Mercer county, 4; Somerset county, 1. Total, 14.

PROPOSED BRIDGES.—Atlantic county, 6; Camden county, 3; Cumberland county, 3; Hunterdon county, 1; Middlesex county, 2; Monmouth county, 1; Somerset county, 4; Warren county, 3. Total, 23.

TOTALS OF ALL BRIDGES COMPLETED IN 1912-1913 AND 1913-1914, UNDER CONSTRUCTION AND PROPOSED.—Atlantic county, 12; Burlington county, 1; Camden county, 5; Cape May county, 1; Cumberland county, 7; Hunterdon county, 2; Mercer county, 4; Middlesex county, 4; Monmouth county, 2; Ocean county, 1; Somerset county, 6; Union county, 3; Warren county, 8. Total, 56.

COMPLETED BRIDGES—STATE'S PAYMENT MADE NOVEMBER 1, 1913, TO OCTOBER 31, 1914.

COUNTY.	ROAD.	BRIDGE.	TYPE.	TOTAL COST.	COST ALLOWED BY STATE.	STATE'S SHARE.
Hunterdon	Hampton borough	Inlaydale	Concrete Arch...	\$9,989 81	\$8,488 89	\$1,697 78
Middlesex	Roosevelt-Woodbridge	Noe's Creek	Concrete Slab...	3,599 82	3,479 82	695 96
Ocean	Bay avenue, Stafford township,	Fox Island	Concrete Slab...	1,431 70	1,431 70	286 34
*Somerset	Rocky Hill	Beden's Brook	Concrete Arch...	9,199 72	9,199 72	
†Warren	Blairstown-Columbia	Jacksonburg Brook Bridge No. 1..	Concrete Arch...	2,550 00	2,550 00	510 00
†Warren	Blairstown-Columbia	Bridge No. 2.	Concrete Slab...	} 1,038 90	1,038 90	207 78
†Warren	Blairstown-Columbia	Bridge No. 3.	Concrete Slab...			
†Warren	Blairstown-Columbia	Bridge No. 4.	Concrete Arch...				471 90	471 90	94 38
†Warren	Lincoln street	Bridge at Station No. 10.	Concrete Slab...	572 32	572 32	114 46

* Paid from M. V. Fund with road improvement, \$8,500.00.

† Bridge included in road contract.

TWENTY-FIRST ANNUAL REPORT

BRIDGES UNDER CONSTRUCTION AND CONTRACT PRICES.

Atlantic County—Miry run, \$3,279.00; Perch cove, \$2,496.00; Powell's creek, \$1,196.00; Lake's creek, \$4,458.00; Gravelly run, \$3,073.00; English creek, \$5,334.00.

Camden County—North Branch Newton creek, \$4,710.00; Main Branch Newton creek, \$5,592.00.

Cape May County—Ocean City drawbridge, \$24,500.00.

Mercer County—Miry run, Sta. 117 + 43, Assunpink creek, Sta. 17 + 85, \$1,745.00; Bridge Sta. 223 + 51, Bridge Sta. 278 + 78, \$2,641.30.

Somerset County—Finderne, \$17,856.00.

Laboratory and Experimental Work

By R. B. Gage, Chemist of the New Jersey Geological Survey.

The examination of various road materials and pavements, together with most of the work of preparing and correcting that part of the specifications relating to bituminous construction, has been done in the Laboratory maintained by the Geological Survey and has been under my immediate direction. While the character of the work is similar to that of former years, the quantity has gradually increased from year to year. The character and amount of work done during the past year are described and fully discussed in the Annual Administrative Report of the State Geologist for the year 1914. The environments under which it has been carried out are far from satisfactory.

The fact that first-class pavements cannot be constructed by novices or those inexperienced in this line of work becomes more evident each year. This is particularly true in the case of bituminous pavements. There are so many vital factors entering into the proper construction of these pavements that their life may be greatly reduced or the pavement ruined if an efficient system of inspection is not maintained during their construction. Such a method of inspection is much easier to secure and maintain if the various factors that ruin these pavements are reduced to the smallest number possible before the construction of the pavement proper has begun. In this connection, marked progress has been made during the past year.

