



Showing how grade was reduced on Normal Avenue, Essex County.

NINETEENTH ANNUAL REPORT

OF THE

Commissioner of Public Roads

For the Year ending October 31st

1912

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Letter of Transmittal.

OFFICE OF COMMISSIONER OF PUBLIC ROADS,
TRENTON, NEW JERSEY, December 12th, 1912.

To His Excellency Woodrow Wilson, Governor, and the Legislature of New Jersey:

I have the honor to submit the Nineteenth Annual Report of the Commissioner of Public Roads for the fiscal year ending October 31st, 1912, with such comments and suggestions as existing circumstances seem to require.

E. A. STEVENS,
Commissioner of Public Roads.

(3)

FINANCIAL STATEMENT.

	Dr.	
Balance, November 1, 1911 (M. V. F.):		
of Motor Vehicle Fund, general.....	\$131,424 74	(includes \$853.45 shown last year as balance for cautionary signs).
of Motor Vehicle Fund, Ocean Highway...	9,585 44	
of Motor Vehicle Fund, Delaware River Drive survey	6,501 10	
		\$147,511 28
Balances of appropriations against which were filed liabilities on contracts:		
for year ending October 31, 1909.....	\$34,757 11	
for year ending October 31, 1910.....	73,895 91	
for year ending October 31, 1911.....	275,484 04	
		384,137 06
Appropriations for year ending October 31, 1912:		
Construction, regular	\$300,000 00	
Construction, supplemental	100,000 00	
		400,000 00
Salaries	\$8,600 00	
Expenses for clerk hire, fees, stationery and traveling	8,000 00	
Expenses for clerk hire, fees, stationery and traveling (supplemental)	5,000 00	
Expenses for checking plans and profiles (supplemental)	2,000 00	
		23,600 00
Motor Vehicle receipts:		
Amount available for maintenance of roads.	\$401,785 00	
Set aside for salaries and expenses of Motor Vehicle Department	\$58,686 00	
Set aside for salaries and expenses of Ass't Supervisors	6,000 00	
Set aside for cautionary signs.....	1,000 00	
Set aside for direction signs.....	2,000 00	
	\$67,686 00	
Total Motor Vehicle receipts, November 1, 1911, to October 31, 1912.....		469,471 00
Total amount available for administration, construction and maintenance, November 1, 1911, to October 31, 1912.....		\$1,424,719 34
	Cr.	
Cost of work and supervision:		
Aid in construction, general—		
from 1909 appropriation.....	\$5,595 73	
from 1910 appropriation.....	23,181 64	
from 1911 appropriation.....	140,428 01	
from 1912 appropriation.....	107,698 16	
	\$276,903 54	
Supervision	27,663 10	
		\$304,566 64

Laboratory, testing road materials.....	\$5,978 38		
Survey of State Highway System (see M. V. F. also)	2,348 72	8,327 10	\$312,893 74
From Motor Vehicle Fund:			
For maintenance of Motor Vehicle Depart- ment, but not including Ass't Super- visors	\$58,686 00		
Cautionary signs	464 00		
Direction signs	1,444 70		
Survey of Delaware River Drive.....	6,492 09		
Survey of State Highway System (see also above)	525 02	\$67,611 81	
Paid on contract for Chestnut Neck Road..	\$5,835 92		
Aid in maintenance	367,717 35		
Total for maintenance of roads.....		373,553 27	\$441,165 08
	Paid from		
	Motor Vehicle		
Expenses of administration:	Appropriation.	Fund.	Total.
Salaries, regular	\$8,600 00	\$3,000 00	\$11,600 00
Wages	3,068 56	43 50	3,112 06
Travel and hotel	700 02	1,811 01	2,511 03
Automobile	7,689 99	540 00	8,229 99
Office, printing, sundries, &c.....	1,541 43	585 49	2,126 92
Checking plans and profiles.....	2,000 00	.....	2,000 00
	\$23,600 00	\$5,980 00	\$29,580 00
Total paid out November 1, 1911, to Oc- tober 31, 1912.....			\$783,638 82
Amount reverting to State Treasury from M. V. F., Ass't Supervisor's account....			20 00
Balance, October 31, 1912.....			641,060 52
			\$1,424,719 34
Total balance, October 31, 1912.....			\$641,060 52
This balance is accounted for as follows:			
Amount of Motor Vehicle Fund, general (includes \$9.01 reverting to fund from amount set aside for survey of Delaware River Drive)	\$160,231 76		
Amount of Motor Vehicle Fund for Ocean Highway	9,585 44		
Total balance in Motor Vehicle Fund.....		\$169,817 20	
Amounts of liabilities on contracts filed, against appropriations:			
for year ending October 31, 1909.....	\$29,161 38		
for year ending October 31, 1910.....	50,714 27		
for year ending October 31, 1911.....	135,056 03		
for year ending October 31, 1912.....	256,311 64		
		\$471,243 32	
Total balance, October 31, 1912.....			\$641,060 52

Cost of Roads, 1912.

In compliance with chapter 58, Laws of 1905, the following statement of cost of roads is submitted:

BERGEN COUNTY.

	Miles.		
Franklin turnpike, third section.....	2.822		
Cost		\$81,457 98	
State's share			\$27,152 66

CAMDEN COUNTY.

	Miles.		
Haddonfield and Camden turnpike.....	*...		
Purchase price		\$12,000 00	
State's share			\$4,000 00
* Mileage added in 1911.			

CAPE MAY COUNTY.

	Miles.		
Seashore road, second section.....	11.000		
Cost		\$49,802 91	
State's share			\$16,600 97
Stone Harbor turnpike.....	3.289		
Purchase price		54,000 00	
State's share			18,000 00
Cape Island turnpike, being improved as Cape May Point boulevard.....	2.520		
Purchase price		1,500 00	
State's share			500 00

CUMBERLAND COUNTY.

	Miles.		
Deerfield road	7.649		
Cost		\$17,205 37	
State's share			\$5,735 12
Shiloh turnpike	6.097		
Purchase price		5,000 00	
State's share			1,666 66

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HUNTERDON COUNTY.

High Bridge and Clinton road. Paid for
in compliance with chapter 395,
Laws of 1912. (See below.)

MONMOUTH COUNTY.

	Miles.		
Allentown and Yardville road.....	1.173		
Cost		\$11,005 10	
State's share			\$3,668 37

PASSAIC COUNTY.

	Miles.		
Lafayette avenue	0.528		
Cost		\$4,864 51	
State's share			\$1,621 50

SALEM COUNTY.

	Miles.		
Mannington, Pilesgrove and Woodstown road	5.049		
Cost		\$26,601 35	
State's share			\$8,867 12

SOMERSET COUNTY.

	Miles.		
Centreville road	2.945		
Cost		\$45,231 12	
State's share			\$15,077 04

COMMISSIONER OF PUBLIC ROADS.

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The following road is paid for in compliance with chapter 395, Laws of 1912:

HUNTERDON COUNTY.

	Miles.		
High Bridge-Clinton road.....	1.023		
Cost		\$12,516 81	
State's share			\$4,808 72
Total number of miles.....	44.095		
Total cost allowed.....		\$321,185 15	
Total paid on contracts from 1912 appropriation.....			\$107,698 16
Total paid supervisors.....			27,663 10
Total			135,361 26
Paid on survey of State highway system.....			2,348 72
Paid for laboratory work (testing road materials).....			5,978 38
Total paid from 1912 appropriations.....			\$143,688 36
Appropriations			400,000 00
Balance of appropriation against which contracts were filed October 31st, 1912			256,311 64

The following roads were paid for from the appropriation for 1911, but they were completed and payment made during the fiscal year 1912:

BURLINGTON COUNTY.

	Miles.		
North Church road, a portion of.....	0.758		
Cost		\$5,615 38	
State's share			\$1,871 79
Central avenue, Moorestown.....	0.287		
Cost		2,316 45	
State's share			772 15
Lewistown and Pemberton road.....	2.789		
Cost		8,803 45	
State's share			2,934 48
Atsion road, part paid from 1910 appropriation, also			
Cost allowed from 1911 appropriation		2,916 26	
State's share allowed from 1911 appropriation			972 09

NINETEENTH ANNUAL REPORT.

CUMBERLAND COUNTY.

	Miles.		
Vineland and Malaga road.....	5.395		
Cost		\$9,134 01	
State's share			\$3,044 67

ESSEX COUNTY.

	Miles.		
Green Brook road.....	0.253		
Cost		\$1,297 00	
State's share			\$432 33
Union avenue	1.161		
Cost		13,435 68	
State's share			4,478 56

GLOUCESTER COUNTY.

	Miles.		
Woodbury and Mantua Grove road.....	2.169		
Cost		\$27,045 74	
State's share			\$9,015 25

HUNTERDON COUNTY.

	Miles.		
Lebanon and Clinton road.....	3.371		
Cost		\$35,192 86	
State's share			\$11,730 95

MERCER COUNTY.

	Miles.		
Pennington and Harbourton road, a portion of	2.791		
Cost		\$27,409 94	
State's share			\$9,136 65
Pennington and Washington's Crossing road, extension of.....	2.715		
Cost		25,682 06	
State's share			8,560 69

COMMISSIONER OF PUBLIC ROADS.

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MIDDLESEX COUNTY.

	Miles.		
Kingston and Aqueduct road.....	2.557		
Cost		\$26,059 16	
State's share			\$8,686 39
Main street, New Bound Brook.....	0.913		
Cost		10,954 28	
State's share			3,651 43

SOMERSET COUNTY.

	Miles.		
Liberty Corner road, second section.....	1.980		
Cost		\$18,640 22	
State's share			\$6,213 41
Blackwell's Mills and Millstone road, second section	2.765		
Cost		29,872 96	
State's share			9,957 65

UNION COUNTY.

	Miles.		
Palisade avenue and Madison Hill road..	2.389		
Cost		\$36,992 51	
State's share			\$12,330 84
Springfield avenue and Shunpike road....	1.131		
Cost		14,476 03	
State's share			4,825 34

Total number of miles..... 33.424

Cost allowed	\$295,843 99	
State share		\$98,614 67
Partial payments from 1911 appropriation (see sheet 13)		41,813 34
Total payments from 1911 appropriation.....		\$140,428 01

The following roads were paid for from the appropriation for 1910, but they were completed and payment made during the fiscal year 1912:

BERGEN COUNTY.

	Miles.		
Belleville turnpike ($\frac{1}{2}$ in Hudson county), $\frac{1}{2}$ mileage.....	0.785		
One-half total cost.....		\$16,992 48	
One-half State's share.....			\$5,664 16

BURLINGTON COUNTY.

	Miles.		
Atsion road (part paid from 1911 appropriation also).....	4.261		
Cost allowed from 1910 appropriation		\$13,560 21	
State's share paid from 1910 appropriation			\$4,520 07

HUDSON COUNTY.

	Miles.		
Belleville turnpike ($\frac{1}{2}$ in Bergen county), $\frac{1}{2}$ mileage.....	0.785		
One-half total cost.....		\$16,992 48	
One-half State's share.....			\$5,664 16

SOMERSET COUNTY.

	Miles.		
Blackwell's Mills and Millstone road, first section	2.653		
Cost		\$21,999 74	
State's share			\$7,333 25
Total number of miles.....	8.484		
Total cost allowed.....		\$69,544 91	
Total paid by State from 1910 appropriation.....			\$23,181 64

COMMISSIONER OF PUBLIC ROADS.

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The following road was paid for from the appropriation for 1909, but payment was not made until the fiscal year 1912:

OCEAN COUNTY.

	Miles.		
New Egypt section of Lakewood and New Egypt road	3.000		
Cost		\$16,787 20	
State's share			\$5,595 73

In compliance with chapter 395, Laws of 1912, partial payments have been made as follows:

County.	Road.	Amount and Appropriation, 1911.
Atlantic.....	Shore road	\$18,520 35
Hunterdon.....	Ringoes-Ringoes Station	1,218 28
Warren.....	Asbury-Washington	22,074 71
Total partial payments.....		\$41,813 34

Roads taken over and maintained by county (added to 1912 mileage).

	Miles.
Ocean county....Lakewood and Toms River road.....	9.412
Ocean county....Toms river and Lakehurst road.....	7.263
Total	16.675

The total length of improved roads added to our mileage during the fiscal year 1912, is as follows:

Paid from the 1912 appropriation.....	44.095
Paid from the 1911 appropriation.....	33.424
Paid from the 1910 appropriation.....	8.484
Paid from the 1909 appropriation	3.000
Taken over by county.....	16.675
Total	105.678

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

County.	Road.	Miles.	Cost.
Atlantic	Main road, Hammonton.....	1.758	\$5,154 00
“	May's Landing, Tuckahoe	11.867	28,499 06
“	Shore road	9.25	131,068 60
Bergen	Sylvan avenue, southern section (Al- pine)	0.487	7,144 20
“	Riverside avenue	2.275	44,156 72
“	Sylvan avenue (or boulevard), Tenafly..	1.536	17,794 68
“	Franklin turnpike, first section.....	1.773	35,744 45
Burlington	Cookstown-New Egypt	1.373	8,028 20
“	Hartford-Fairview	1.093	8,363 25
Camden	Camden and Westfield turnpike.....	3.850	36,158 88
“	Gibbsboro and Berlin.....	2.924	9,308 70
Cape May	Woodbine, Tuckahoe, first section.....	4.208	13,976 25
“	Seashore road, third section.....	6.589	24,751 61
Cumberland ...	Malaga road, second section.....	5.595	12,957 11
Essex	Cedar street	1.666	21,200 82
Gloucester ...	Mantua Grove and Mickleton.....	3.503	43,079 42
Hunterdon	Clinton, Hampton	5.227	57,252 40
Middlesex	Spotswood and Englishtown.....	2.015	9,698 08
Monmouth	Englishtown, Jamesburg.....	1.094	7,650 00
“	Sea Bright, Highlands.....	1.666	9,951 51
Ocean	Lakewood and New Egypt, eastern sec- tion	1.995	5,875 00
“	Lakewood and New Egypt, western sec- tion	6.110	29,950 00
“	Lakewood and New Egypt, middle sec- tion	5.445	18,976 00
“	Lakehurst and Brown's Mills, eastern sec- tion	5.777	30,161 43
Passaic	Midvale and Greenwood Lake.....	2.321	26,576 32
Salem	Woodstown	0.459	14,198 49
Somerset	Liberty Corner road, first section.....	2.011	25,379 96
“	Plainville road	2.559	24,729 89
Sussex	Newton, Stanhope	9.780	83,453 16
“	Franklin Furnace, Stockholm.....	5.816	61,863 35
“	Hamburg, Sussex	2.867	25,451 77
Union	Shunpike, end section.....	1.195	20,507 25
“	Morris avenue	2.917	41,747 54

Miles and Cost.

The total amount expended by the State and the number of miles paid for in each county from the passage of the State Aid Law to October 31st, 1912, are as follows:

County.	Miles.	Amount.
Atlantic	111.175	\$129,206 53
Bergen	37.910	151,235 15
Burlington	195.818	321,061 23
Camden	107.550	261,703 88
Cape May	59.494	129,319 03
Cumberland	20.361	25,219 68
Essex	115.717	299,190 53
Gloucester	87.828	114,855 42
Hudson	5.545	45,799 43
Hunterdon	37.866	105,177 19
Mercer	143.308	371,064 71
Middlesex	168.280	338,577 18
Monmouth	127.391	233,788 56
Morris	76.658	165,345 55
Ocean	78.697	84,582 28
Passaic	66.342	153,799 10
Salem	42.311	68,063 33
Somerset	99.540	224,069 72
Sussex	14.331	33,254 31
Union	32.485	109,455 51
Warren	55.467	142,471 73
Paid to Supervisors.....		144,359 70
	<hr/>	<hr/>
	1,684.074	\$3,651,599 75

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

	Macadam.	Telford.	Asphalt Binder.	Tar Binder.	Amiesite.	G. F. B.	Filbertine.	Bitulithic.	Gravel.	Shell.	Bog Ore.	Totals.
Atlantic	28,776								1,077,988			1,106,764
Bergen	239,295		24,125	29,087	8,758	27,924						329,189
Burlington	849,287	255,180							296,551			1,401,018
Camden	381,214	193,623	19,712		104,116				185,481			884,146
Cape May									614,289			614,289
Cumberland									195,089			195,089
Essex		1,059,389	12,136									1,071,525
Gloucester	239,313				20,357		35,084		494,281			789,035
Hudson		55,665			8,759							64,424
Hunterdon	256,467		27,078									283,545
Mercer	1,115,670	48,792	66,677									1,231,139
Middlesex	946,841	37,752	108,416		15,981				188,086			1,297,076
Monmouth	494,065	16,498							561,341		52,264	1,124,168
Morris	485,906	6,275	24,818		54,550							571,549
Ocean									902,949			902,949
Passaic	595,980		18,488			39,280						653,748
Salem	44,124							16,115	249,347	94,206		403,792
Somerset	43,755	679,563	36,976									760,294
Sussex	76,113	10,560	26,793									113,466
Union	161,155		49,991		93,173							304,319
Warren	334,655	86,453	79,787									500,895
Total	6,292,616	2,449,750	494,997	29,087	305,694	67,204	35,084	16,115	4,765,402	94,206	52,264	14,602,419

* In case of some of the early roads this yardage is approximate only.

Description of Turnpikes Purchased in 1912.

During the fiscal year just closed four turnpikes have been purchased, one-third of the cost of which, as provided by the statute, was paid by the State after the purchase price had been approved by the Commissioner of Public Roads.

These turnpikes are: *First*, Stone Harbor Turnpike in Cape May county.

This improvement begins at the main shore road in Cape May Court House and extends across the salt marsh and thoroughfares to the sandbar known as Seven Mile Beach. This road was built at great expense by the proprietors of the lower portion of Seven Mile Beach for the purpose of bringing their improved property into closer communication with the main land. In fact, before the construction of this turnpike the only sure means of reaching the beach from the mainland was by boat.

The price paid by the State is in reality only one-third of one-half of the cost of the road, the entire cost of the other half being borne by the land company. Owing to the fact that the seven mile beach is being rapidly built up and improved, there is no doubt whatever that the investment is a wise one for the State. The length of the turnpike is 3.289 miles. Its graded width is one hundred feet, fifty feet of which is conveyed to the State and county. The graveled portion is from thirty-five to thirty feet in width and eight inches in the center, and four inches on the side in depth.

A very moderate price paid by the State for the cost of its improvement was \$18,000.

At the lower extremity of Cape May county likewise a turnpike, known as Cape Island Turnpike, 2.52 miles long, was built, fifty years ago, from Cape May City to the dock at Cape May Point. As this was the main boat landing for larger vessels it was very

necessary that the road from it to the city be maintained in good condition. As the turnpike had been taken over by the trolley company some years since, it was deemed wise to protect the title by securing a quitclaim deed. This was done for the sum of \$1,500, one-third of which, or \$500, was contributed by the State. This road is now being improved, and will be ready for use next summer.

In the last county in the State to avail itself of the provisions of the State act, viz., the county of Cumberland, the Shiloh turnpike, 6.097 miles long, has been purchased and paid for. This turnpike extends from the county seat at Bridgeton, northwesterly through Shiloh to the Salem county line. This turnpike was in good condition and the purchase price was very moderate, the State's one-third amounting to only \$1,666.66. The last turnpike to be paid for out of the 1912 appropriation was the Camden and Haddonfield, 4.132 miles long. The purchased portion begins at the city line of Camden and ends at the main street in Haddonfield. Agreement to purchase this turnpike was entered into some year ago. Owing to some legal questions the State's share of the purchase price was not paid until this year. This amount was \$4,000.

Description and Statement of Cost of Roads Improved in 1912.

BERGEN COUNTY.

Franklin Turnpike, Third Section, 2.822 Miles Long.

This improvement begins at the borough line of Allendale and extends southerly to the borough line of Hohokus. The graded width of the roadway is thirty feet and that of the paved is sixteen feet.

This pavement consists of a macadam base with a hot mixed asphalt concrete top, two inches in thickness, the total thickness of the pavement being seven inches.

This is a portion of the main thoroughfare between Edgewater Ferry, opposite One Hundred and Twenty-third street, New York, to Suffern and Tuxedo. The road is subject therefore to very heavy and severe traffic. As the road was originally an old turnpike, the alignment was very good, but in some sections the grade was very bad. This necessitated quite heavy cutting and filling at some points, which was very strenuously objected to by the property owners before and during the work of improvement, but since the completion of the work they are one and all enthusiastic in its praise. As the soil over which most of the road is built is composed of a coarse glacial drift or gravel it was necessary on the steeper grades to pave the gutters in order to hold them against the wash and scour of the water; also owing to this same fact it was necessary to build several concrete retaining walls in order to hold the roadbed in place.

As many of these conditions developed after the work commenced the contract price was increased over fifty per cent.

Detailed statement of the cost of the Franklin turnpike, third section, from the north line of Allendale to the north line of Hobokus, county of Bergen. Total length, 14,901.0 feet, or 2.822 miles.

Width of stone-bed, 16.0 feet.
Length of stone-bed, 14,901.0 feet.
Depth of stone-bed, 7 inches.

Macadam, G. F. B., 27,924 square yards, at \$1.47; total.....	\$41,048 28
Excavation, unclassified, 26,838 cubic yards, at 50 cents; total..	13,419 00
Excavation, rock, 40 cubic yards, at \$2.50; total.....	100 00
4-inch tile drain, 8,400 lineal feet, at 35 cents; total.....	2,940 00
12-inch tile drain, 1,744 lineal feet, at \$1.05; total.....	1,831 20
15-inch tile drain, 550 lineal feet, at \$1.15; total.....	632 50
18-inch tile drain, 1,078 lineal feet, at \$1.45; total.....	1,563 10
24-inch tile drain, 120 lineal feet, at \$1.70; total.....	204 00
18-inch x 12-inch Y-branches, 6, at \$1.70; total.....	10 20
15-inch x 12-inch Y-branches, 3, at \$1.20; total.....	3 60
12-inch x 12-inch Y-branches, 8, at 90 cents; total.....	7 20
4 small basins, at \$15; total.....	60 00
12 standard basins, at \$85; total.....	1,020 00
1 double basin, at \$125; total.....	125 00
7 manholes, at \$35; total.....	245 00
Open ditch, 1,065 lineal feet, at 10 cents; total.....	106 50
Cobble gutter, 1,975 square yards, at 85 cents; total.....	1,678 75
Concrete walls, 1,662 cubic yards, at \$8.65; total.....	14,376 30
Rubble walls, 352.89 cubic yards, at \$6; total.....	2,117 35
Total	\$81,487 98
Deduct for work omitted by reason of requirements of Shade Tree Commission	30 00
	<hr/>
	\$81,457 98
Supervisor's salary	516 00
Engineering expenses	2,423 00
Extras, paid by county.....	3,693 50
Total cost of road.....	\$88,090 48
<hr/>	
Lump sum, contract price, original, \$51,163.84; supplemental, \$22,902.75	\$74,066 59
Total allowed by the State.....	\$81,457 98
One-third of above, amount paid by the State.....	\$27,152 66
 Maximum grade before.....	9.20 per cent.
Maximum grade after.....	5.00 per cent.

RALPH D. EARLE, JR.,
Engineer.
J. B. CHRISTOPHER,
Supervisor.

Belleville Turnpike, 1.57 Miles Long.

This is a county line road, the center line of which forms the boundary between Hudson and Bergen counties. The section just improved begins at Saw Mill creek, the end of the old macadam, and ends at the Belleville bridge over the Passaic river. This road was chartered as a turnpike in 1807 for the purpose of giving Jersey City an outlet to Northern New Jersey by way of the Newark and Pompton turnpike. This road is regaining its old popularity, and the increase of travel has been so great that the three counties of Essex, Hudson and Bergen have contracted for a new bridge over the Passaic river to accommodate it. The grade was improved, but not as much as was desired, owing to the fact that gate house and gates of the Jersey City Water Works are located on top of the hill.

The macadam pavement is twenty feet wide and eight inches thick.

Detailed statement of the cost of the Belleville turnpike, from Saw Mill creek to Passaic river (boundary line between the county of Hudson and the county of Bergen). Total length, 8,295 feet, or 1.57 miles.

Width of stone-bed, 20 feet.
 Length of stone-bed, 8,295 feet.
 Depth of stone-bed, 8 inches.

Macadam with amiesite, 17,517 square yards, at \$1.12; total....	\$19,619 04
Earth excavation, { 7,415 cubic yards, at 40 cents; total.....	2,966 00
{ 23,653 cubic yards, at 30 cents; total....	7,095 90
Rock excavation, 1,142 cubic yards, at 1 cent; total.....	11 42
Drain, 2,306 lineal feet, at 20 cents; total.....	461 20
Belgian block gutter, 3,654 square yards, at \$1.00; total.....	3,654 00
Open ditch, 500 lineal feet. at 50 cents; total.....	250 00

Total	\$34,057 56
Deduct 726 square yards top dressing of amiesite, at 10 cents; total	72 60

Supervisor's salary	\$33,984 96
Engineering expenses, 5 per cent. on (\$39,538.46 total contract),	1,170 00
Extras, paid by counties (Division B).....	1,976 92
	5,553 50

Total cost of road.....	\$42,685 38
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Lump sum, contract price.....	\$36,372 02
Total allowed by the State.....	\$33,984 96
One-third of above, amount paid by the State.....	\$11,328 32

Maximum grade before	10 per cent.
Maximum grade after	7 per cent.

RALPH D. EARLE, JR.,
Engineer for Bergen Co.

EUGENE SMITH,
Engineer for Hudson Co.

CHARLES F. RODEN,
Supervisor, from September 21, 1911.

NOTE.—As cobblestones could not be obtained at the time, Belgian blocks were substituted for the gutter pavement, the price being increased from \$0.75 to \$1 per square yard therefor.

BURLINGTON COUNTY.

North Church Road, Portion of, .758 Miles Long.

This closes the gap between two stretches of macadam road extending from West Moorestown to Palmyra, thus giving the people of this section a continuous smooth, hard road between these places. The macadam is fourteen feet wide and six inches deep.

Detailed statement of the cost of the North Church road, a portion of township of Chester, county of Burlington. Total length, 4,000 feet, or .758 miles.

Width of stone-bed, 14 feet.
 Length of stone-bed, 4,000 feet.
 Depth of stone-bed, 6 inches.

Macadam, 6,222 square yards, at 79 cents; total.....	\$4,915 38
Earth excavation, 2,480 cubic yards, at 25 cents; total.....	620 00
Extra excavation, 200 cubic yards, at 40 cents; total.....	80 00
<hr/>	
Total	\$5,615 38
Supervisor's salary	153 00
Engineering expenses	280 76
<hr/>	
Total cost of road.....	\$6,049 14
<hr/>	
Lump sum, contract price.....	\$5,615 38
Total allowed by the State.....	\$5,615 38
One-third of above, amount paid by the State.....	\$1,871 79
<hr/>	
Maximum grade before.....	3.00 per cent.
Maximum grade after.....	0.53 per cent

EARL THOMSON,
Engineer.
 SAM'L W. SMITH,
Supervisor.

COMMISSIONER OF PUBLIC ROADS.

25

Central Avenue, Moorestown, .287 Miles Long.

This is more properly described as a village street than a road, as it simply connects the improvements already made in Moorestown. It begins at Stanwick avenue and ends near Elm avenue. The pavement is of macadam, fourteen feet wide and six inches deep.

Detailed statement of the cost of Central avenue, Moorestown, from Elm to Stanwick avenue, Township of Chester, county of Burlington. Total length, 1,516 feet, or .287 miles.

Width of stone-bed, 14 feet.

Length of stone-bed, 1,516 feet.

Depth of stone-bed, 6 inches.

Macadam, 2,358 square yards, at 72 cents; total.....	\$1,697 76
Extra macadam, 202 square yards, at 72 cents; total.....	145 44
Earth excavation, 935 cubic yards, at 25 cents; total.....	233 75
Extra excavation, 100 cubic yards, at 40 cents; total.....	40 00
Drain, 210 lineal feet, at 15 cents; total.....	31 50
French drain, 336 lineal feet, at 50 cents; total.....	168 00

Total	\$2,316 45
Supervisor's salary	75 00
Engineering expenses	115 82

Total cost of road.....	\$2,507 27
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Lump sum, contract price.....	\$1,971 51
Total allowed by the State.....	\$2,316 45
One-third of above, amount paid by the State.....	\$772 15

Maximum grade before.....	2.45 per cent.
Maximum grade after.....	1.19 per cent.

EARL THOMSON,
Engineer.
 SAM'L W. SMITH,
Supervisor.

Lewistown and Pemberton Road, 2.789 Miles Long.

This road was done by the township of Pemberton, as the county did not feel able to undertake it. It begins at the intersection of the Juliustown road in Lewistown and extends to the railroad crossing in North Pemberton where it joins the improved roads of that town. It is the first section of the extension of the through line across the State that has so long been desired, hence is of State as well as of local value. This road is built of gravel, sixteen feet wide and eight inches thick.

Detailed statement of the cost of the Lewistown-Pemberton road, township of Pemberton, county of Burlington. Total length, 14,725.0 feet, or 2.789 miles.

Width of gravel-bed, 16 feet.

Length of gravel-bed, 14,725.0 feet.

Depth of gravel-bed, .8 inches.

Gravel, 5,487 cubic yards, at \$1.35; total.....	\$7,407 45
Earth excavation, 4,054 cubic yards, at 25 cents; total.....	1,013 50
Extra material required for embankment, 1,530 cubic yards, at 25 cents; total.....	382 50
Total	\$8,803 45
Supervisor's salary	222 00
Engineering expenses	307 00
Total cost of road.....	\$9,332 45
Lump sum, contract price.....	\$9,248 95
Total allowed by the State.....	\$8,803 45
One-third of above, amount paid by the State.....	\$2,934 48
Maximum grade before.....	2.5 per cent.
Maximum grade after.....	1.433 per cent.

ALMER J. EARL.

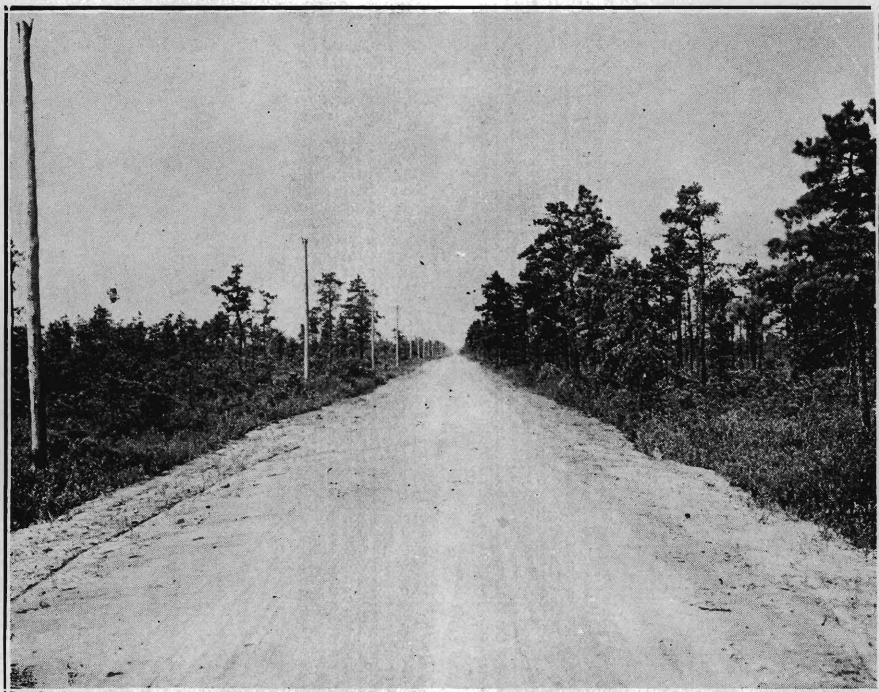
Engineer.

T. C. SHUM,

Supervisor.



Burlington County, Atsion Road, Before.



Burlington County, Atsion Road, Gravel, After.

Atsion Road, 4.261 Miles Long.

This is the last link in our line of improvements between Trenton and Atlantic City, reducing the distance over improved roads fifteen miles. The sand over which the gravel was laid was so loose and fine that the road was almost impassable for motor vehicles. The country through which the improvement was made was so wild and unimproved that the property along its line could not be asked to bear the cost. Therefore, it naturally became a State and county task.

This gravel road is sixteen feet wide and eight and four inches thick.

Detailed statement of cost of the Atsion road, township of Shamong, county of Burlington. Total length, 22,500 feet, or 4.261 miles.

Width of gravel-bed, 16 feet.

Length of gravel-bed, 22,500 feet.

Depth of gravel-bed, 8 inches in center, 4 inches at sides.

This road was constructed under two contracts, one of which included grading the entire length and width of the road (22,500 feet), and graveling, 4,800 feet; the second contract provided for graveling the remainder, or 17,700 feet.

First Contract.

Gravel, 1,422.18 cubic yards, at \$1.40; total.....	\$1,991 05
Earth excavation, 6,753 cubic yards, at 30 cents; total.....	2,025 90
Extra material required for embankment, 3,878.2 cubic yards, at 30 cents; total.....	1,163 46
Grubbing, 15.21 acres, at \$50.00; total.....	760 50
Filling up and walling race bridge.....	100 00
Total	<hr/> \$6,040 91

Second Contract.

Gravel, 5,244 cubic yards, at \$1.99; total.....	\$10,435 56
Total	<hr/> \$16,476 47
Supervisor's salary	588 75
Total cost of road.....	<hr/> \$17,065 22

State's share of first contract.....	\$2,013 64
State's share of second contract.....	3,478 52
Total State's share.....	\$5,492 16
Amount paid from 1910 appropriation.....	\$4,520 07
Amount paid from 1911 appropriation.....	972 09
Total	\$5,492 16
Maximum grade before.....	3.95 per cent.
Maximum grade after.....	0.40 per cent.

Original detailed statements signed by,

EARL THOMSON,
Engineer.
ISAAC N. B. WRIGHT,
Supervisor.

CAPE MAY COUNTY.

Seashore Road, Second Section, 11 Miles Long.

This is the continuation of the improvement which was begun at Cape May City in 1901, and completed to Cape May Court House in the following year.

For nine years following nothing was done to improve the remainder of the Main Shore road.

In passing it might be well to say that the topography of Cape May shore is different from that farther north, inasmuch as there is a salt marsh varying in width from three to four miles between the mainland and the sandbar which forms the seashore.

The road we are describing runs along the top of the ridge on the edge of the mainland adjacent to the salt meadow. It is therefore in fact, as well as in name, the main road of the county into which all others run.

The section paid for this year is eleven miles in length and was commenced last year. The graded width of the roadway is thirty-five feet. The gravel covering is twenty feet wide and varies in consolidated thickness from eight inches in the center to five inches on either side. This, in connection with the six miles just completed to Beesley's Point, completes Cape May county's entire portion of the ocean highway.



Cape May County, Sea Isle City Road, Before Improvement.





Cumberland County, Deerfield Road, Before.



Detailed statement of the cost of the Seashore road, second section, townships of Middle, Dennis and Upper, county of Cape May. Total length, 58,080 feet, or 11 miles.

Width of gravel-bed, 20 feet.

Length of gravel-bed, 58,080 feet.

Depth of gravel-bed, 8 inches in centre, 5 inches at sides.

Gravel, 23,533 cubic yards, at \$1.37; total.....	\$32,240 21
Earth excavation, 30,160 cubic yards, at 25 cents; total.....	7,540 00
Earth embankment, 27,522 cubic yards, at 35 cents; total.....	9,632 70
Grubbing, 6½ acres, at \$60.00; total.....	390 00
<hr/>	
Total	\$49,802 91
Supervisor's salary	1,020 00
Engineering expenses	2,254 30
Extras, paid by county.....	292 70
<hr/>	
Total cost of road.....	\$53,369 91
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Lump sum, contract price.....	\$49,802 91
Total allowed by the State.....	\$49,802 91
One-third of above, amount paid by the State.....	\$16,600 97
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Maximum grade before.....	5 per cent.
Maximum grade after.....	2 per cent.

L. M. RICE,

Engineer.

BARCKLEY E. GRACE,

Supervisor.

CUMBERLAND COUNTY.

Deerfield Road, 7.649 Miles Long.