The old unreliable method of specifying that a bituminous pavement must be of a given depth, either before or after compression, has been replaced by a unit weight per square yard, which guarantees to the State that the specified quantity of pavement shall be supplied by the contractor. Since most of the materials used in this class of pavement are secured at some distance from the work, it is an easy matter to check up the quantities used from the railroad shipping weights. The quantity of stone used in a macadam pavement could no doubt be checked up in the same manner. A given weight per square yard would have to be specified in addition to the thickness as now required by the specifications.

The specifications require that contractors must control the equipment necessary for the proper execution of the work, before their contract is approved. This is important in securing good work. If possible, previous experience in the particular line of work which is to be done, and the necessary financial resources to properly carry out the work in the time specified, should also be demanded. A contractor may control the required equipment, yet if he is inexperienced in the work to be done, or does not have the necessary resources to properly finance the work, it is almost impossible for him to construct a good pavement within the time

specified. The award of contracts to such contractors generally results in the construction of an inferior grade of pavement, and one that has cost the State double what it should for inspection, because under such conditions the time required to complete the work is not infrequently twice as long as necessary. Extensions of time for finishing a pavement, except as provided in the specifications, should be granted only under extraordinary circumstances. A comparison of the character and composition of pavements constructed by experienced and inexperienced contractors, even in the same county and under similar conditions, is quite marked. The use of an official list of contractors, with the privilege of removing the names therefrom of those who have shown themselves incapable or unwilling to do the work properly, is suggested as the best remedy. Care must be exercised, however, not to unduly limit competition.

Honest and efficient inspection is necessary to secure the construction of good roads. This is particularly the case in all classes of bituminous pavements. The present system of appointing inspectors is far from satisfactory. The number of inspectors in the employ of the department who are competent to supervise the construction of a bituminous pavement is very limited. Some errors during the past season could have easily been prevented had the inspector known that the pavement that was being laid under his very eyes was not of the proper quality. When both contractor and inspector are ignorant of the conditions necessary for the proper construction of a bituminous pavement, inferior work must be expected. Owing to the fact that it is impossible for the engineers of the county and State Road Department to be present on the work at all times, they cannot always detect defects in bituminous pavements during construction or after the road has been completed. The chemical analyses made of the pavement laid each day will not detect these defects unless the inspector is sufficiently experienced in the work to know when inferior pavement is apparently being laid, and then honest enough to select the daily sample from that portion of the pavement. These facts have been quite definitely proven during the past season. Neither do the failures caused by such defects always develop during the first year of the pavement's life. Under these conditions, defective pavements are sometimes accepted that would have had to have been extensively repaired before acceptance had these defects been known. The present method of awarding contracts to the lowest bidder as required by law, regardless of their experience, is a practical guarantee that some contracts will be awarded to inexperienced contractors. Under these circumstances it is of vital importance that the inspector assigned to such a job be experienced and acquainted with all the essential details needed to guarantee the proper construction of these pavements if serious errors are to be avoided. Experienced inspectors cannot be secured and those now in the employ of the department who have become experienced, cannot be held at the present rate of pay established by statute for inspectors. It must also be borne in mind that before the unfitness of a new, temporary inspector assigned to a particular job is discovered, many errors in construction may have been made.

Experimental Work.

Some of the experimental roads constructed during the last four years are sufficiently old to furnish some definite conclusions regarding the merits of the different types of construction. The principal results secured in this connection to date can be summarized as follows:

Concrete, when used as a surface pavement, must be constructed in a very careful manner from a rich cement mortar. The stone aggregate should be a tough, hard road metal, such as trap rock, and not too large in size. These pavements frequently crack where least expected. The cracks are generally parallel to the axis of the pavement. In some cases transverse cracks occur. Expansion joints are essential, especially if the pavement is ever to be used as a foundation for a bituminous pavement. When the stone aggregate is slag or soft limestone, ruts and pot-holes are soon worn in the surface if the pavement is subjected to much heavy travel. Premature failures can often be avoided by using mortars uniform in composition and preventing segregation during the spreading of the same. Such defects may be quite costly, for these pavements are exceedingly difficult to repair.