This road begins at the Salem county line near Shelby, and runs southerly through Deerfield, thence southeasterly to Carl's Corner, and thence southwesterly into Bridgeton, the county seat of Cumberland county.

The improvement of this one road means more to Cumberland county than might at first glance appear, for when less than one mile is improved in Salem county, Bridgeton will be connected with the improved highway system of New Jersey, from which it has been separated during all the past years.

The graded width of this road is thirty feet, and the graveled width is twenty feet. The depth of compacted gravel varies from eight inches in the center to four inches at the outer edges.

In the improvement of this road two dangerous grade crossings were eliminated by the simple expedient of laying out a new road, thereby keeping the improved highway on one side of the railroad throughout its entire length.

The road traverses a very good farming country, and is consequently of great value to the farmers along its line as well as to the automobilists who are attracted to Cumberland county either for business or pleasure.

Detailed statement of the cost of the Deerfield road, township of Deerfield, county of Cumberland. Total length, 40,387 feet, or 7.649 miles.

Width of road, graded, 30 feet.

Width of gravel-bed, 20 feet.

Length of gravel-bed, 40,387 feet.

Depth of gravel-bed, 8 inches in centre, 4 inches at sides.

Gravel, 15,123 cubic yards, at 70 cents; total.....	\$10,586 10
Borrow, 3,350 cubic yards, at 28 cents; total.....	938 00
Earth excavation, 19,150 cubic yards, at 28 cents; total.....	5,362 00
Grubbing, 1½ acres, at \$66⅔; total.....	100 00
Extra approaches and driveways.....	229 27

Total	\$17,215 37
Deduction, account of slope, at Sta. 295.....	10 00

Total	\$17,205 37
Supervisor's salary	474 00
Engineering expenses	860 46
Culverts and bridges paid for by county.....	1,581 53
Extras, paid by county.....	60 00

Total cost of road.....	\$20,181 36
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Lump sum, contract price.....	\$16,986 10
Total allowed by the State.....	\$17,205 37
One-third of above, amount paid by the State.....	\$5,735 12

Maximum grade before.....	5.00 per cent.
Maximum grade after.....	2.92 per cent.

WALTER M. SHARP,
County Engineer.
W. A. EASTLACK,
Supervisor.



Cumberland County, Deerfield Road, Before Improvement.



Cumberland County, Deerfield Road, Gravel, After Improvement.

Vineland and Malaga Road, 5.395 Miles Long.

This gravel road begins at the end of the improved road at Gloucester county line and extends south to Landis avenue in Vineland. It is the first improved highway built in Cumberland county to connect with the improved roads of the adjacent counties.

The existing grades were improved and one very crooked section straightened. This work was completed last year, but too late to be reported. The great improvement made in this old road has so aroused the good road sentiment throughout the county that demands are being made from all sections for like benefits.

The width of the gravel bed as first designed was fourteen feet, but the very marked difference between the gravel and sand caused the Board to request that the graveled width be increased to twenty-two feet on a portion of the road. This was readily granted by the Commissioner, as the department had urged the greater width from the beginning. Its depth is nine and six inches.

Detailed statement of the cost of the Vineland and Malaga road, township of Landis, county of Cumberland. Total length, 28,488 feet, or 5.395 miles.

Width of gravel-bed, 14 feet for 23,208 feet; 22 feet for 5,280 feet.

Length of gravel-bed, 28,488 feet.

Depth of gravel-bed, 9 inches in center; 6 inches at sides.

Gravel, 9,332 cubic yards, at 54 cents; total.....	\$5,039 28
Earth excavation, 16,480 cubic yards, at 23 cents; total.....	3,790 40
Grubbing, 0.33 acre, at \$100.00; total.....	33 00
Plus difference between items and lump sum.....	33

Total	\$8,863 01
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Extra work on driveways, 50 cubic yards excavation, at 70 cents; total	35 00
Extra gravel-bed, 587.5 cubic yards, at 80 cents; total.....	470 00

Total	\$9,368 01
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Deduction on account of excavation not made, about 1,017 cubic yards, at 23 cents; total.....	234 00
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Total	\$9,134 01
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Supervisor's salary	501 00
Engineering expenses	446 78
Extras, paid by county	185 00

Total cost of road.....	\$10,266 79
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Lump sum, contract price	\$8,863 01
Total allowed by the State.....	\$9,134 01
One-third of above, amount paid by the State.....	\$3,044 67

Maximum grade before	4.67 per cent.
Maximum grade after	3.33 per cent.

WALTER M. SHARP,
Engineer.
D. S. EDSON,
J. E. PAYNE,
Supervisors.

ESSEX COUNTY.

Green Brook Road, .253 Miles Long.

This was practically a resurfacing job, and completed the work done last year which ended at the North Caldwell borough line, leaving a short gap. This improvement begins at the borough line and ends at Pier lane, an improved county road. This is in line with the policy of the department in closing up all short gaps between improved highways. The width of the macadam pavement is sixteen feet, and its depth three and three-quarter inches. No change was made in alignment or grade.

Detailed statement of the cost of the Green Brook road, township of Caldwell, county of Essex. Total length, 1,334 feet, or 0.253 miles.

Width of stone-bed, 16 feet.
Length of stone-bed, 1,334 feet.
Depth of stone-bed, 3¾ inches.

Telford, with surface oil, 2,384 square yards, at 50 cents; total..	\$1,192 00
Earth embankment, 105 cubic yards, at \$1.00; total.....	105 00

Total	\$1,297 00
Supervisor's salary	291 00

Total cost of road.....	\$1,588 00
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Lump sum, contract price.....	\$1,297 00
Total allowed by the State.....	\$1,297 00
One-third of above, amount paid by the State.....	\$432 33

Maximum grade, no change.

JAS. OWEN,
Engineer.
FRED. E. PADDOCK,
Supervisor.

Union Avenue, 1.161 Miles Long.

This road begins at Jerolamon street, Belleville, and runs north-
 erly to Avondale road, Nutley. It is parallel with Washington
 avenue, and consequently will relieve that highway to some extent.
 The graded width of the telford roadbed is thirty-six feet and
 that of the pavement is sixteen feet. Its depth is eight inches.

Detailed statement of the cost of the Union avenue, township of Belleville,
 and Nutley, county of Essex. Total length, 6,133 feet, or 1.161 miles.

Width of stone-bed, 16 feet.

Length of stone-bed, 6,133 feet.

Depth of stone-bed, 8 inches.

Telford, with surface oil, 10,924 square yards, at 68 cents; total,	\$7,428 32
Earth excavation, 14,622 cubic yards, at 38 cents; total.....	5,556 36
Cobble stone gutter, 600 square yards, at 75 cents; total.....	450 00
Plus difference between items and lump sum.....	1 00

Total	\$13,435 68
Supervisor's salary	217 50

Total cost of road.....	\$13,653 18
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Lump sum, contract price.....	\$13,435 68
Total allowed by the State.....	\$13,435 68
One-third of above, amount paid by the State.....	\$4,478 56

Maximum grade before.....	9.60 per cent.
Maximum grade after.....	4.00 per cent.

JAS. OWEN,
Engineer.
 ANDREW BARR,
Supervisor.

GLOUCESTER COUNTY.

Woodbury and Mantua Grove Road, 2.169 Miles Long.

This is the first section of the through line from Woodbury to Swedesboro, and begins at the city pavement in Woodbury and ends at the Mantua Grove school house. The graded width of the road is twenty-eight feet, and that of the pavement sixteen feet. Its depth is seven inches. Owing to the continuous heavy traffic over this road it was deemed economy to substitute hot mixed asphalt concrete for the plain macadam, and thus far the decision seems to have been a wise one. The second section through Mount Royal, Clarksboro and Mickleton is practically finished, but not in time to be included in this year's report. It is the intention of the county to complete the remaining four miles to Swedesboro the coming year.

Detailed statement of the cost of the Woodbury and Mantua Grove road, city of Woodbury and township of West Deptford, Gloucester county, New Jersey. Total length, 11,451 feet, or 2.169 miles.

Width of stone-bed, 16 feet.
Length of stone-bed, 11,451 feet.
Depth of pavement, 7 inches.

Earth excavation, 5,985 cubic yards, at 28 cents; total.....	\$1,675 80
Amiesite, 20,357 square yards, at \$1.19½; total.....	24,326 62
Tile drain, 1,690 lineal feet, at 12 cents; total.....	202 80
Total	\$26,205 22
Extras ordered by county and approved by State:	
Excavation, 125 cubic yards, at 28 cents; total.....	\$35 00
Tile drain, 385 feet, at 24 cents; total.....	92 40
Tile drain, 600 feet, at 30 cents; total.....	180 00
French drain, 691 feet, at 45 cents; total.....	310 95
Extra depth, 444½ square yards (4 inches extra depth), at 50 cents; total.....	222 17
	<hr/> 840 52
Total	\$27,045 74
Supervisor's salary	420 00
Total cost of road.....	\$27,465 74
Lump sum contract price.....	\$26,205 22
Extras approved by State.....	840 52
Total allowed by State.....	\$27,045 74
One-third of above, paid by State.....	\$9,015 25



Gloucester County, Woodbury-Mantua Grove Road, Before.



Gloucester County, Woodbury-Mantua Grove Road, Amiesite, After.

COMMISSIONER OF PUBLIC ROADS.

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Maximum grade before.....	4.4 per cent.
Maximum grade after.....	3.5 per cent.

WM. C. CATTELL,
County Engineer.
 WILL. H. HOFFMAN,
Supervisor.

HUNTERDON COUNTY.

High Bridge and Clinton Road, 1.023 Miles Long.

This road leaves the Spruce Run turnpike about one mile north of the village of Clinton and runs through the valley to the thriving borough of High Bridge. As High Bridge is located in a basin, it is very difficult to reach it from the outside on easy grades. For that reason the present road was laid out in a new location for the greater part of its length, and is, therefore, remarkable for its easy grades.

The width of the graded roadway is twenty-eight feet, and that of the macadam pavement fourteen feet, and the depth of the macadam is six and eleven inches.

After the macadam was thoroughly rolled and consolidated, it was treated with an application of asphalt binder, and the entire work is finished in a model manner.

Detailed statement of the cost of the High Bridge-Clinton road, township of Clinton, county of Hunterdon. Total length, 5,400 feet, or 1.023 miles.

Width of stone-bed, 14 feet.
 Length of stone-bed, 5,350 feet.
 Depth of stone-bed, 6 and 11 inches.

Foundation C, 5,923 square yards, at \$31.82 cents; total.....	\$1,886 00
Foundation B, 2,800 square yards, at 46 cents; total.....	1,288 00
Surface B, Binder B, 8,723 square yards, at 47 cents; total.....	4,099 81
Earth excavation, 2,771 cubic yards, at 50 cents; total.....	1,385 50
Extra excavation, 4,140 cubic yards, at 60 cents; total.....	2,484 00
Drain, 1,835 lineal feet, at 30 cents; total.....	550 50
Macadam driveways, 120 square yards, at 50 cents; total.....	60 00
Ditch 580 square yards, at 50 cents; total.....	290 00
Total	\$12,043 81

Supervisor's salary	198 00
Engineering expenses	275 00
Extras, paid by county :	
Pipes, 6	462 00
Culverts, 3	1,186 35
<hr/> Total cost of road.....	<hr/> \$14,165 16
Lump sum, contract price.....	\$11,690 79
Total allowed by the State.....	\$12,516 81
 Forty per cent. of above, amount paid by the State.....	 \$5,006 72
Less inspection already paid by the State.....	198 00
<hr/> Balance of State share	<hr/> \$4,808 72
 Maximum grade before	 10 per cent.
Maximum grade after	5 per cent.

GRANT DAVIS,
Engineer.
HARRY P. SNYDER,
Supervisor.

Lebanon and Clinton Road, 3.371 Miles Long.

This is one more section of the old New Jersey turnpike, and begins at the present improvement in Lebanon and ends at the borough line of Clinton. The improvements in grade on this line are many and marked. These, with the smooth, hard pavement, made this one of the most noticeable improvements of last year. The road was finished last year, but too late to warrant the application of the surface treatment of asphalt oil. This was applied in April as soon as the weather would permit. The alignment, like that of nearly all old turnpikes, was very good. We feel that in improving this road we are building a portion of our State highway.

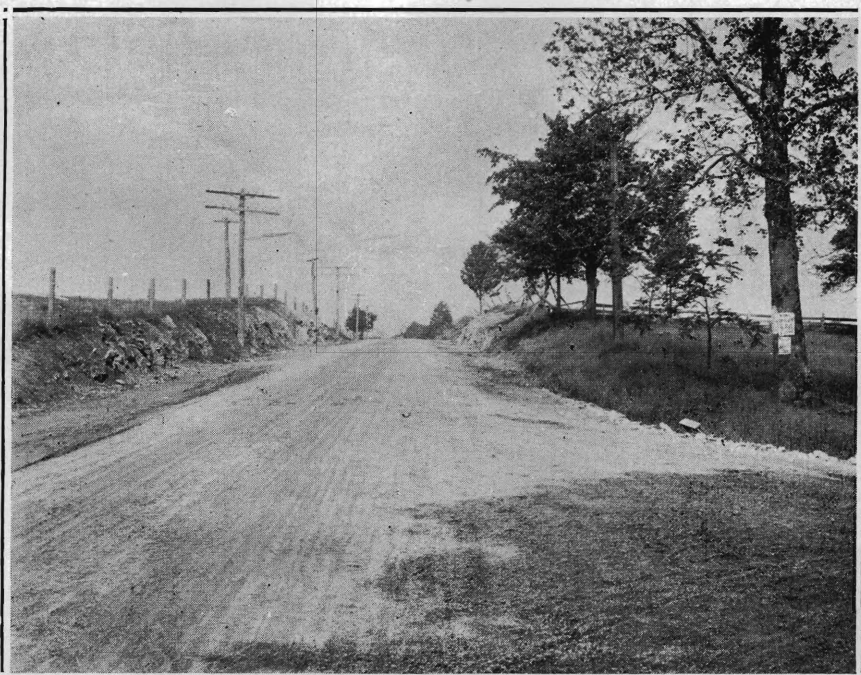
This stone work is fourteen feet wide and six inches deep.

Detailed statement of the cost of the Lebanon-Clinton road, township of Clinton, county of Hunterdon. Total length, 17,802 feet, or 3.371 miles.

Width of stone-bed, 14 feet.
Length of stone-bed, 17,802 feet.
Depth of stone-bed, 6 inches.



Hunterdon County, Lebanon-Clinton Road, Before Improvement.



Hunterdon County, Lebanon-Clinton Road, After Improvement.

Macadam, without oil, 28,381 square yards, at 46 cents; total...	\$13,055 26
Macadam driveways, 1,080 square yards, at 30 cents; total.....	324 00
Earth excavation, 33,436 cubic yards, at 60 cents; total.....	20,061 60
Extra excavation, 1,876 cubic yards, at 60 cents; total.....	1,125 60
Drain, 2,112 lineal feet, at 20 cents; total.....	422 40
Cobble stone gutter, 204 square yards, at \$1.00; total.....	204 00
<hr/>	
Total	\$35,192 86
Supervisor's salary	645 00
Engineering expenses	745 00
Extras, paid by county, pipes and culverts.....	649 60
<hr/>	
Total cost of road.....	\$37,232 46
<hr/>	
Lump sum, contract price.....	\$34,817 62
Total allowed by the State.....	\$35,192 86
One-third of above, amount paid by the State.....	\$11,730 95

Maximum grade before.....	12.00 per cent.
Maximum grade after.....	5.7 per cent.

GRANT DAVIS,
Engineer.
 ISAAC CREVELING,
Supervisor.

MERCER COUNTY.

Pennington and Harbourton Road, Portion of, 2.791 Miles Long.

This is another local road thus far, but may be made of more importance if extended. At present it is only a feeder to Pennington, and an outlet to the railroad for the farmers along it. It is built of macadam, fourteen feet wide, six inches thick.

Detailed statement of the cost of the improvements to the public highway in Mercer county, New Jersey, known as the Pennington and Harbourton road, portion of, beginning at borough line of Pennington and extending to Trenton and Harbourton road, in the township of Hopewell. Total length of road, 14,735.3 feet, or 2.791 miles.

- Length of stone-bed, 14,712.3 feet.
- Width of stone-bed, 14 feet.
- Depth of stone-bed, not less than 6 inches.
- Average width of shoulders, 7 feet.
- Average total width of improved roadway, 28 feet.

Excavations, 10,900 cubic yards, at 40 cents; total.....	\$4,360 00
Macadam, 23,240 square yards, at 86 cents; total.....	19,986 40
Macadam driveways, 136 square yards, at 89 cents; total.....	121 04
Underdrains, 7,400 lineal feet, at 22 cents; total.....	1,628 00
Authorized extra, 5,975 lineal feet underdrains, at 22 cents.....	1,314 50
<hr/>	
Total	\$27,409 94
Supervisor's salary	984 00
<hr/>	
Total cost of road.....	\$28,393 94
<hr/>	
Lump sum, contract price.....	\$26,095 44
Total allowed by the State.....	\$27,409 94
One-third of above, amount paid by the State.....	\$9,136 65
<hr/>	
Maximum grade before.....	7.3 per cent.
Maximum grade after.....	4.7 per cent.

We hereby certify the above statement to be correct, and that the work was constructed in all respects in strict conformity to the plans and specifications, and that the finished pavement was Class B, or not less than 6 inches deep.

Respectfully yours,

FRANK J. EPPELE,
Engineer.
 J. EDWARD HUNT,
Supervisor.

*Pennington and Washington's Crossing Road, Extension of, 2.715
 Miles Long.*

This improvement begins at Woolsey's branch, at the end of the present macadam, and meanders to Washington's Crossing, thus connecting two macadam roads. This may be properly described as a local road, and as such is of great value to the farmers living along it. The pavement was of macadam, to which was applied a coat of light asphaltum oil as a dust layer and binder. The width of the pavement is fourteen feet and its depth six inches. The alignment is not good, a mistaken idea of economy preventing its proper straightening.

Detailed statement of the cost of the improvement to the public highway in Mercer county, New Jersey, known as the extension of the Pennington and Washington's Crossing road, beginning at Woolsey's Branch of Jacob's creek, and extending to Washington's Crossing, in the township of Hopewell. Total length of road, 14,334 feet, or 2.715 miles.