The fact that a concrete pavement, constructed in a given manner in a certain locality, has proven efficient, does not necessarily prove that the same pavement, when similarly constructed in another locality, will give the same satisfaction, even if the character and quantity of travel in both instances is practically the same. The sub-foundation may be of such a nature that the cost of properly draining the same makes this type of construction in some cases very costly and in others practically prohibitive, for unless a concrete base or pavement is properly drained it will soon be ruined.

The most economical policy to follow in constructing these pavements seems to point to their use first as a surface pavement and then a base for a bituminous road. In that case, the bituminous pavement need only be applied when the concrete is no longer satisfactory as a surface pavement. Any defects which may have developed in them can be repaired and they will then make an excellent base for future bituminous pavements. For new construction this appears to be the ideal method, for the proper drainage system can be installed before the concrete is laid, and the only part of the improvement that would need replacing in the future would be the surface proper.

The advantages possessed by a concrete base over a macadam base for a bituminous pavement are also quite pronounced. The former possess a density and stability that is not obtained in a macadam or telford base, the most essential qualities a base should possess which is to be used under a dense bituminous pavement. Such bases also prevent the sub-surface waters from attacking the surface pavement, by passing through the foundation, as often happens with macadam or telford bases. On account of their greater stability and the uniform character of their surface, a much thinner bituminous pavement can be used upon them than on a macadam or telford base. In what cases the additional advantages possessed by a concrete base over a macadam base are sufficient to warrant replacing old macadam bases with new concrete, has not yet been definitely demonstrated.

The experimental surface pavements constructed with bituminous mortars have, on the average, stood up well. This method of construc-

tion appears to be one of the most promising of any we have yet tried. This mortar is especially adapted for use on concrete bases. A pavement can be constructed of it for less than half the cost of a bituminous concrete pavement. It can also be repaired much more easily and cheaply, as no expensive equipment is needed. For general use upon a country road this type of pavement no doubt will fulfill almost every requirement. Its low initial cost, compared to that of a bituminous concrete pavement, and the manner in which it can be repaired, gives it a very promising future in localities where the auto traffic is fairly heavy and the funds available for road construction limited.

Whether it is practical or economical to use these mortars on macadam bases, or properly repaired old macadam roads, remains to be seen. Our experience indicates that they can, but it is too soon to prophesy with what success.

Serious consideration should be given to the question of repairs in determining what types of pavements should be laid. That defects will occur is self-evident, yet very seldom is this point considered. An expensive field equipment is required to prepare properly the paving mixtures used in repairing some bituminous concrete pavements. On isolated country roads such an equipment cannot be installed at any reasonable cost to do the limited quantity of work that will be required for the necessary yearly repairs. Consequently, pavements of one type of materials are now being repaired and will have to be repaired in the future by patching with another material. This is not desirable; all surfaces should be homogeneous.

The fact that a properly graded bituminous concrete pavement, that does not infringe on the Warren patent, is a very difficult pavement to construct, and of little value unless so constructed, has been quite conclusively demonstrated. That the grading, devised by the Road Department and now specified by it for the aggregate of this pavement, is superior to that known as the "Topeka-Sterling" grading, is proven not only by the results secured, but by the fact that other bituminous engineers and chemists who are considered authorities on this particular subject, are specifying practically the same grading. The object of incorporating stone in a bituminous concrete pavement is to increase its stability. This stone often shortens the life of such a pavement by rendering it easier of attack by surface waters. If the maximum stability is to be secured, the stones should be present in sufficient quantity to form the skeleton work of the pavement. Unless the percentage of stone used is sufficient to form an interlocked skeleton, the stone simply floats in a sand-asphalt matrix. Such a pavement possesses few, if any, of the merits and all of the defects of a bituminous concrete pavement. It will creep as readily as a sheet asphalt pavement laid without a binder course and will be disintegrated by surface water as quickly as any other type of bituminous concrete pavement.