COMMISSIONER OF PUBLIC ROADS.

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Length of stone-bed, 14,286 feet.

Width of stone-bed, 14 feet.

Depth of stone-bed, Class B, or not less than 6 inches deep.

Average width of shoulders, 6 feet.

Average total width of improved roadway, 26 feet.

Excavations, 14,100 cubic yards, at 45 cents; total.....	\$6,345 00
Macadam, Class B, 22,710 square yards, at 74 cents; total....	16,805 40
Macadam driveways, 204 square yards, at 79 cents; total.....	161 16
Underdrains, 8,525 lineal feet, at 22 cents; total.....	1,875 50
Authorized extra, 2,250 lineal feet underdrains, at 22 cents; total;	495 00
<hr/>	
Total	\$25,682 06
Supervisor's salary	1,074 00
<hr/>	
Total cost of road.....	\$26,756 06
<hr/>	
*Lump sum, contract price.....	\$25,187 06
Total allowed by the State.....	\$25,682 06
One-third of above, paid by the State.....	\$8,560 69
<hr/>	
Maximum grade before	14.8 per cent.
Maximum grade after	5.0 per cent.

We hereby certify the above statement to be correct, and that the work was constructed in all respects in strict conformity to the plans and specifications, and that the finished pavement was Class B, or not less than 6 inches deep.

Respectfully yours,

FRANK J. EPPELE,

Engineer.

OLIVER W. STOUT,

Supervisor.

* The original lump sum contract price was \$26,322.56, and the original price bid for Class B macadam, 79 cents per square yard, but under a supplemental agreement entered into by the Board of Freeholders and approved by the State Road Department, the method of construction was changed and under this agreement Class B macadam was to cost 74 cents per square yard, thereby reducing the lump sum, contract price, to \$25,187.06.

MIDDLESEX COUNTY.

Kingston and Aqueduct Road, 2.557 Miles Long.

This road begins at the Trenton and New Brunswick turnpike, near Plainsboro, and extends to and along Carnegie Lake, and thence to the Kingston and Monmouth Junction road. It forms a beautiful drive along this now famous sheet of water, and also forms part of the shortest line of improved road between Trenton and New Brunswick, inasmuch as it begins and ends at roads already improved. The width of the macadam is fourteen feet and its depth eight inches. This stone was treated with asphalt binder applied hot, and it is what is popularly known as a penetration road.

Detailed statement of the cost of the Kingston and Aqueduct road, township of South Brunswick, county of Middlesex. Total length, 13,500 feet, or 2.557 miles.

Width of stone-bed, 14 feet.

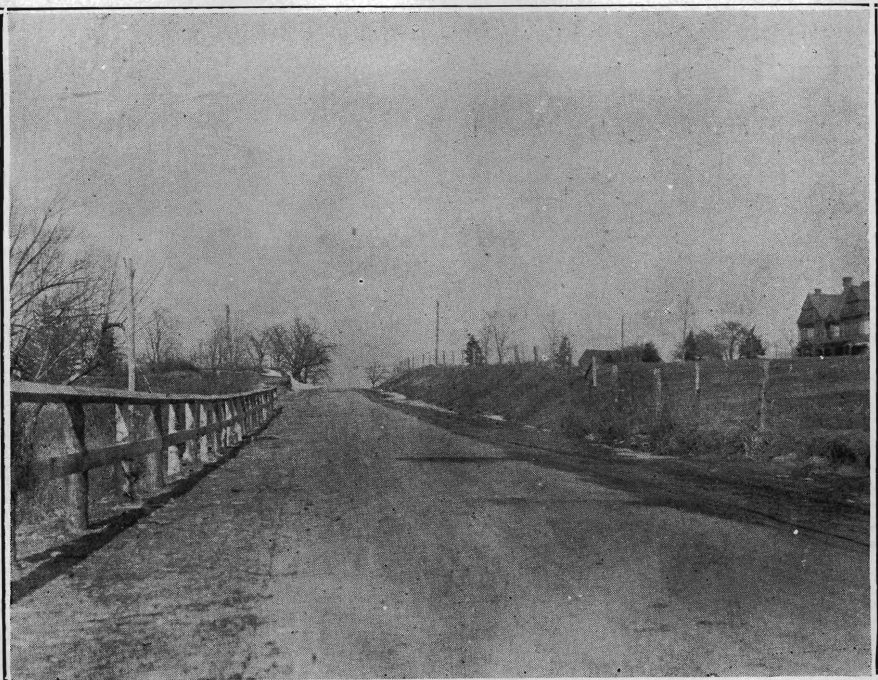
Length of stone-bed, 13,500 feet.

Depth of stone-bed, 8 inches.

Macadam, with Bermudez asphaltum binder, 21,500 square yards, at 70 cents; total.....	\$15,050 00
Macadam, with filler, 21,050 square yards, at 7½ cents; total...	1,578 75
Extra material for embankment, 4,422 cubic yards, at 50 cents; total	2,211 00
Earth excavation, 6,168 cubic yards, at 70 cents; total.....	4,317 60
Fence, 4,480 lineal feet, at 12 cents; total.....	537 60
Drain, 5,300 lineal feet, at 25 cents; total.....	1,325 00
Belgian block gutter, 66 square yards, at \$2.50; total.....	165 00
Cobble stone gutter, 26¾ square yards, at 50 cents; total.....	13 33
Macadam driveways, 75 square yards, at 50 cents; total.....	37 50
Screenings, roller and 10 per cent. for filler.....	823 38
Total	\$26,059 16
Supervisor's salary	697 50
Extras, paid by county, culvert pipe.....	156 00
Total cost of road.....	\$26,912 66
Lump sum, contract price.....	\$22,000 00
Total allowed by the State.....	\$26,059 16
One-third of above, amount paid by the State.....	\$8,686 39



Middlesex County, Kingston-Aqueduct Road, Before.



Middlesex County, Kingston-Aqueduct Road, After.

COMMISSIONER OF PUBLIC ROADS.

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Maximum grade before.....	8.00 per cent.
Maximum grade after.....	4.038 per cent.

FRED. SIMONS,

Engineer.

WILLIAM W. STULTS,

*Supervisor.**Main Street, New Bound Brook, 0.913 Miles Long.*

Beginning at Avenue D, the end of the present pavement, this improvement forms a continuation of Main street, Bound Brook, to Cedar lane, Lincoln, where it meets another paved road, thus forming a direct outlet from the business section of Bound Brook toward Dunellen. This new line is much shorter than the old route by way of Union avenue, and will, therefore, be of value as a portion of a through line as well as of great use to the inhabitants of the two towns.

This road is built of macadam, sixteen feet wide and eight inches deep, and is finished with a surface dressing of heavy asphalt oil.

Detailed statement of the cost of Main street, New Bound Brook, township of Piscataway, county of Middlesex. Total length, 4,823 feet, or 0.913 miles.

Width of stone-bed, 16 feet.

Length of stone-bed, 4,823 feet.

Depth of stone-bed, 8 inches.

Macadam, with heavy oil dressing, 9,257 square yards, at 68 cents; total	\$6,294 76
Macadam driveways, 117 square yards, at 45 cents; total.....	52 65
Earth excavation, 7,392 cubic yards, at 30 cents; total.....	2,217 60
Trench for outlet for drains, 88 hours, at 18½ cents, plus ten per cent; total	17 91
Drain, 2,618 lineal feet, at 22 cents; total.....	575 96
Stone for ditches, 130 tons, at \$1.25; total.....	162 50
Labor placing stone, 149 hours, at 18½ cents, plus ten per cent; total	30 32
18-inch C. I. pipe, 72 feet, at \$2.00; total.....	144 00
Excavating for extra pipe, extra deep, 4 hours, at 18½ cents.....	7 58
24-inch Terra Cotta pipe, 8 feet, at \$1.125; total.....	9 00
Concrete retaining wall, 206 cubic yards, at \$7.00; total.....	1,444 00
Total	<hr/> \$10,954 28

Supervisor's salary	322 50
Engineering expenses	547 71
Total cost of road.....	<u>\$11,824 49</u>
Lump sum, contract price.....	\$9,114 36
Total allowed by the State.....	\$10,954 28
One-third of above, amount paid by the State.....	\$3,651 43
Maximum grade before.....	1.90 per cent.
Maximum grade after.....	0.541 per cent.

ALVIN B. FOX,

Engineer.

MICHAEL A. GALLAGHER,

Supervisor.

MONMOUTH COUNTY.

Allentown and Yardville Road, 1.173 Miles Long.

The graded width of this road is thirty feet. The width of the macadam pavement is eighteen feet, and the depth is six inches.

This road was the original turnpike from Allentown to Yardville, from which point it connected with the White Horse pike to Trenton. The road is of both local and State value, inasmuch as it passes through a very fine farming country, and the amount of truck raised forms quite an important addition to the market supplies of Trenton.

The road also forms part of a through line from Trenton through Allentown and Cream Ridge to New Egypt, thence over the roads just improved to Lakewood and the seashore.

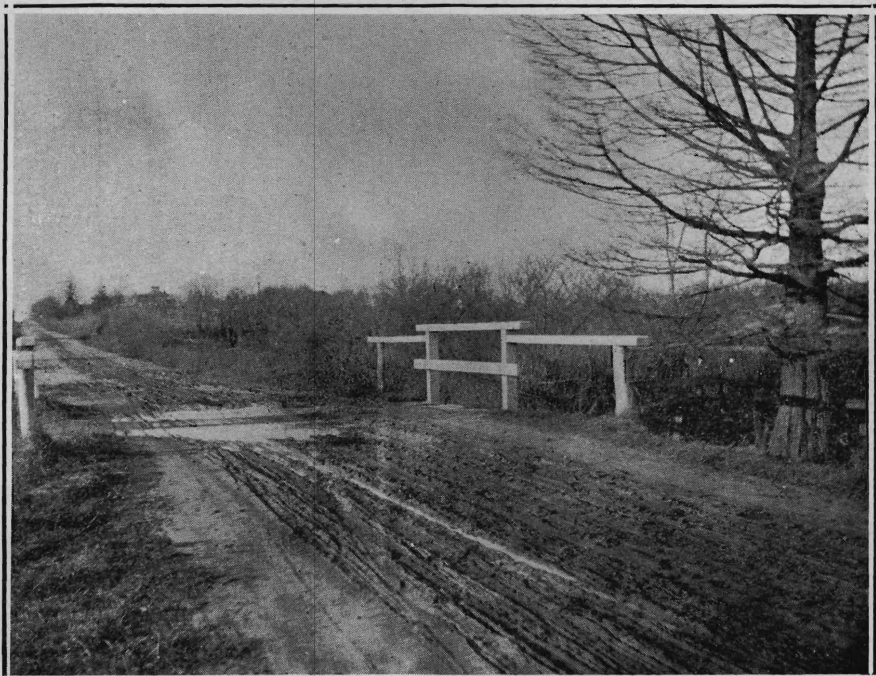
This road, like most all old turnpikes, had a very good alignment, but the grades were rather too steep; consequently, when the roads were improved it was necessary to modify the surface by cutting down the hills, filling the hollows and raising the bridges.

Detailed statement of the cost of the Allentown-Yardville road, township of Upper Freehold, county of Monmouth. Total length, 6,194 feet, or 1.173 miles.

Width of stone-bed, 18 feet.

Length of stone-bed, 6,132 feet.

Depth of stone-bed, 6 inches.



Monmouth County, Cedar Avenue and Monmouth Boulevard, Before.



Monmouth County, Cedar Avenue and Monmouth Boulevard, Gravel, After.

Macadam, with gravel binder, 12,387 square yards, at 80 cents; total	\$9,909 60
Earth excavation, 3,130 cubic yards, at 35 cents; total.....	1,095 50
<hr/>	
Total	\$11,005 10
Supervisor's salary	309 00
Engineering expenses	330 15
Extras, paid by county.....	218 45
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Total cost of road.....	\$11,862 70
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Lump sum, contract price.....	\$11,005 10
Total allowed by the State.....	\$11,005 10
One-third of above, amount paid by the State.....	\$3,668 37
<hr/>	
Maximum grade before	4.20 per cent.
Maximum grade after	3.42 per cent.

GEORGE D. COOPER,
Engineer.
G. WILSON PEPPLER,
Supervisor.

OCEAN COUNTY.

Lakewood and New Egypt Road, New Egypt Section, 3 Miles Long.

This is the first section of the improved highway from east to west across Ocean county through New Egypt to Lakewood, and, with the improvements being made in Burlington county, will form part of a direct line from Camden and Philadelphia to Lakewood and the seashore, and reduce the distance, over improved roads, more than eighteen miles. The soil over which this gravel has been spread is loose and sandy and was in many places almost impassable for motor vehicles. This is now all changed. The narrow, deeply rutted country road has been transformed into a smooth, straight, hard boulevard.

The western and middle sections of this same road have been completed, but were not paid for in time to be included in this report. This leaves only two miles of unimproved road between Lakewood and New Egypt, and this is being graded and will be graveled early in the spring.

The width of the gravel is twenty-four feet and its depth nine and three inches.

NINETEENTH ANNUAL REPORT.

Detailed statement of the cost of the New Egypt section of the Lakewood and New Egypt road, township of Plumstead, county of Ocean. Total length, 15,840 feet, or 3 miles.

Width of gravel-bed, 24 feet.

Length of gravel-bed, 15,840 feet.

Depth of gravel-bed, 9 inches in centre, 3 inches at sides.

Gravel, Class A, 3,520 cubic yards, at \$2.16; total.....	\$7,603 20
Gravel, Class B, 3,520 cubic yards, at \$1.25; total.....	4,400 00
Earth excavation, 14,640 cubic yards, at 30 cents; total.....	4,392 00
Grubbing, 1 acre, \$75.00; total.....	75 00
Drain, 300 lineal feet, at 25 cents; total.....	75 00
Plus difference between items and lump sum.....	242 00

Total	\$16,787 20
Supervisor's salary	606 00
Engineering expenses	503 62
Extras, paid by county.....	434 56

Total cost of road.....	\$18,331 38
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Lump sum, contract price.....	\$16,787 20
Total allowed by the State.....	\$16,787 20
One-third of above, amount paid by the State.....	\$5,595 73

Maximum grade before.....	5.5 per cent.
Maximum grade after.....	2.3 per cent.

I. H. CRAMER,

Engineer.

A. H. STIDFOLLE,

Supervisor.

PASSAIC COUNTY.

Lafayette Avenue, 0.528 Miles Long.

This road forms a connecting link between the improved roads of Hawthorne and the Goffle Hill road, which leads to the Bergen county line. The chief value of this road lies in the fact that it forms a connecting link between existing improvements, thus enhancing the value of work already done.

The width of this road is thirty feet; the width of the pavement, which is composed of bituminous macadam, is twenty feet, and its depth six inches. After the second course of stone had been spread and rolled, asphalt heated to 160° C. was applied by means



Passaic County, Lafayette Avenue, North Paterson, Before Improvement.



Passaic County, Lafayette Avenue, North Paterson, After Improvement.

COMMISSIONER OF PUBLIC ROADS.

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of sprinkling pots. The whole was then covered with stone screenings and rolled in. Wherever an excess of asphalt appeared more screenings were added.

After this had been thoroughly rolled into place, and the whole road consolidated, one-half gallon more of asphalt, heated as above, was added, and screenings again spread upon the surface, after which the road was again rolled until it was thoroughly consolidated, hard and smooth.

This is one of the few penetration jobs we have done this year, and the result thus far seems to be very satisfactory.

Detailed statement of the cost of the Lafayette avenue road, borough of Hawthorne, county of Passaic. Total length, 2,788 feet, or 0.528 miles.

Width of stone-bed, 20 feet.

Length of stone-bed, 2,788 feet.

Depth of stone-bed, 6 inches.

Macadam, with asphaltum binder, 6,337 square yards, at 65 cents; total	\$4,119 05
Earth excavation, 1,577.5 cubic yards, at 30 cents; total.....	473 25
Drain, 100 lineal feet, at 38½ cents; total.....	38 50
Total	\$4,630 80
Supervisor's salary	280 50
Extras, paid by county, including grading approaches to new concrete bridge and gutters	233 71
Total cost of road.....	\$5,145 01
Lump sum, contract price.....	\$5,004 54
Total allowed by the State.....	\$4,864 51
One-third of above, amount paid by the State.....	\$1,621 50
Maximum grade before	4.50 per cent.
Maximum grade after	1.06 per cent.

GARWOOD FERGUSON,
Engineer.

JOHN McMULLEN,
Supervisor.

SALEM COUNTY.

Mannington, Pilesgrove and Woodstown Road, 5.049 Miles Long.

This road begins at the canal bridge in Mannington township, on the other side of which is the cold mixed concrete pavement built by the borough of Woodstown with State aid. It then extends southwesterly to the canal bridge in Mannington township, at which point it connects with the oyster shell road previously built.

By the construction of this road the last gap between the city of Salem, the county of Salem, and the improved roads lying north is closed. The road, therefore, is not only of great value to the large farmers who live along it and who use it constantly, but also to the people of the State at large and others who wish to reach the city of Salem and points lying further south. It is a part of our State highway system, and as such will constantly increase in value and importance.

All but one-half mile is improved with gravel twenty feet in width, and varying in depth from nine inches in the center to six inches at the outer edges. The remaining one-half mile is built of oyster shells, sixteen feet wide and twelve inches thick, loose measurement. This concession was made to local wishes inasmuch as the remainder of the road to the Salem city line is built of oyster shells.

Detailed statement of the cost of the Mannington, Pilesgrove and Woodstown road, in the townships of Mannington, Pilesgrove and the borough of Woodstown, county of Salem and State of New Jersey. Total length, 26,656 feet, or 5.049 miles.

Width of gravel-bed, 20 feet.

Length of gravel-bed, 24,056 feet.

Depth of gravel-bed, 9 inches in centre, 6 inches at sides.

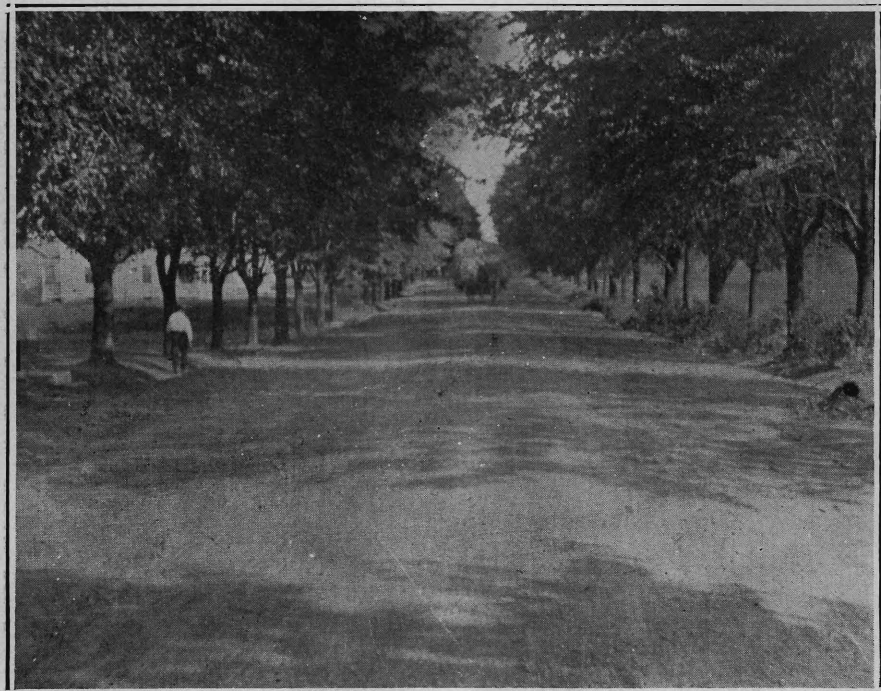
Width of shell-bed, 16 feet.

Length of shell-bed, 2,600 feet.

Depth of shell-bed, 12 inches, loose.



Somerset County, Centreville Road, Before.



Somerset County, Centreville Road, After.

COMMISSIONER OF PUBLIC ROADS.

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Gravel, 11,134 cubic yards, at \$1.35; total.....	\$15,030 90
Shells, 33,428 bushels, at 8 cents; total.....	2,674 24
Earth excavation, 26,351 cubic yards, at 33 cents; total.....	8,695 83
Added to make bid by items equal lump sum.....	41 63

Total	\$26,442 60
Supervisor's salary	810 00
Engineering expenses	701 65
Additional material	158 75

Total cost of road.....	\$28,113 00
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Lump sum, contract price.....	26,442 60
Additional material	158 75

Total allowed by State.....	\$26,601 35
One third of above amount, paid by State.....	8,867 12

Maximum grade before.....	8.28 per cent.
Maximum grade after.....	2.75 per cent.

We do hereby certify the above statement to be correct and that the pavement was constructed strictly according to the specifications, and that the depth of the finished pavement was from 6 to 9 inches.

Respectfully yours,

H. B. KEASBEY,
Engineer.

H. W. AUSTIN,
Supervisor.

SOMERSET COUNTY.

Centreville Road, 2.945 Miles Long.

This road is improved with water-bound macadam. The graded width is thirty-three feet. The macadam is fourteen feet wide and from eight to ten inches deep. The pavement is very well and carefully laid, and the shoulders are accurately shaped, thoroughly consolidated, and carefully trimmed.

The slopes both in excavation and embankment are carried out to their full width and carefully finished. The grading as a whole is worthy of special commendation.

The road begins at the bridge over the south branch of the Raritan river, and runs thence through the village of Neshanic Station, under the track of the Lehigh Valley railroad, thence

along Pleasant Run, which it crosses over a concrete arch bridge, then still following the same stream to the Hunderton county line at Centreville. It is hoped that in time this road may be connected with an improved road in Hunterdon county.

At present it is simply a feeder to Neshanic Station, its chief value lying in the fact that it gives a good, smooth outlet for the farmers along its line to the railroad station.

Several notable changes in alignment were made, thereby greatly improving the road both for present and future use. The same may be said of the grading, which has added very greatly to the value of the road.

Detailed statement of the cost of the Centreville road, township of Branchburgh, county of Somerset. Total length, 15,551 feet, or 2.945 miles.

Width of stone-bed, 14 feet.

Length of stone-bed, 15,418 feet.

Depth of stone-bed, 10 inches.

Macadam, 4-inch. 320 square yards, at 92 cents; total.....	\$294 40
Telford, 24,632 square yards, at 92 cents; total.....	22,661 44
Concrete, 194.85 cubic yards, at \$6.00; total.....	1,169 10
Open drains, 3,790 lineal feet, at 35 cents; total.....	1,326 50
Relaying township pipe disturbed.....	223 75
Earth excavation, 27,680 cubic yards, at 50 cents; total.....	13,840 00
Furnishing and laying T. C. pipe at various points and prices...	124 40
Laying 6-inch C. I. pipe.....	15 20
Furnishing and laying 36 feet 18-inch C. I. pipe.....	119 58
Drain, 10,473 lineal feet, at 35 cents; total.....	3,665 55
Stone for reinforcing pipe, 3 tons, at \$1.10; total.....	3 30
Open ditch and right of way as substituted for item of contract,	
375 feet of pipe, at \$6.00; total.....	1,500 00
Cobble stone gutter, 287.9 square yards, at \$1.00; total.....	287 90
Items eliminated in construction:	
82.1 square yards cobble, at \$1.00; total.....	\$82 10
164 square yards 4-inch macadam, at 92 cents; total..	150 88

\$232 98

Total	\$45,231 12
Supervisor's salary	433 50
Engineering expenses	960 10

Total cost of road..... \$46,624 72

Lump sum, contract price.....	\$39,781 22
Total allowed by the State.....	\$45,231 12
One-third of above, amount paid by the State.....	\$15,077 04

COMMISSIONER OF PUBLIC ROADS.

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Maximum grade before.....	8½ per cent.
Maximum grade after.....	5 per cent.

JOSHUA DOUGHTY, JR.,
Engineer.

LOUIS D. CASE,
Supervisor.

*Liberty Corner Road, Second Section, 1.98 Miles Long;
First Section, 2.011 Miles Long.*

This work began at the end of the old macadam east of Liberty Corner, and was carried through that village. Part of the grading on the first section was completed last year. The whole improvement was finished this year, but too late to be paid for. This latter section was 2.011 miles long, and joins the macadam laid by Mr. Grant Schley.

The completion of the road gives us an improved road with easy grades and much better alignment from the Morris county line west through Millington, Liberty Corner, Far Hills, and Bedminster to Greater Cross roads, thus leaving only three miles to be built to complete an east and west line across the northern part of the county.

This macadam road is fourteen feet wide, ten inches thick.

Detailed statement of the cost of Liberty Corner road, second section, township of Bernards, county of Somerset. Total length, 10,452 feet, or 1.980 miles.

Width of stone-bed, 14 feet.

Length of stone-bed (deducting 20-foot bridge), 10,432 feet.

Depth of stone-bed, 10 inches.

Earth excavation, 8,800 cubic yards, at 45 cents; total.....	\$3,996 00
Telford, with 4-inch macadam, 16,228 square yards, at 94 cents; total	15,254 32
Gravel, 948 square yards, at 60 cents; total.....	568 80
Drain, 7,957 lineal feet, at 20 cents; total.....	1,591 40
Cobble stone gutter, 640 square yards, at 80 cents; total.....	512 00
Total	\$21,922 52
Less error in lump sum of bid.....	3,282 30
Total	\$18,640 22

Supervisor's salary	702 00
Engineering expenses	829 00
Extras, paid by county:	
Setting fence	\$21 50
Net 858 cubic yards excavation, at 45 cents; total..	386 10
	<hr/>
	407 60
 Total cost of road.....	 \$20,578 82
	<hr/>
Lump sum, contract price.....	\$17,231 32
Total allowed by the State.....	\$18,640 22
One-third of above, amount paid by the State.....	\$6,213 41
 Maximum grade before	 7.5 per cent.
Maximum grade after	4.1 per cent.

JOSHUA DOUGHTY, JR.,
Engineer.
 PATRICK McGUINNESS,
Supervisor.

Blackwells Mills and Millstone Road, Second Section, 2.765 Miles Long; First Section, 2.653 Miles Long.

This road begins at Blackwells Mills and runs northerly along the west bank of the Millstone river to Millstone, the former county seat of Somerset county, where it strikes the second section. This is 2.765 miles long, and passes through Weston on the Reading railroad and Hillsborough on the Lehigh Valley railroad, ending at Groendyke's Corner on the bluff overlooking the Raritan river. Two large manufacturing plants are located along this road, hence it promises to increase rapidly in importance. The road was one of the old turnpikes, but had fallen into disuse. Since the completion of the pavement the road has almost regained its former stage-coach day importance and promises to grow in value.

This macadam road is fourteen feet wide and eight inches deep, and is finished with a surface dressing of asphalt binder.

Detailed statement of the cost of the Blackwells Mills and Millstone road, second section, township of Hillsborough, county of Somerset. Total length, 14,600 feet, or 2.765 miles.

Width of stone-bed, 14 feet.
 Length of stone-bed, 14,536 feet.
 Depth of stone-bed, 8 inches.



Somerset County, Blackwell's Mills, and Millstone Road, Second Section,
Before Improvement.



Somerset County, Blackwell's Mills and Millstone Road, Second Section,
After Improvement.

COMMISSIONER OF PUBLIC ROADS.

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Macadam, 21,350 square yards, at 73 cents; total.....	\$15,585 50
Telford, 1,594 square yards, at 94 cents; total.....	1,498 36
4-inch macadam, 759 square yards, at 44 cents; total.....	333 96
Earth excavation, 25,878 cubic yards, at 40 cents; total.....	10,351 20
Extra depth underdrains, 3,982 lineal feet, at 2 cents; total....	79 64
Drain boards, 7,575 lineal feet, at 2 cents; total.....	151 50
Drain, 10,252 lineal feet, at 20 cents; total.....	2,050 40
Cobble gutter, 6 square yards, at 40 cents; total.....	2 40

Total	\$30,052 96
Less error in lump sum of bid.....	180 00

Net total	\$29,872 96
Supervisor's salary	504 00
Engineering expenses	454 63

Total cost of road.....	\$30,831 59
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Lump sum, contract price.....	\$29,985 06
Total allowed by the State.....	\$29,872 96
One-third of above, amount paid by the State.....	\$9,957 65

Maximum grade before.....	9 per cent.
Maximum grade after.....	5 per cent.

JOSHUA DOUGHTY, JR.,
Engineer.
 C. A. WYCKOFF,
Supervisor.

Detailed statement of the cost of the Blackwells Mills and Millstone road, first section, township of Hillsborough, county of Somerset. Total length, 14,010 feet, or 2.653 miles.

Width of stone-bed, 14 feet.
 Length of stone-bed, 14,010 feet.
 Depth of stone-bed, 8 inches.

Macadam, 22,085 square yards, at 74 cents; total.....	\$16,342 90
Earth excavation, 12,263 cubic yards, at 40 cents; total.....	4,905 20
4-inch macadam driveways, 966 square yards, at 44 cents; total,	425 04
Drain, 1,633 lineal feet, at 20 cents; total.....	326 60

Total	\$21,999 74
Supervisor's salary	429 00
Engineering expenses	614 28

Total cost of road.....	\$23,043 02
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Lump sum, contract price.....	\$23,610 20
Total allowed by the State.....	\$21,999 74
One-third of above, amount paid by the State.....	\$7,333 25

Maximum grade before	7.0 per cent.
Maximum grade after	5.8 per cent.

JOSHUA DOUGHTY, JR.,
Engineer.

JOHN W. FRENCH,
Supervisor.

UNION COUNTY.

Palisade Avenue and Madison Hill Road, 2.389 Miles Long.

The improvement of these roads completes the pavement between Plainfield and Rahway. It continues the work begun in 1910 at the city line of Plainfield, and carries it to the county road leading into Rahway. The graded width is thirty-six feet, and that of the pavement sixteen feet, and its depth eight inches. The latter is of cold mixed asphalt concrete, and thus far is proving very satisfactory after one year's wear. The road was completed last year, but too late to be reported.

Detailed statement of the cost of the Palisade avenue and Madison Hill road, township of Clark and city of Rahway, county of Union. Total length, 12,617 feet, or 2.389 miles.

Width of stone-bed, 16 feet.
Length of stone-bed, 12,554 feet.
Depth of stone-bed, 8 inches.

Macadam, with Amiesite, 22,969 square yards, at \$1.24; total..	\$28,481 56
Macadam driveways, 326 square yards, at 40 cents; total.....	130 40
Earth excavation, 22,657 cubic yards, at 35 cents; total.....	7,929 95
Drain, 900 lineal feet, at 14 cents; total.....	126 00
Stone gutter, 541 square yards, at 60 cents; total.....	324 60
Total	\$36,992 51
Supervisor's salary	667 50
Engineering expenses	1,870 62
Extras, paid by county, 1,200 cubic yards, excavation at borrow pit, at 35 cents; total.....	420 00
Total cost of road.....	\$39,950 63
Lump sum, contract price.....	\$37,713 32
Total allowed by the State.....	\$36,992 51
One-third of above, amount paid by the State.....	\$12,330 84

COMMISSIONER OF PUBLIC ROADS.

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Maximum grade before.....	6.6 per cent.
Maximum grade after.....	4 per cent.

Plainfield, N. J., December 4, 1911.

F. J. HUBBARD,

Engineer.

GEORGE V. AUDELFINGER,

Supervisor.

NOTE.—Owing to lack of cobble, 473 square yards of stone gutters were constructed of 2-inch crushed trap rock, spread 4 inches deep, well dishd, thoroughly rammed and grouted with Portland cement.

Springfield Avenue and Shunpike Road, 1.131 Miles Long.

This is the extension of Springfield avenue done in 1910, and carries the pavement to the old Shunpike, thence to Westfield avenue, the county road. The work was completed last year, but too late to appear in our report for 1911. This is one of the few penetration roads that we have built, and is in fair condition after a year's use. The pavement is sixteen feet in width, while the graded width of the roadway is thirty-three feet. Its depth is eight inches. The alignment of this old road was very much improved, with the end in view of making a through line from Westfield to Summit.

Detailed statement of the cost of the Springfield avenue and Shunpike road, township of Springfield, county of Union. Total length, 5,972.7 feet, or 1.131 miles.

Width of stone-bed, 16 feet.
Length of stone-bed, 5,972.7 feet.
Depth of stone-bed, 8 inches.

Macadam, 11,574.1 square yards, at 89 cents; total.....	\$10,300 95
6-inch macadam, on Turkey road approach, 284 square yards, at 55 cents; total	156 20
Earth excavation, 11,232 cubic yards, at 34 cents; total.....	3,818 88
Drain, 1,000 lineal feet, at 20 cents; total.....	200 00
Total	\$14,476 03
Supervisor's salary	201 30
Engineering expenses, at 5 per cent.....	712 84
Extras, paid by county, bridges, &c.....	295 00
Total cost of road.....	\$15,685 17
Lump sum, contract price.....	\$14,256 88
Total allowed by the State.....	\$14,476 03
One-third of above, amount paid by the State.....	\$4,825 34

NINETEENTH ANNUAL REPORT.

Maximum grade before.....	5	per cent.
Maximum grade after.....	2.55	per cent.

J. L. BAUER,
Engineer.

A. P. CARTER,
Supervisor.

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, money from the motor vehicle fund, during the fiscal year from November 1st, 1911, to October 31st, 1912, has been sent to the various authorities for repairs on the following roads:

Name of Road.	County.	Amount.
Broadway, Saddle River township.....	Bergen	\$10,188 38
Belleville turnpike	Hudson	12,500 00
Browning Lane	Camden	1,693 50
Ballinger's Mills, Pipers Corner.....	Burlington	1,548 80
Bloomfield avenue	Essex	10,000 00
Belle Mead, Somerville, Bedminster.....	Somerset	6,913 61
Bridgeboro, Delanco, Riverside, Riverton..	Burlington	426 62
Chestnut Neck	Burlington	5,835 92
Crown Point	Gloucester	5,000 00
Church	Camden	1,844 91
Cranbury turnpike	Middlesex	10,303 84
Clayton, Malaga	Gloucester	500 00
Cedar Cliff	Passaic	504 44
Denville, Pine Brook.....	Morris	9,500 00
Elmer, Alloway	Salem	1,000 00
East Rahway.....	Middlesex	4,665 38
Frankford, Sandyston	Sussex	500 00
Farmingdale, Asbury Park.....	Monmouth	2,000 00
Far Hills, Bernardsville, Basking Ridge...	Somerset	3,073 79
Hudson Terrace (Fort Lee).....	Bergen	1,100 00
Hartford	Burlington	747 03
Hudson County Boulevard.....	Hudson	2,000 00
Highland Park, Metuchen, Stelton.....	Middlesex	293 00
Keyport, Red Bank, Seabright.....	Monmouth	6,000 00
Kings Highway	Camden	1,461 59
Keyport, Freehold, Farmingdale, Lake- wood	Monmouth	5,000 00
Kingston, Monmouth Junction.....	Middlesex	250 00
Lawrenceville, Princeton	Mercer	8,882 93
Lexington avenue	Passaic	5,000 00
Lakewood, Tuckerton	Ocean	4,500 00
Lower Penn's Neck.....	Salem	1,000 00