In some localities it is laid on a binder course of three-quarter-inch to one and one-quarter-inch stone, similar to that used with sheet asphalt, in order to prevent its creeping or being attacked by the surface waters. The use of such a binder course certainly lengthens the life of the pavement. When laid adjacent to a street car track and on a concrete foundation this binder course is of vital importance in preventing decomposition of the bituminous pavement by surface waters. Our experience has shown that when bituminous concrete pavements are laid on old macadam

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surfaces, their life is greatly lengthened by spreading over the old macadam surface a fresh layer of one and one-half-inch stone. The top voids in these stones are partially filled with clean or dustless screenings in order to prevent their displacement during the laying of the top surface. This stone layer gives additional stability to the base, forms an efficient drain for the surplus waters, and prevents the sub-surface waters from attacking the pavement by capillary attraction through the base.

The injury that can be done to bituminous pavements by the moisture held in an old macadam foundation was not generally recognized a few years ago, and even now is often overlooked and underestimated. Such bases are seldom dry, even at the end of a long drought. The life of a bituminous concrete pavement, especially those uniform in structure, when laid direct upon an old macadam foundation or surface, must necessarily be shorter than that of a similar pavement protected from the injurious factors common to foundations of this type. Our experience has repeatedly proven such to be the case. On this account, bituminous pavements consisting of a coarse, open bottom or binder course, covered with a denser top, have a greater power to resist decomposition than pavements laid without such a course, when both are laid on the same type of foundation and subjected to similar conditions.

Our experience in resurfacing macadam roads with any kind of a bituminous pavement has also shown that if satisfactory or even fairly satisfactory results are to be secured, the pavement must be protected as much as possible from being injuriously attacked by sub-surface and surface waters. Also, that the drainage and general conditions on an old macadam road are a very uncertain quantity. Consequently, the method selected to prepare these old surfaces and bases for the application of a bituminous pavement should be the one that will reduce the factors that are injurious to a bituminous pavement to the lowest possible quantity. The surface pavement then selected should be the one that is best able to successfully combat the remaining adverse factors, and one that can be easily and cheaply repaired by the average inspector or patrolman. A careful preliminary examination and determination of the detrimental factors present in an old macadam pavement, when such a pavement is used for a foundation, and how their influences can be neutralized or prevented, should be determined before the type of repair to be used is selected. In this way only will it be possible to avoid many of the errors that have been made in the past.

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 ofcounty 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:

.....
Clerk.

[SEAL.]