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Name of Road.	County.	Amount.
Meadow Boulevard	Atlantic	\$2,630 25
Manalapan, Hightstown	Middlesex	800 00
Mount Holly Pike.....	Burlington	17,464 17
Morris turnpike	Union	4,138 98
Mendham	Morris	17,000 00
Moorestown, Mt. Holly and Burlington..	Burlington	904 65
Mendham, Bernardsville	Morris	3,000 00
Mercerville, Edinburgh.....	Mercer	558 10
Manalapan, Freehold, Long Branch.....	Monmouth	7,000 00
Morris turnpike	Warren	1,800 00
Macopin	Passaic	80 00
Midvale, Greenwood Lake.....	Passaic	100 00
Montvale Roads	Bergen	1,200 00
Moorestown and Mt. Laurel.....	Burlington	3,467 56
Maple Shade School House.....	Mercer	752 78
Main street	Passaic	4,000 00
Main street, Butler.....	Morris	3,000 00
Morristown, Green Village.....	Morris	1,000 00
Newark and Pompton turnpike.....	Passaic	3,000 00
North Broad street.....	Union	3,973 52
Newark turnpike	Hudson	1,500 00
Northvale, Harrington township.....	Bergen	150 00
North Branch	Somerset	746 11
New Vernon	Morris	4,800 00
New Brunswick turnpike.....	Somerset	369 94
Ocean Boulevard	Atlantic	2,500 00
Phillipsburg, Hackettstown	Warren	3,500 00
Phillipsburg, Belvidere	Warren	1,500 00
Passaic Valley	Morris	9,500 00
Passaic street	Bergen	500 00
Park avenue	Middlesex	7,259 00
Paterson, Hamburg turnpike.....	Passaic	955 56
Palisade avenue	Bergen	900 00
Princeton, Kingston	Mercer	100 00
River	Passaic	1,000 00
River	Middlesex	632 51
Rivervale Roads	Bergen	800 00
Red Bank, Shrewsbury.....	Monmouth	7,000 00
Smalley's Corner, Vincentown.....	Burlington	164 84
St. George's avenue.....	Union	21,887 50
St. George's avenue.....	Middlesex	6,318 00
Singac	Passaic	160 00
Shore	Cape May	1,750 00
South Orange avenue.....	Essex	10,000 00
Springfield avenue	Essex	5,000 00
Springtown	Morris	236 85
Teaneck township	Bergen	350 00
Trenton-Lawrenceville	Mercer	22,292 62
Terrace avenue	Bergen	10,000 00
Tappan	Bergen	700 00
Trenton turnpike	Middlesex	2,237 27
Union avenue	Middlesex	193 00

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Name of Road.	County.	Amount.
Union avenue	Somerset	\$778 90
Union avenue	Passaic	2,000 00
Union avenue, Bound Brook.....	Somerset	1,500 00
Van Houten avenue.....	Passaic	1,000 00
White Horse Pike.....	Camden	24,490 65
White Horse Pike.....	Mercer	1,465 74
Westville, Malaga	Gloucester	9,974 02
Woodbury, Woodstown	Gloucester	2,000 00
Westfield, Riverton	Burlington	1,237 01
White Horse Pike.....	Atlantic	4,000 00

Amount spent on repair of roads..... \$373,553 27

The following amounts were ordered paid the latter part of October, but warrants were not sent out by the Comptroller until after October 31st, 1912. These payments will appear in 1913 report:

Road.	County.	Amount.
Absecon-Chestnut Neck	Atlantic	\$2,000 00
Ballinger's Mills and Pipers Corner....	Burlington	1,955 84
Crown Point	Gloucester	500 00
Eldridge Hill	Salem	436 80
Hammonton-Absecon	Atlantic	5,500 00
Mays Landing-Tuckahoe	Atlantic	500 00
Paulsboro-Swedesboro	Gloucester	500 00
Trenton-Bordentown	Burlington	549 14
Westville-Glassboro.....	Gloucester	500 00

\$12,441 78

Repairs From County Funds During the Year 1912.

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

County.	Amount.
Atlantic	\$33,831 46
Bergen	819 60
Burlington	19,766 56
Camden	30,362 87
Cape May	9,945 86
Cumberland	397 81
Essex	190,915 00
Gloucester	19,034 52
Hudson	422,604 89
Hunterdon	9,345 02
Mercer	79,536 80
Middlesex	62,696 26
Monmouth	110,096 43
Morris	143,000 00
Ocean	6,529 37
Passaic	113,602 76
Salem	5,272 13
Somerset	12,956 71
Sussex	4,500 00
Union	55,694 83
Warren	21,829 18
Total	\$1,352,738 06

Ocean Highway.

Pursuant to the provisions of chapter 220, laws of 1910, the State Highway Commission has appropriated and made payments as follows:

	Appropriation.	Payments during 1910.	Payments during 1911.
For the improvement of a road along the bluff at Atlantic Highlands, conditioned upon the county expending a like amount	\$10,000 00		
For filling in the head of Wesley Lake and the construction of a roadway between Ocean Grove and Asbury Park,	5,700 00		\$5,700 00
For the acquisition of land and the opening up and improvement of the road known as the extension of Ocean avenue in the borough of Spring Lake..	4,300 00	\$4,312 90	
For the improvement of the road between Lakewood and Tom's River.....	11,000 00	11,000 00	
For the improvement of the road between New Gretna and the Mullica River Bridge	7,000 00	7,000 00	
For the straightening, widening and improvement of the road between Chestnut Neck and Absecon.....	5,000 00	5,000 00	
For the improvement of the Main Shore road between Cape May Court House and Cape May, and the road between Petersburg and Seaville.....	7,000 00		7,401 66
Amount appropriated	\$50,000 00		
Amount expended during 1910.....		\$27,312 90	
Amount expended during 1911.....			\$13,101 66
Unexpended balance			9,585 44
No amounts expended in 1912.			

Report.

There is no question in the opinion of this department that the increased use of roads in the past few years is only the first step in an evolution of traffic that will soon restore the highway to the importance it occupied until about the middle of the last century. This evolution will soon make the economic value of the improved roads a matter of such moment that no community can afford to do without them, or to neglect them after construction. The service of providing and maintaining these arteries of commerce will become yearly a more and more important public function. It is in the maintenance that our work in this State has been least satisfactory.

The law of 1912 in effect divides our roads, exclusive of city streets, into three classes: The State highway, the county road, and the municipal road. The roads in these classes should vary in respective importance according to their classification.

The State highways, when taken over, can be efficiently maintained with the present organization and an enlarged force, as soon as adequate appropriations are available.

I fear, however, that the same is not true of county and municipal roads. In saying this I want to disavow any intention of reflecting on the officials in charge. The conditions under which they work render the problem one of almost insuperable difficulty. There is no standard set which these officials must attain, excepting such as the department may, very ineffectively, try to enforce as a condition of State aid. These men usually hold office for a short term, and subject either to re-election or reappointment at the hands of a board of changeable political and personal views. Under such conditions the inducement to allow political considerations instead of the good of the roads to have paramount influence in settling the policy of road building and maintenance becomes, as a rule, too great to be withstood.

TWO REMEDIES SUGGEST THEMSELVES.

First. To place all roads under a permanent State force, holding office under civil service.

Second. To require of all counties and municipalities, as a requisite to receipt of State aid, compliance with such regulations as shall end the present undesirable conditions.

The first alternative will do away with local self-government as to roads, and will create a large centralized force, both of which I take it are not in agreement with the general policy of the State if the object sought can otherwise be reached.

For this purpose I urge consideration of the following—the second alternative above:

The Department of Public Roads should be directed as a prerequisite to the granting of State aid, either in maintenance or improvement, to require the county or municipality applying therefor to adopt the civil service rules as to the county engineer and the county supervisor of roads and all their subordinates, to fix rules defining the duties and limits of authority of each of these officers, to provide the machinery, implements and materials necessary for maintenance work, and to keep their roads up to a standard set by the Department of Public Roads.

Such a system would provide means whereby an effective road force could be enlisted. It would not provide the means necessary to do the work.

In considering this subject it is well to bear in mind the fact that the cost of maintaining a road bears no relation to the financial resources of the governing body charged with this duty. This discrepancy is to some extent met by the present method of disbursing the motor vehicle fund, but not by any means in full. The motor vehicle and road laws do not provide for the so-called unimproved roads. Under the amendments of 1912 the income from motor vehicles will materially increase, to what extent is still uncertain. While it is not the province of the Road Department to suggest changes in this matter, it seems not out of place to point out that the more powerful class of cars at present are by no means bearing a share of the expense commensurate with the damage inflicted by them to road structures. The same is true of motor trucks.

It is above all wise to keep the amounts distributed for repair work as large as possible if the suggestion as to local organization hereinbefore made is to be really effective.

The State Highway Act, chapter 396, laws of 1912, should be amended in some minor detail to render its application more general and to properly distribute the benefits.

The result of this law will be to relieve the counties, and in some cases municipalities, of the cost of maintaining the most heavily used trunk lines.

It will reduce the amount available for aid to local communities in maintenance, but will likewise reduce the charges against their maintenance funds.

The work of mapping and the preparation of the report required by the act of 1912 have been greatly hindered by lack of any adequate appropriation. This work, however, has progressed far enough to warrant a rough estimate of the probable results of operation.

It would be unwise to take over at once roads to an extent beyond the capacity of the present force, or in excess of available means. The taking over should be gradual. It seems probable that the department, with its present body of men, can safely within a year take over about one-third of the total system, or say some 500 miles. The proper maintenance of this mileage will require an expenditure now roughly estimated at from \$300,000 to \$400,000 a year.

The motor vehicle fund yielded for the year ending October 31st, last, a net sum available for road work of \$402,000. The probable receipts of this year will be \$550,000. If the amount distributed to counties, &c., in aid, is reduced one-third, this item would be about \$270,000, leaving for State highways \$280,000. This sum might suffice. A wise economy, however, would indicate the need of resurfacing, widening and straightening many roads heretofore improved. It would therefore seem best to devote a portion of the fund, usually set aside for aid in improvement, to work on State highways unless the funds available are to be increased.

Anticipating the demand for resurfacing roads that have shown themselves unable to comply with the statutory requirement that "with reasonable repairs they should be smooth, firm and convenient for traffic at all seasons of the year," the department has

for some time been experimenting with various types of pavement. While both first cost, yearly maintenance charge, and probable life all enter as factors into the determination of the economical pavement for any given case, and while the latter factors can, from lack of experience, in many cases, be estimated only, the experimental work done seems to justify the conclusion that both our stone and gravel roads can be resurfaced so as to bear the ever-increasing weight of traffic without exceeding a reasonable cost of repair.

For this purpose on our principal roads we may have to rely largely on Portland cement concrete, either for the whole road structure or as a base carrying a bituminous surface. The experimental work also indicates the superiority of certain brands of tar as a dust layer over the lighter asphalt oils and the non-asphaltic oils, especially on gravel roads. It also shows that gravel roads can be maintained during all the year in a proper condition at a reasonable cost.

Engineering, Design and Execution.

By ROBERT A. MEEKER, *State Highway Engineer.*

During the past year our engineering force has been considerably augmented, and the department has thus been enabled to improve and perfect much of its work, thereby bringing it more nearly up to our requirements, so that to-day plans, profiles and cross sections are thoroughly standardized. The results of this are seen not only in the work of our own force but in that of the several county engineers, whose work will compare favorably with any done in this country. Grades are carefully studied, cross sections accurately plotted, road intersections and entrances to private properties shown in both plan and profile; in fact we are now fast approaching the goal we have so long striven for, namely, the lump sum price for a road without numerous and costly extras. In other words, we are carefully laying out our work, giving time and thought to the design as well as the execution of each piece of construction. Added to this we now have for the first time a voice in the design and construction of highway bridges. The increasing weight and volume of traffic demands wider and stronger structures, the burden of whose cost should in part be borne by the State, because the change in traffic conditions has been so great that a county cannot be asked to spend large sums for bridges that are used fully as much by residents of other counties. It is not so many years ago that it was unusual for a heavy van to make a trip of over thirty miles; now one hundred mile hauls are so common that they are looked upon as a matter of course. In fact since the advent of the railroad our highways have never been so generally and continuously used as they are to-day. One of the most noticeable evidences of this is that the old inns and taverns that had fallen into disuse are being remodeled and once more are centers of activity.

This constantly increasing use of our roads calls forth the efforts of our people to meet the increasing demands of travel. Hills must be cut, hollows must be filled and sharp turns and crooked lines eased and straightened. The necessity for easy curves and straight lines is apparent when we stop to consider that a motor running at the legal rate of twenty-five miles per hour travels one hundred and ten feet in three seconds, and should another traveling at the same rate be approaching from the opposite direction the drivers would have one and one-half seconds to avoid a collision, if the line of vision were limited to one hundred and ten feet. As the statute provides that the highways shall be not only convenient but safe for travel, the question of alignment must be met and solved. No joking or sarcasm will relieve road builders from this responsibility. The department has devoted much time and thought to this problem, the result of which is that no curve of less than 6° , or 955 feet radius, is recommended or approved unless local conditions render it practically impossible. The reason for this is that on a 6° curve the clear line of vision on a roadway thirty feet wide is only three hundred and fifty feet; hence the drivers of the approaching machines would have four and three-quarters seconds in which to avoid one another. Surely no one would say that this is more than is necessary. Hence, we have fixed this as the maximum degree of curvature.

The standard cross section is the arc of a circle drawn through three points, namely, the center and the two gutters. The latter are located at the intersection of the side lines, with a line descending from the center at the rate of one-half inch per foot. The arc thus obtained gives us a fall of one-fourth inch per foot from the center to the edge of a sixteen foot pavement, of five-eighths inch from this edge to the center of the seven foot shoulder, and of nine-tenths of an inch from this point to the gutter, thus increasing the grade in such manner that the water will be most readily carried off with least damage to the shoulders of the road, also giving a section upon which the greatest portion is convenient for travel.

Everyone who has driven over a highly crowned road has experienced the unpleasant sensation of tipping or sliding when compelled to turn off to one side. Hence the travel is naturally concentrated on the center of the road. If the crown is lowered

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until it will just give sufficient slope to carry off the water, the traffic is distributed more uniformly over the entire width of the road, and, as a result, the wear is upon the entire road and not merely upon the center. Two results follow: *first*, there are few or no ruts; *second*, the cross-section of the road is maintained, and, consequently, the drainage is properly taken care of.

Our force having been augmented by one more engineer and ten inspectors, we have been able to secure a more thorough and exact compliance with the engineering requirements of our plans. The results of this are seen in a better finished class of work, which is not only pleasing to the eye but adds greatly to the life of the road, inasmuch as it insures thorough consolidation and perfect drainage of the road. During the past year we have devoted more attention to the correction of alignment than ever before. This is due to the increasing demands of traffic which have compelled a closer adherence to the rules that were laid down by this department some time ago.

Road Repair Work in North Jersey.

By E. M. VAIL, *Division Engineer.*

A marked improvement in the manner of making repairs on the county and State aid roads was noticeable in all parts of North Jersey during 1912. The roads are in better condition today than they have ever been before.

The State Legislature passed a reciprocity measure last winter which allowed motor vehicles from other states to visit New Jersey without license or registration fee, providing they had registered in states extending the same courtesy to New Jersey.

This has helped all business interests throughout the State and made the Jerseyman a good fellow again, but from the standpoint of road repairs we are deprived of an additional source of income and have increased road repair expenses on account of it. These expenses to the State are, of course, shared by cities, boroughs, counties, townships and private interests, as well as the State.

Many officials have given hearty co-operation to the suggestions of the Commissioner that some of the money usually appropriated for new work be spent on carefully resurfacing and widening present thoroughfares.

The resurfacing in the thickly populated counties has generally been of asphalt-concrete, either hot or cold mix. This class of pavement has given good satisfaction in the past except in a few places where the trouble was usually caused by poor foundation or defective drainage. These surfaces, as usually applied, have been of about two inches in thickness. This year a surface coat of about three-quarters of an inch to one inch in thickness has been used experimentally. The cost is much less, and while the same wear cannot be expected as is had from the thicker surface, it seems probable that this treatment will prove economical in the case of roads carrying a moderately heavy traffic.

A few more miles have been resurfaced with asphalt macadam, commonly called the penetration method, but this work does not always wear well, due usually to careless workmanship. In all bituminous work the cost of repair of the hot mixed surfaces is greater and the trouble much more than with the cold mixes.

Old-fashioned water bound macadam is still the easiest kind of resurfacing, and continues in use in many sections. Most of this work is now protected by one or another of the various kinds of dust layers or light binders.

Where resurfacing work has not been done, the department has tried to have the holes in the present pavement patched, and the roads made "hard, smooth and convenient for travel at all seasons of the year," as required by law, this year with better success than heretofore.

One matter which has always seemed of great importance to the department is that of having the gutters set back as far as possible from the center of the road, at the same time removing all bushes, trees and overhanging limbs or other objects that obstruct the view of approaching vehicles, especially on the inside of curves.

It has been pretty well demonstrated that roads repaired in this way cost less money per year for maintenance than before.

Since the law allowing the State Commissioner of Public Roads to expend the Motor Vehicle Fund for the maintenance of improved roads came into effect, some six or seven years ago, more attention has been given to this matter in nearly all of the counties and it is probable that it will be found wise to require that an ever increasing percentage of this fund be used for shoulder work, ditching, drainage and general widening and straightening.

Road Repair Work in South Jersey.

By EDWARD E. REED, *Division Engineer.*

The following is a report of a few things accomplished with money from the Motor Vehicle Fund:

The gravel roads of South Jersey are all that can be desired during a large part of the year, but during some parts of the winter and in the spring, when the frost is coming out of the ground, they become soft and slippery, and it is often very difficult to go over them.

Various materials are now being used to try and make these roads "hard, firm and convenient for travel, at all seasons of the year," as provided by law.

In the fall of 1911, glutrin, a product obtained from the manufacture of wood-pulp, was applied on a short piece of the Meadow boulevard, the gravel road connecting Atlantic City with the mainland. During the spring of 1912, which was an unusually severe one on the roads, this piece showed a marked improvement over the adjacent untreated sections, being more thoroughly bonded; consequently it did not rut and it proved to be very satisfactory.

The main road from Camden to Atlantic City was badly heaved in many places during the spring. These places were fixed temporarily with cinders in order to make the road passable. Gravel was put on later, and in the fall the Atlantic county section of the road was treated with glutrin. Before applying the material the road was scraped, to remove any existing inequalities. The glutrin was shipped in barrels, pumped by hand into an ordinary sprinkling wagon, which was first filled half full of water, and this mixture sprinkled on the road at the rate of about one-half gallon of glutrin per square yard of surface.

On the May's Landing-Pleasantville gravel road we have applied liquid asphalt and Trinidad asphalt. These were applied under pressure from a special distributor at the rate of one-half

gallon per square yard and left uncovered. This was put on in August and has so far given good results.

A section of the gravel road from Chambers Corner to Mt. Holly, in Burlington county, has been treated with Ugite, a water-gas tar. The material was applied from a pressure distributor at the rate of one-half gallon per square yard and then covered with sand. This work was done in October, and, consequently, has not had much wear, but it is now very satisfactory. We hope that the gravel roads thus treated will not break up in the spring.

In Camden county a section of the White Horse pike, near Audubon, is being paved with concrete only. This work was started late in the season and will have to be stopped before it is finished, on account of cold weather. The location is an excellent one for a severe test of the pavement. It is the main highway between Philadelphia and Atlantic City, and over it pass heavily loaded produce wagons to their market in the city, and also very heavy motor trucks as well as touring cars and horse drawn vehicles.

The road connecting Sea Isle City with the main shore was widened and resurfaced with gravel. This road crosses the meadows, and it was necessary to form a mattress to hold the new material. This new work is quite a transformation, as is shown by the photographs of the road published elsewhere in this report.

In New Jersey, the pioneer in granting State aid in road construction, it seems strange that road work should be done by private subscription, but such is the case in Cumberland county. This shows the keen interest being taken in road matters in this section. Farmers are giving their time and money to cut down hills and gravel their roads in order that they may haul increased loads and also receive the benefit and pleasure accompanying good roads. Cumberland county had a rather unfortunate experience with its first State aid road. This was a road across the meadows, built in 1903, and cost so much, due to the great amount of fill required, because of the very soft bottom, that most people in that county lost all interest in State aid roads. Now the pendulum has swung the other way.

In Gloucester county particularly, good repair work is being done by the penetration method. Roads are being widened and resurfaced with stone. In resurfacing, the old stone bed is scarified and raked to remove any inequalities, rolled thoroughly, then stone is spread about three inches loose measure and rolled enough to give it a uniform surface; about a gallon of asphalt binder per square yard is then applied from hand distributors and one-quarter or one-half inch stone is spread and the whole road is then rolled thoroughly. About half a gallon of asphalt binder is then applied, more fine stone or sand is spread and the whole again thoroughly rolled. In Gloucester county their aim seems to be not how much they can do but how well they can do it.

In Mercer and Middlesex counties we have two patrolmen, each working continually on a section of road. I am most familiar with the Mercer county section. The section is four and one-quarter miles long, and is one of the best pieces of road in the county. It is a good demonstration of the effectiveness of the patrol system.

We are about to try convict labor on road work, and while it is late in the season and we will not be able to accomplish much, we hope to profit by the little experience and hope to use it advantageously in the spring.

The experiment will be tried on the White Horse road, from White City Park to White Horse Hotel, in Mercer county. This road is not far from the State Penitentiary, and fifteen men and two guards will be transported from and to the institution morning and night. Provision has been made for serving dinner at a house on the road.

Through the courtesy of Mayor Bryant B. Newcomb of Long Branch, we received a traffic report taken on Ocean avenue, Long Branch, from 6 A. M., August 17, to 2 A. M., August 18, 1912, and while this was not classified according to tonnage, but according to pleasure and commercial automobiles, and pleasure and commercial wagons, it will give some idea of the volume of traffic on this section of the Ocean boulevard. The traffic is not local, but comes from other sections of this State and also from other states. It is a serious problem to maintain this road, and a very heavy burden on the community.

Total number of vehicles is as follows:

Pleasure automobiles	5,071
Commercial automobiles	178
Pleasure wagons	420
Commercial wagons	453
Total	6,122

This is an average of 306 an hour. The traffic was greatest between 4 and 5 p. m., when 682 vehicles passed.

Work was delayed and much time was lost during the past summer because of lack of machinery. Pressure wagons were rented from different concerns and, of course, were not received when they were expected, and sometimes they could not be kept long enough to finish a job when they did arrive, but were shipped to another part of the State.

As the counties hesitate about investing in these machines, it would greatly facilitate the work if the State could buy a number of these machines and rent them to the various counties. Another matter worthy of consideration is that of using motor trucks for hauling stone and other materials used in road repair. They could also be used for transporting men to different sections, and in that way the same organization could be used in all parts of the county. The advantage of a constant organization instead of an ever changing one is too obvious for further comment.

Owing to the lack of transportation facilities it is impossible to inspect the work as it should be inspected, and scarcely any time can be given to the matter of eliminating dangerous points on our old roads. Considerable money has been spent on widening and resurfacing the Chestnut Neck road in Burlington county, but I earnestly recommend the elimination of the bad corner at the intersection of this road and the New Gretna, Green Bank road, before any other work is done on this road. Several bad accidents have occurred at this point. Some other dangerous points that should be eliminated are: Bergen's Mills, between Hightstown and Manalapan, in Monmouth county; the narrow bridge crossing the Delaware and Raritan canal on the Brunswick pike, between Trenton and Penn's Neck, Mercer county; between Kingston and Rocky Hill, on the Princeton and Somerville road, in Somerset county.

Laboratory and Experimental Work.

By ROBERT B. GAGE.

In response to your request regarding a statement of the work done directly under my supervision for your department, or in co-operation with other members of your department, during the past year, I beg to give a short description of the same.

During the past year I have endeavored to test all the bitumens used on any roads being constructed in New Jersey in which the State paid part or all of the cost of construction. This includes the bitumens used in the construction of roads of various types such as the hot and cold mixed methods, different penetration methods and surface coated macadam roads.

In addition to these samples of bitumens I have also tested quite a few samples of dust oils submitted to me by the different county authorities for my opinion of the same. This work was all done at the request of the counties under whose jurisdiction these oils were applied, for in many cases they were applied and paid for by the counties themselves.

We have also tried during the past year to test most of the pavement samples taken during construction, in order to keep in as close touch as possible with the manner in which these bituminous pavements were being prepared. It was my desire at the beginning of the season to have the supervisors take a sample daily from all pavements of this type as they were being laid, and send these samples to the laboratory at least once a week. This was done in many cases, but we were not equipped at that time to handle the volume of work which this method of procedure required.

I am very glad to inform you that during the past season we have secured several testing machines which will be of great assistance to us in testing these materials, both in the high degree

of accuracy we can secure and the increased amount of work that can be done by the use of them. However, I am sorry to say that as yet but a few of these machines have been installed, for we have no room whatever in our present laboratory to install many of them which I expect to use later. The ones that are most needed have been installed in the best manner possible under the conditions now existing in our laboratory.

During the past season we have laid several experimental roads, and have also repaired some of the experimental roads which were constructed last year and were found to be faulty this spring. These experimental roads will now be described separately.

EXPERIMENTAL ROAD NEAR HARTFORD, BURLINGTON COUNTY.

This experiment was made last year and described in our report for 1911. The object of this experiment was to see if a gravel base did not possess sufficient strength to hold a bituminous pavement on roads which were not subject to too heavy travel. The results secured so far on this particular road would lead one to believe that such is the case, for as yet the defects that have developed in this pavement have all been confined to the bituminous surface, and can hardly be traced to any defects in the base.

The bituminous top that was laid upon this road was composed of sand and tar built up by a penetration method to a thickness in many places of about two inches. Since a soft tar was used in the construction of this pavement, it became quite soft during the warm weather last summer and rutted more or less. This would no doubt not have happened had the thickness of the tar coating been limited to about one-half to three-quarters of an inch instead of two inches. Apparently the main fault to be found with this surface was its lack of stability. In order to give it the necessary resisting power, a layer of one and a half inch stone was scattered over its surface and rolled into the soft pavement. Another layer of tar was then applied and some stone chips and the road again rolled. This appeared to be just what was needed, for no evidence of rutting or creeping has developed since the application of these stones. The road to-day is in very good condition, and its life no doubt now depends on the ability of the tar to resist oxidation with subsequent disintegration.

This experiment would lead one to believe that if a good solid gravel base were protected by some kind of a waterproof coating that would prevent its becoming over saturated with water during the wet season, or too dry during the summer, it would then possess sufficient strength and stability to maintain an ordinary bituminous pavement. No doubt the pavement best adapted to lay upon such a surface would be like that specified under our Type H. Pavements of this class have an open base with a tight top; consequently, the moisture contained in the gravel could not come in contact with and decompose the upper part of the pavement. Pavements of this type are prepared by a mixing method, and cost considerably more than a pavement constructed by a penetration method in the manner described hereinabove. The former type, however, possesses greater uniformity and no doubt durability, yet in certain cases where the travel is not excessive the latter type will fulfill all the requirements to which it will be subjected.

Since several different types of pavement will conform to our Type H requirements, we are not limited to any one particular pavement in this case. If these gravel bases can be made to maintain a bituminous pavement in this manner it will be a considerable saving in the construction of new roads and maintaining the old gravel roads in localities where gravel is abundant.

I would respectfully suggest that the coming season we resurface some of our gravel roads with a few different types of bituminous pavements in order to determine (more definitely than we have done as yet) the stability of these gravel surfaces when used as a base for a bituminous pavement and subject to various conditions of travel and climate.

WHITE HORSE-MAPLE SHADE EXPERIMENT.

The section of this road treated with glutrin last year showed little effect of such treatment this spring. At a few points in this road a clay gravel was exposed in the cuts. At such places the glutrin appeared to have had some little effect, but on the sandy base no effect whatever could be seen this spring of the glutrin applied during the fall of 1911. Two other experiments were completed upon this road during the past summer. One of these

was a slag base with a slag top. This road has been treated with glutrin, the manufacturers of which claim will harden the surface of this road into a concrete. The object of this experiment is to ascertain the correctness of this statement, and also to see if a slag base will in time cement itself into a slag concrete.

Upon another section of this road was laid some 1,500 feet of bituminous pavement known as Westrumite. This pavement was laid upon a regular macadam base of about five inches in thickness after compression. The pavement itself was laid in two courses, the bottom course consisting of a uniform size of one and a half inch stone laid two inches thick. These stones were coated with the Westrumite, using just enough of this material to coat them. They were then scattered over the base of the road in a uniform layer and allowed to harden somewhat before the surface was applied. The top course consisted of limestone screenings impregnated with the Westrumite.

It was prepared by mixing these screenings with sufficient of the Westrumite to make a mortar that would flow and could be raked quite easily, but not sufficiently thin to run off the road after being spread. This mortar was dumped on the road surface and immediately raked over the larger stones in a uniform layer of about one inch in thickness. After several hours the mortar had cured sufficiently so that it could be rolled without adhering to the wheels of the roller. It was then rolled until the mortar had been forced into the voids of the one and a half inch stone. The surface thus produced was then painted with the Westrumite, after which an application of screenings was spread over its surface, the road again rolled and opened to travel.

The bitumen used in this case is known as Westrumite, and is one of the so-called emulsified asphalts in which ammonia is used as the emulsifying alkali. Materials of this character can be mixed with water, and it is claimed that on this account these pavements can be laid during either wet or dry weather with equally good results.

It is very doubtful if any results can be secured with these materials that would equal or exceed those secured by the regular hot or cold mixed methods, and the cost of such a pavement is no doubt in excess of that secured by the latter methods. Bitumens of this type can no doubt be applied in certain instances to advantage. In repair work, where there is not sufficient yardage to

justify an equipment, no doubt satisfactory repairs can be made with them; also where it is desired to penetrate a dusty aggregate which an ordinary bitumen will not do, this class of material can no doubt be used to advantage.

MOORESTOWN EXPERIMENT.

The road leading from Moorestown to Camden was originally paved with cobblestones. These stones have become displaced by the frost and travel to such an extent that the present surface is very irregular. About the only way in which such a surface can be repaired is to relay these stones to the proper grade and curvature, or cover them over with a thin layer of concrete before the bituminous surface is laid. Such a road can be repaired by the latter method at a much lower figure than by the former; consequently, a small stretch was selected and repaired by the latter method.

After the concrete was spread and brought to the proper grade and curvature, a layer of one and one-half inch stone was scattered over the fresh concrete and tamped until the stones were about one-half imbedded in the concrete. Upon the surface thus prepared a layer of bituminous mortar was spread about one inch thick after compression. This mortar was composed of about 48 per cent. grit, 44 per cent. sand and 8 per cent. asphalt. The mortar was squeezed by rolling into the openings between the stones which projected above the concrete and was thus firmly anchored in place. It is the function of these stones to hold this mortar firmly in place and prevent it from creeping or rutting, and also to diminish the quantity of mortar which would be otherwise required. In time these stones will show on the surface and should then take the burden of the travel.

The chief benefits secured from this experiment to date has been the determination of the errors which most generally accompany any new type of construction, and which we desired to know. Once these points have been determined we can easily prevent their repetition in constructions of this type in the future. If the merits of this type of construction can be judged from the present appearance of the pavement, it should be very satisfactory. A bituminous mixture of this type is waterproof and exceedingly

tough. It possesses the durability of a sheet asphalt pavement, has much more inherent stability, can be prepared from a softer bitumen and is not nearly so brittle or slippery.

There is little doubt but that we will have more or less trouble in constructing roads using this base or any other concrete base, until the contractors realize the importance of making concrete of a uniform character and high quality. The quality of concrete which the ordinary contractor has been accustomed to lay will not answer our purpose in a base of this type. If we adopt a concrete base or use this type of base to any extent it will have to be constructed of a uniform character and of a high quality, otherwise failures will surely develop at points where the concrete is of an inferior grade.

The inequalities of the base upon which this concrete was placed compelled us to use a much larger quantity of concrete than was originally figured upon. In depressions, four to five inches of concrete often had to be laid in order to bring the surface up to the required grade.

GRAVEL ROADS.

During the season we have made several efforts to try to find a satisfactory method of repairing and maintaining our gravel roads. Glutrin was applied with fairly satisfactory results. It may be possible with this material, when it is properly applied, to prevent these roads from rutting and cutting up during the wet season in the spring, and also from raveling during the dry period of the summer. As yet we have no assurance that we have applied this material in a manner that will give us the maximum results. Several applications have been made on roads of different characters to determine the ability of this material to resist solution and subsequent disintegration during the spring and wet season.

There is little doubt but that this material is almost a total failure when applied to a sand aggregate or an aggregate composed of silicates which are not easily decomposed by mineral or organic acid. However, when it is applied to an aggregate that is easily attacked by these acids, such silicates are more or less gelatinized, and will cement the aggregate thus treated into a comparatively solid concrete. This being the case, we will no doubt

find that this material may hold certain gravel roads and fail on others, depending on the character of the silicates, which are the real binding materials that hold a gravel road together. It has been demonstrated, apparently quite conclusively, that this material will cement some blast furnace slags into an apparently firm concrete.

Another method of repairing gravel roads that was tried and promises to give fairly good results at a comparatively low cost of treatment, is the coating of the surfaces of these roads with a liquid asphalt containing about 30 per cent. of a volatile liquefier. An asphalt cement containing this quantity of a liquefier will be sufficiently thinned that it can be handled and applied cold. After the gravel surface has been coated with about one-quarter to three-eighths of a gallon of such a bitumen the surface is ignited and the volatile liquefier burnt out of the bitumen. The heat thus generated heats the top surface of the road sufficiently so that the hot bitumen will penetrate into the surface to a depth of from one-quarter to one-half an inch. As soon as the surface has become cooled, the bitumen will no longer adhere to the wheels of passing vehicles and the road can be opened to travel at once. It is, however, always safer to scatter a light layer of sand over the surface, for it is not always possible to keep the travel off such a road until it has become thoroughly cooled.

The heat generated during ignition of the light liquefiers is not sufficient to injure the asphalt. This point was carefully determined by testing a bituminous residue from such an ignition. It possessed all the qualities the original material had before fluxing, and was not "cracked" in any way. This is not true of crude petroleum containing medium and heavy distillates, for such a material is ruined by this treatment. Cut back tars are also ruined if all the light liquefiers are burnt out. In order to secure the best results by this method of treatment, the gravel surface should be perfectly dry, of a dense uniform character and free from breaks in the surface containing loose material. Since most of our gravel roads when in a dry condition contain more or less of these loose openings, it will be necessary to fill these openings with a gravel which has been treated with some material that will harden fairly quickly and give a surface equally as hard as the remaining part of the road.

The cost of a cut back asphalt of this character is about 12 cents per gallon. By using one-third of a gallon per square yard the cost of the bitumen required and its application should not be over six to seven cents per square yard of surface treated. If such a treatment will hold the surface of these roads in shape for a year or more, the cost of applying this bitumen is so low that the roads could be treated annually by this method, for the quantity of bitumen required for the second application will be much less than the amount used for the first.

In order to secure the maximum results by this method it may, however, be necessary to first treat the gravel surface with some other material that will harden it temporarily until the bitumen has been applied in the manner above described.

As yet we have no roads thus treated which have passed through a winter; consequently, it is not possible at this time to say just how efficient this method of repairing a gravel road will be.

Survey for State Highway System.

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

DEAR SIR—In compliance with section 3, chapter 396, laws of 1912, I have made a survey of the State and am preparing a map on a scale of two miles to the inch which will show the improved roads and principal bridges.

This survey was carried out by the aid of the county engineers and road supervisors of most of the counties, but in some cases it was necessary to get the assistance of other engineers.

I secured prints from the New Jersey State Geological Survey of the maps of the State on a scale of three inches to the mile. These maps were made from the original survey of the State, and in many places roads have been built since the survey was made. In such cases it was necessary to run out the lines of the road and plot them on the maps.

In taking up the work in a county I made arrangements with one of the officials in that county to go over the roads with me, and we marked the location of all the improved roads on the maps, carefully locating the beginning and ending points of the road improvement. We also took notes of the official body in charge of the road. We measured all of the principal bridges on the line of these roads.

The enclosed tables give the miles of road and number of bridges listed to date.

Very truly yours,

M. H. WEEKS.

ROAD MILEAGE.

MATERIAL.	STATE AID TO		County.	Township.	Turnpike.	Built by Private Interest for Public Use.	Totals.
	County.	Township.					
Stone Blocks				10.208			10.208
Brick	1.333			5.667			7.000
Bituminous Concrete	86.584		14.041	1.042			101.667
Bituminous Macadam	46.083		5.208	3.417		1.000	55.708
Macadam	1,150.499	11.125	292.375	1,055.458	8.333		2,517.790
Gravel	515.958	1.708	31.500	1,182.374	21.876	3.834	1,757.250
Shell	13.250			53.541		2.208	68.999
Cinders				9.750		1.458	11.208
Rubble	1.292				2.000		3.292
Slag				1.083			1.083
Concrete .....				.333			.333
Asphalt (sheet)				7.667			7.667
Total	1,814.999	12.833	343.124	2,330.540	32.209	8.500	4,542.205

BRIDGES (of five feet span or over).