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	" "	984⅔
" 9	" "	6	" "	1,476⅞
" 9	" "	8	" "	1,968¾
" 9	" "	10	" "	2,460⅓
" 9	" "	12	" "	2,953⅞
" 10	" "	4	" "	1,093¾
" 10	" "	6	" "	1,640⅝
" 10	" "	8	" "	2,187½
" 10	" "	10	" "	2,734⅝
" 10	" "	12	" "	3,281¼
" 11	" "	4	" "	1,203⅞
" 11	" "	6	" "	1,804⅞
" 11	" "	8	" "	2,406¾
" 11	" "	10	" "	3,007⅓
" 11	" "	12	" "	3,609⅞
" 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					1,421 $\frac{7}{8}$ tons of stone per mile.			
" 13	"	"	6	"	2,132 $\frac{3}{16}$	"	"	"
" 13	"	"	8	"	2,843 $\frac{3}{4}$	"	"	"
" 13	"	"	10	"	3,554 $\frac{11}{16}$	"	"	"
" 13	"	"	12	"	4,265 $\frac{5}{8}$	"	"	"
" 14	"	"	4	"	1,531 $\frac{1}{4}$	"	"	"
" 14	"	"	6	"	2,296 $\frac{7}{8}$	"	"	"
" 14	"	"	8	"	3,062 $\frac{1}{2}$	"	"	"
" 14	"	"	10	"	3,828 $\frac{1}{2}$	"	"	"
" 14	"	"	12	"	4,593 $\frac{3}{4}$	"	"	"
" 15	"	"	4	"	1,640 $\frac{5}{8}$	"	"	"
" 15	"	"	6	"	2,460 $\frac{13}{16}$	"	"	"
" 15	"	"	8	"	3,281 $\frac{1}{4}$	"	"	"
" 15	"	"	10	"	4,101 $\frac{9}{16}$	"	"	"
" 15	"	"	12	"	4,921 $\frac{7}{8}$	"	"	"
" 16	"	"	4	"	1,750	"	"	"
" 16	"	"	6	"	2,625	"	"	"
" 16	"	"	8	"	3,500	"	"	"
" 16	"	"	10	"	4,375	"	"	"
" 16	"	"	12	"	5,250	"	"	"
" 17	"	"	4	"	1,859 $\frac{3}{8}$	"	"	"
" 17	"	"	6	"	2,789 $\frac{1}{16}$	"	"	"
" 17	"	"	8	"	3,718 $\frac{3}{4}$	"	"	"
" 17	"	"	10	"	4,648 $\frac{7}{16}$	"	"	"
" 17	"	"	12	"	5,578 $\frac{1}{8}$	"	"	"
" 18	"	"	4	"	1,968 $\frac{3}{4}$	"	"	"
" 18	"	"	6	"	2,953 $\frac{3}{8}$	"	"	"
" 18	"	"	8	"	3,937 $\frac{1}{2}$	"	"	"
" 18	"	"	10	"	4,921 $\frac{7}{8}$	"	"	"
" 18	"	"	12	"	5,906 $\frac{1}{4}$	"	"	"
" 19	"	"	4	"	2,078 $\frac{3}{8}$	"	"	"
" 19	"	"	6	"	3,117 $\frac{1}{16}$	"	"	"
" 19	"	"	8	"	4,156 $\frac{3}{4}$	"	"	"
" 19	"	"	10	"	5,195 $\frac{5}{16}$	"	"	"
" 19	"	"	12	"	6,234 $\frac{3}{8}$	"	"	"
" 20	"	"	4	"	2,187 $\frac{1}{2}$	"	"	"
" 20	"	"	6	"	3,281 $\frac{1}{4}$	"	"	"
" 20	"	"	8	"	4,375	"	"	"
" 20	"	"	10	"	5,468 $\frac{3}{4}$	"	"	"
" 20	"	"	12	"	6,562 $\frac{1}{2}$	"	"	"

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 4,693 $\frac{3}{8}$ 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.

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SQUARE YARDS IN ONE MILE OF

8 feet in width.....	4,693 $\frac{1}{8}$	square yards.
10 "	5,866 $\frac{2}{3}$	"
12 "	7,040	"
14 "	8,213 $\frac{1}{2}$	"
16 "	9,386 $\frac{2}{3}$	"
18 "	10,560	"

8 feet wide, or 4,693 $\frac{1}{8}$ square yards, at 25c. per sq. yd.....	\$1,173	33 $\frac{1}{3}$
10 " " 5,866 $\frac{2}{3}$ " " 25c. "	1,466	66 $\frac{2}{3}$
12 " " 7,040 " " 25c. "	1,760	00
14 " " 8,213 $\frac{1}{2}$ " " 25c. "	2,053	33 $\frac{1}{3}$
16 " " 9,386 $\frac{2}{3}$ " " 25c. "	2,346	66 $\frac{2}{3}$
18 " " 10,560 " " 25c. "	2,640	00

8 " " 4,693 $\frac{1}{8}$ " " 30c. "	1,408	00
10 " " 5,866 $\frac{2}{3}$ " " 30c. "	1,760	00
12 " " 7,040 " " 30c. "	2,112	00
14 " " 8,213 $\frac{1}{2}$ " " 30c. "	2,464	00
16 " " 9,386 $\frac{2}{3}$ " " 30c. "	2,816	00
18 " " 10,560 " " 30c. "	3,168	00

8 " " 4,693 $\frac{1}{8}$ " " 35c. "	1,642	66 $\frac{2}{3}$
10 " " 5,866 $\frac{2}{3}$ " " 35c. "	2,053	33 $\frac{1}{3}$
12 " " 7,040 " " 35c. "	2,464	00
14 " " 8,213 $\frac{1}{2}$ " " 35c. "	2,874	66 $\frac{2}{3}$
16 " " 9,386 $\frac{2}{3}$ " " 35c. "	3,285	33 $\frac{1}{3}$
18 " " 10,560 " " 35c. "	3,696	00

8 " " 4,693 $\frac{1}{8}$ " " 40c. "	1,877	33 $\frac{1}{3}$
10 " " 5,866 $\frac{2}{3}$ " " 40c. "	2,346	66 $\frac{2}{3}$
12 " " 7,040 " " 40c. "	2,816	00
14 " " 8,213 $\frac{1}{2}$ " " 40c. "	3,285	33 $\frac{1}{3}$
16 " " 9,386 $\frac{2}{3}$ " " 40c. "	3,754	66 $\frac{2}{3}$
18 " " 10,560 " " 40c. "	4,224	00

8 " " 4,693 $\frac{1}{8}$ " " 45c. "	2,112	00
10 " " 5,866 $\frac{2}{3}$ " " 45c. "	2,640	00
12 " " 7,040 " " 45c. "	3,168	00
14 " " 8,213 $\frac{1}{2}$ " " 45c. "	3,696	00
16 " " 9,386 $\frac{2}{3}$ " " 45c. "	4,224	00
18 " " 10,560 " " 45c. "	4,752	00

8 " " 4,693 $\frac{1}{8}$ " " 50c. "	2,346	66 $\frac{2}{3}$
10 " " 5,866 $\frac{2}{3}$ " " 50c. "	2,933	33 $\frac{1}{3}$
12 " " 7,040 " " 50c. "	3,520	00
14 " " 8,213 $\frac{1}{2}$ " " 50c. "	4,106	66 $\frac{2}{3}$
16 " " 9,386 $\frac{2}{3}$ " " 50c. "	4,693	33 $\frac{1}{3}$
18 " " 10,560 " " 50c. "	5,280	00

8 " " 4,693 $\frac{1}{8}$ " " 55c. "	2,581	33 $\frac{1}{3}$
10 " " 5,866 $\frac{2}{3}$ " " 55c. "	3,226	66 $\frac{2}{3}$
12 " " 7,040 " " 55c. "	3,872	00
14 " " 8,213 $\frac{1}{2}$ " " 55c. "	4,517	33 $\frac{1}{3}$
16 " " 9,386 $\frac{2}{3}$ " " 55c. "	5,162	66 $\frac{2}{3}$
18 " " 10,560 " " 55c. "	5,808	00

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8 feet wide, or	4,693½	square yards, at	60c. per sq. yd.	2,816 00
10 "	5,866¾	"	60c. "	3,520 00
12 "	7,040	"	60c. "	4,224 00
14 "	8,213½	"	60c. "	4,928 00
16 "	9,386¾	"	60c. "	5,632 00
18 "	10,560	"	60c. "	6,336 00
8 "	4,693½	"	65c. "	3,050 66¾
10 "	5,866¾	"	65c. "	3,813 33½
12 "	7,040	"	65c. "	4,576 00
14 "	8,213½	"	65c. "	5,338 66¾
16 "	9,386¾	"	65c. "	6,101 33½
18 "	10,560	"	65c. "	6,864 00
8 "	4,693½	"	70c. "	3,285 33½
10 "	5,866¾	"	70c. "	4,106 66¾
12 "	7,040	"	70c. "	4,928 00
14 "	8,213½	"	70c. "	5,749 33½
16 "	9,386¾	"	70c. "	6,570 66¾
18 "	10,560	"	70c. "	7,392 00
8 "	4,693½	"	75c. "	3,520 00
10 "	5,866¾	"	75c. "	4,400 00
12 "	7,040	"	75c. "	5,280 00
14 "	8,213½	"	75c. "	6,160 00
16 "	9,386¾	"	75c. "	7,040 00
18 "	10,560	"	75c. "	7,920 00
8 "	4,693½	"	80c. "	3,754 66¾
10 "	5,866¾	"	80c. "	4,693 33½
12 "	7,040	"	80c. "	5,632 00
14 "	8,213½	"	80c. "	6,570 66¾
16 "	9,386¾	"	80c. "	7,509 33½
18 "	10,560	"	80c. "	8,448 00
8 "	4,693½	"	85c. "	3,989 33½
10 "	5,866¾	"	85c. "	4,986 66¾
12 "	7,040	"	85c. "	5,984 00
14 "	8,213½	"	85c. "	6,981 33½
16 "	9,386¾	"	85c. "	7,978 66¾
18 "	10,560	"	85c. "	8,976 00
8 "	4,693½	"	90c. "	4,224 00
10 "	5,866¾	"	90c. "	5,280 00
12 "	7,040	"	90c. "	6,336 00
14 "	8,213½	"	90c. "	7,392 00
16 "	9,386¾	"	90c. "	8,448 00
18 "	10,560	"	90c. "	9,504 00
8 "	4,693½	"	95c. "	4,458 66¾
10 "	5,866¾	"	95c. "	5,573 33½
12 "	7,040	"	95c. "	6,688 00
14 "	8,213½	"	95c. "	7,802 66¾
16 "	9,386¾	"	95c. "	8,917 33½
18 "	10,560	"	95c. "	10,032 00
8 "	4,693½	"	\$1.00 "	4,693 33½
10 "	5,866¾	"	1.00 "	5,866 66¾
12 "	7,040	"	1.00 "	7,040 00
14 "	8,213½	"	1.00 "	8,213 33½
16 "	9,386¾	"	1.00 "	9,386 66¾
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.....	586¾	684¼	782½	880	977¾	1,075½	1,173¼
One mile.....	7 feet wide.....	684¼	798¼ ²⁷	912¼ ²⁷	1,026¾	1,140 ²⁹ / ₂₇	1,254 ²² / ₂₇	1,368¾
One mile.....	8 feet wide.....	782½	912¼ ²⁷	1,042 ²⁵ / ₂₇	1,173¼	1,303¼ ¹⁹ / ₂₇	1,434 ⁷ / ₂₇	1,564¼
One mile.....	9 feet wide.....	880	1,026¾	1,173¼	1,320	1,466¾	1,613¼	1,760
One mile.....	10 feet wide.....	977¾	1,102 ²⁹ / ₂₇	1,303¼ ¹⁹ / ₂₇	1,466¾	1,629¼ ¹⁷ / ₂₇	1,792¼ ¹⁰ / ₂₇	1,955½
One mile.....	11 feet wide.....	1,075½	1,254 ²² / ₂₇	1,434 ⁷ / ₂₇	1,613¼	1,792¼ ¹⁰ / ₂₇	1,971 ²³ / ₂₇	2,151¾
One mile.....	12 feet wide.....	1,173¼	1,368¾	1,564¼	1,760	1,955½	2,151¾	2,340¾
One mile.....	13 feet wide.....	1,271¼	1,482 ²⁹ / ₂₇	1,694 ²² / ₂₇	1,906¾	2,118¼ ¹⁴ / ₂₇	2,330¼ ¹⁰ / ₂₇	2,542¾
One mile.....	14 feet wide.....	1,368¾	1,597¼ ²⁷	1,825 ⁹ / ₂₇	2,053¼	2,281¼ ¹³ / ₂₇	2,509¼ ¹⁷ / ₂₇	2,737¾
One mile.....	15 feet wide.....	1,466¾	1,711¼	1,955½	2,200	2,444¾	2,688¾	2,933¼
One mile.....	16 feet wide.....	1,564¼	1,825 ⁹ / ₂₇	2,085 ²⁵ / ₂₇	2,346¾	2,607¼ ¹¹ / ₂₇	2,868¼ ²⁷	3,128¾
One mile.....	17 feet wide.....	1,662¾	1,919 ⁷ / ₂₇	2,216 ² / ₂₇	2,493¼	2,770¼ ¹⁹ / ₂₇	3,047¼ ¹² / ₂₇	3,324¾
One mile.....	18 feet wide.....	1,760	2,053¼	2,346¾	2,640	2,933¼	3,226¾	3,520
One mile.....	19 feet wide.....	1,857¾	2,167¼ ¹² / ₂₇	2,477¼ ²⁷	2,786¾	3,096 ⁸ / ₂₇	3,405 ²⁵ / ₂₇	3,715½
One mile.....	20 feet wide.....	1,955½	2,281¼ ¹³ / ₂₇	2,607¼ ¹⁷ / ₂₇	2,933¼	3,259¼ ²⁷	3,585 ⁵ / ₂₇	3,911¼

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