MATERIAL OF DECK.	DRAW SPANS.		FIXED SPANS.							
	Steel.	Wood.	TRUSSES.		BEAMS.		Concrete.	Stone.	Brick.	Total.
			Steel.	Wood.	Steel.	Wood.				
Masonry	5		70		356		179	274	109	993
Wood	25	36	256	66	258	432				1,073
Totals	30	36	326	66	614	432	179	274	109	2,066

APPENDICES.

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Appendix A.

CONTRACT FOR STATE AID

for the Bridge over the

.....
in the.....Road
Between the

STATE COMMISSIONER OF PUBLIC ROADS

and the

BOARD OF CHOSEN FREEHOLDERS,
COUNTY OF

.....
WHEREAS, The State Commissioner of Public Roads, under authority conferred on him by section 4, chapter 395, laws of 1912, deems the following bridge in the.....
a road to be improved, namely.....

.....
to be
and the cost of the structure yet unbuilt to replace the said bridge as too great for the public body charged with its construction;

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

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

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

The said Board further agrees to advertise for and receive bids as required in section 3, chapter 395, laws of 1912, in the case of roads, excepting that the certified check to accompany each bid need not exceed 10 per cent. of the price bid.

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.

NINETEENTH ANNUAL REPORT.

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.]

Standard Specifications, Etc., for State Aid Roads.

Name of road

Beginning at

in the of

Ending at

in the of

Length, feet..... miles.

Width of right of way,

“ Graded between curbs,

“ Paved,

Depth of Pavement,

HISTORY OF ROAD

NOTE.—Beginning and ending points must be accurately located by reference to fixed landmarks. History of road must include reference to any documents of record.

I. CONDITIONS FOR APPROVAL AND ACCEPTANCE.

1. COMPETITION.

The Department of Public Roads will approve of no specification which unduly limits competition between bidders.

2. RIGHTS OF WAY.

The department, as a consideration of approval of award of any contract, will insist on proper grants of rights of way for all lands necessary for the road and for releases from any claims for damage by construction and by forming the slopes shown in drawings both in cut and fill. Where such grants and releases cannot be secured there must be filed with the department an undertaking by the governing body to begin condemnation proceedings within thirty days of said approval against all lands as to which grants and releases have not been secured.

There will be required a certificate that the grants, releases and lands to be condemned embrace all the property needed for the road and for slopes.

3. DRAWINGS, ETC.

Drawings for department files must be black prints on white ground, either on cloth or cloth backed.

Size of sheets.....	22" x 42"
Scales, Plan.....	1" = 80'
Profile, horizontal.....	1" = 80'
vertical	1" = 4' or 8'
Cross sections	1" = 4'
Details, cross roads, entrances, etc.....	1" = 40'

There will also be required by the department two complete sets of blue prints.

Where there are several sheets and a key map is submitted therewith any scale may be used for such key; sheet must be 22" x 42". All cross roads and entrances to private property will be shown on plan, and, where the proper connection thereof with the road requires fill or cut, by profiles and cross sections on separate detail sheets. These must contain all the data necessary for calculation of the quantities involved, which quantities must be given in the calculations under head of excavation outside road.

At entrances drainage will preferably be carried in paved gutters.

Drawings must show all important trees within the right of way of the road and in the slopes. Such trees as are to be removed must be indicated. This does not apply to trees less than four inches in diameter, nor in woodland where area to be cleared will be indicated.

The center and side lines of the roadway, the exterior lines of the right of way, the location of all buildings within fifty feet of the center line, and all encroachments of whatever character or description on the right of way must be shown on the drawings.

Details of retaining walls, where the same are included in the road contract, will be shown on the plan and cross-sections.

Whenever the slopes extend beyond the right of way such extensions will be shown on the plan. The names of all property owners will be indicated.

Where the road is diverted from the previous right of way, and property taken for the new location, its ownership will be shown.

When curbs have been set or sidewalks improved along the line of the road, these must be shown on the plans and cross sections. In such locations, the municipal officers in charge of the sidewalks and curbs, must be notified of any proposed changes and approve in writing thereof. The engineer will submit, together with the drawings, specifications and estimate of quantities, a preliminary estimate of cost based on said estimated quantities.

At railroad grade crossings, elevation of top of every rail crossed must be shown on a detailed profile of the road at such points to a scale, vertical, 1"=1'; horizontal, 1"=4'.

4. EXTRA WORK, CHANGES AND MODIFICATIONS.

Any desired change or modification must be evidenced by an agreement in writing by the contracting parties, accompanied by the drawings necessary to show the same and, where the change involves any change in price, by a supplemental contract fixing the amount. Additions or changes, hereafter provided for (see Articles 20, 28 and 29), must be evidenced by written orders of the engineer. All such agreements, contracts and orders must have the approval in writing of the State Commissioner of Public Roads. The State will contribute 40 per cent. of the cost of such extra work only when the same has been ordered by the engineer in writing, approved by the governing body of the county or municipality as the case may be and the Commissioner of Public Roads in writing and consented to in writing by the contractor, and all orders thus executed filed with the Department before the work thereunder is begun. The State can share in no increase in cost due to oversight or omissions in preparing plans and specifications.

5. CONDITIONS OF ACCEPTANCE.

The road must comply with the drawings and specification, as the same may have been modified as herein provided.

There can be no obstruction to traffic within the graded width of the road, nor any encroachment on the right of way. Sign posts, letter boxes, lamp posts, telegraph or telephone poles, must be removed outside of the gutter lines. Fences must be set back to the exterior lines of the right of way unless otherwise specified or shown on drawings. Pipes or cross bridges in and over gutters must be removed where they offer any obstruction to traffic or interfere with the cross-section, as shown on drawings.

Intersecting roads and entrances must be so graded as not to drain on the road or its shoulders or interfere with the drainage of the gutters.

Bridges, viaducts, ropes, wires, branches of trees, etc., crossing or overhanging the road, must be at least fourteen feet above the graded surface.

II. GENERAL PROVISIONS.

6. WORK TO BE PERFORMED.

The work to be performed will consist in furnishing all material, tools, machinery and labor necessary for the efficient and proper grading of roadway, side ditches and side banks, laying, spreading material and rolling of road, all other work of construction incidental thereto and the delivery of the completed road. The roadway will be left complete in every manner, free from obstruction and ready for immediate use. The maintenance of the road in condition for one year after the date of acceptance by the State Commissioner of Public Roads is a part of the work.

7. DRAWINGS.

The plan, profile and cross-sections on file in the office of the State Commissioner of Public Roads and at the office of _____

_____engineer, _____New Jersey, show

general location, profile, details and dimensions. The work will be constructed in all respects according to the above-mentioned plan, profile and cross-sections, which form part of these specifications.

On all drawings, figured dimensions are to govern in cases of discrepancy between scale and figures.

8. ENGINEER.

The engineer shall be selected by the governing body. He shall furnish all surveys, drawings, specifications and estimates of quantities. He shall set stakes for all lines and grades required for the completion of the work as may be required by the State Commissioner of Public Roads. He shall furnish certificates of the quantities of work done before partial payments can be made, the quantity of road laid being determined by surface measurements. Should any difference arise between the contracting parties as to the meaning or intent of these specifications, his decision on these matters, when approved by the State Commissioner of Public Roads, is to be final and conclusive.

All instructions necessary to give due and full effect to any of the provisions of these specifications shall be given by him.

All material and workmanship of any kind shall be subject at all times to his inspection. Whenever unfaithful or imperfect work or unsuitable material is discovered, he will immediately condemn it and it will at once be repaired or removed from the work and replaced with proper material.

9. INSPECTOR.

Nothing in these specifications relating to the duties of the engineer shall be taken or construed in any manner to conflict with the duties of the inspector, as specifically set forth in the act entitled "An act to provide

for the permanent improvement and maintenance of public roads in this State," approved April 15, 1912. He will verify the engineer's estimates of quantities and must sign the certificates thereof required for payments.

10. STOPPING WORK ON ACCOUNT OF WEATHER.

The State Commissioner of Public Roads, engineer or inspector may stop any portion of the work, if, in their judgment, the weather is such as to prevent the same being done properly. No allowance of any kind will be made for such stoppage, except an extension of the time for the completion of the work as herein provided. All bituminous pavements, built by penetration or mixing methods, laid either hot or cold, must be constructed after the first day of May and before the fifteenth day of October, unless permission is given by the State Commissioner of Public Roads in writing to lay these before or after the above dates.

11. ABANDONMENT OF CONTRACT.

If at any time the work under contract should be abandoned, or if at any time the engineer or State Commissioner of Public Roads should judge and so certify in writing to the governing body that said work, or any part thereof, is unnecessarily delayed, or that the contractor is willfully violating any of the conditions or covenants of this contract, or is executing the same in bad faith, then, in that case the engineer or governing body shall notify the said contractor to discontinue all work under this contract. The governing body may employ other parties to complete the work in accordance with the specification and use such material as may be found upon the line of aforesaid work, and, if necessary, procure other material for its completion, and charge the expense of the said labor and material to the contractor, which expense shall be deducted from any moneys due him under contract. In case these expenses shall exceed the sum which would have been payable under contract, if the same had been completed by said contractor, he or his bondsmen shall pay the amount of the excess to the governing body, on demand.

12. DUTIES OF CONTRACTOR.

He shall maintain sufficient guards by day and night to prevent accidents from travel, and will be liable for any damage which may arise from any negligence on his part or that of his agents and employes.

He is to commence and prosecute the work upon the road at the end farthest from the source of supply of material, unless otherwise ordered

by the engineer, within.....days from the approval of the contract by the State Commissioner of Public Roads and shall continue work thereon until completion, except as herein provided.

The contractor will be required to preserve all stakes and bench-marks made and established on the line of work until duly authorized by the engineer to remove the same. All stakes or bench-marks disturbed or re-

moved by the contractor or his agents without the permission of the engineer shall be replaced at the expense of the contractor.

The contractor shall not disturb the position of title stones (the corners of properties adjacent to the road), but where they appear he will either lift or lower them, under the personal supervision of the engineer.

The contractor must also preserve the roadway on which he is working from needless obstruction, and where necessary he must construct and maintain safe and commodious crossings for the residents along the line of the road. He is to remove or cause to be removed all obstructions in or over the graded width of the road so as to leave a clear headway of not less than 14 feet except where otherwise shown on drawings.

All loss or damage arising from the nature of the work to be done, from the action of the elements or from any unforeseen or unusual obstruction or difficulty, which may be encountered in the prosecution of said work or during the period of maintenance, shall be borne by the contractor.

The contractor shall employ competent men to do the work. Whenever the engineer and inspector shall inform him or his representatives in charge, in writing, that any man on the work is unfitted for the place, or is working contrary to the provisions of the specifications or the instructions of the engineer and inspector, he shall thereupon be discharged.

The contractor shall not assign or sub-let any portion of this contract without the written consent of the governing body and the State Commissioner of Public Roads.

13. COMPLETION AND MAINTENANCE, ETC.

The work is to be completed on or before the

In case the contractor shall fail to fully and entirely and in conformity to the provisions and conditions of this agreement, perform and complete the said work and each and every part and appurtenance thereto, within the time hereinbefore limited for such performance and completion, or within such further time as in accordance with the provisions of this agreement shall be fixed or allowed for such performance and completion, provided such extension or extensions shall receive the written approval of the Commissioner of Public Roads, the contractor shall and will pay to the governing body the sum of twenty dollars for each and every day that he, the contractor, shall be in default, which said sum of twenty dollars per day is hereby agreed upon, fixed and determined by the parties hereto as the damages which the governing body will suffer by reason of such default, and not by way of penalty.

And the governing body may and shall deduct and retain the same out of any moneys which may be due or become due the contractor under this agreement.

The contractor shall keep the finished roadway, shoulders, side slopes, ditches and underdrains in repair and free from obstructions, and shall make good any settlement in the work or other defect from whatever cause arising therein for the period of one year from the date of its completion and acceptance by the State Commissioner of Public Roads, and, in addition thereto, for as much longer as for any period or periods during said year it shall be out of proper condition. For this purpose he shall employ not less than one man constantly on said work of maintenance and shall keep on the work the

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necessary materials of an approved quality and in such quantities as the engineer may direct. The unused material shall become the property of the governing body on final payment. If, during that time, the roadway or any part of the work shall, in the judgment of the engineer and the governing body, require repairing, and they shall duly notify the contractor to make such repairs as required, and if the contractor should refuse or neglect to do so, within five days from the date of service of notice, then the said body shall have the right to have the work done as it may see fit, and to recover the cost thereof by deducting the same from any moneys due to said contractor, or by an action at law against the contractor or his surety, or by both methods. Such work of maintenance as the engineer shall certify to be necessary must be done before the payment of the remainder.

14. BIDS.

Bids will be received under these specifications for the completion of the whole work. The total or lump sum bid will govern in the awarding of the contract. The contractor must give separate prices per unit of measure for each of the several classes of work to be performed, as given in the estimate of quantities. The sum of the estimated quantities multiplied by the prices per unit of measure, should equal the lump sum bid for the entire work. No bids will be considered in which all of the necessary items are not filled out for at least one complete method of construction. Bidders are cautioned not to attach any conditions or provisos to their proposal as such conditions or provisos will render their bid informal and cause its rejection.

The right is reserved to reject any or all bids, if deemed to the interest of the governing body or State.

15. CHECK ACCOMPANYING BIDS.

Each bidder will accompany his bid with a certified check, payable to the order of the financial officer of the governing body, in the sum of one thousand dollars (\$1,000), as a guarantee that if the contract shall be awarded to him he will, within thirty days of said award, execute the form of contract hereto attached and the bond hereinafter required. Upon failure by the contractor to enter into said contract and to deliver said bond, the certified check shall be forfeited as liquidated damages.

16. BOND OF CONTRACTOR.

The contractor will be required to execute and deliver, within thirty days of awarding of contract, and as condition of approval of said award, a bond with such sureties as shall be approved by the governing body to secure the faithful performance of the contract and to indemnify and save harmless the said body from all suits or actions of any name or description. Also to secure the payment of all laborers and material men who have performed work or furnished material to the contractor in the prosecution of the work. The form and conditions of the bond provided for in this paragraph and to be used, is hereto attached and bound herewith and made a part hereof.

Said bond shall be in a sum of not less than the estimated cost of the road. Any change made in the plans, specifications, agreements or quantities without the consent of the bondsmen shall in no way vitiate said bond.

17. PAYMENTS.

Monthly payments will be made by the governing body to the contractor for work performed to an amount not to exceed eighty per cent. of the total cost of the work then completed to date upon presentation by him of the proper certificate of the engineer and inspector. Upon completion and presentation of a final estimate, signed by the engineer and inspector, and the written acceptance of the work by the State Commissioner of Public Roads, fifteen per cent. will be paid by the governing body. The remainder, or five per cent., will be retained by said body for a period of one year as further security for the faithful performance of Article 13, and will be paid on certificate of the engineer, approved in writing by the State Commissioner of Public Roads.

Whenever work is stopped, as provided in Article 10, the engineer and inspector may issue a certificate for the full contract price less one hundred and twenty-five per cent. of the value of the portion of the work remaining undone and the said five per cent.

The contractor must, before receipt of any certificate calling for a payment, furnish the engineer with satisfactory evidence, verified under oath, that all persons who have done work, or furnished material for this contract, or who have sustained damage or injury by reason of any act, omission or carelessness on his part or his agents in the prosecution of the work, have been duly paid or so secured that no liability can attach to said body on account of any such claim.

18. RIGHT TO BUILD BRIDGES, CULVERTS, ETC.

The right of the county to build bridges, culverts, and place guard rails in said road during the progress and prior to the completion of the work is expressly reserved.

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III. EARTH WORK, WORKMANSHIP, &c.

19. GENERAL.

Under this head will be included all excavation and embankment required for the formation of the highway, cutting all ditches or drains about or contiguous to the road, removing all fences, walls, buildings, trees, poles or other obstructions, the excavation and embankment necessary for reconstructing cross or branch roads or entrances to dwellings and all other excavation and embankment connected with the construction of the said road, including the rolling of the sub-foundation and construction of retaining walls.

20. EXCAVATION.

The roadway, intersecting, cross or branch roads, and entrances to dwellings are to be excavated or built to the widths and depths as shown on the drawings. The crown, from center to sides, must be so shown on plan but must not exceed three-quarters of an inch per foot.

The grading shall be completed for the full width of the road, between outer edges of slopes, before any second course work is commenced.

Excavation will be unclassified unless the engineer shall deem it to the best interest of the governing body to classify the same. In such case, with the approval of the State Commissioner of Public Roads, he may classify the excavation into earth and rock. Rock will consist of ledge or boulders over one-half ($\frac{1}{2}$) cubic yard in volume of such nature as to require blasting for removal. Unless an estimate of rock yardage is entered in above estimate of quantities, bidders will give no figure therefor.

In order to entitle the contractor to an allowance for rock excavation he must on striking this material notify the engineer, who must establish the location of the upper surface in position before removal. The depth allowed for rock excavation shall not extend beyond a line six inches below sub-grade. The engineer must furnish the department with cross sections of all rock cuts and must give the contractor a written order (in the manner prescribed in Article 4) for any such work at the unit price bid therefor.

21. EMBANKMENT.

Material taken from excavation, except when otherwise directed by the engineer, shall be deposited in embankment, either on the roadway or sidewalks. Rejected or excess material will be used to increase the width of embankment, or deposited in spoil banks or waste piles, as and where the engineer may direct, either within or without the road. In case there is not sufficient material in the excavation to form the embankment, the deficiency shall be supplied by the contractor from without the line of the road. The character of said material and place of excavation must be approved by the engineer.

The use of vegetable matter will not be permitted excepting on the outer edge of slopes.

The embankment will be formed in layers not to exceed one (1) foot in depth. The required allowance for settling must be added. Each layer

shall be carried across the entire width of the embankment and completed before commencing another, and this method shall be followed with each succeeding layer until the established grade is reached.

22. SLOPES.

Slopes in both excavation and embankment shall be one and one-half ($1\frac{1}{2}$) horizontal to one (1) vertical, unless otherwise shown on cross-sections.

23. GRUBBING.

The contractor will also be required, when the engineer so directs, to grub and remove from a strip of land feet on outside of curb-lines, all objectionable material, such as trees, stumps, roots and brush, and refill the holes with earth. This work will not be required unless a figure is given therefor in the Estimate of Quantities.

24. SUB-FOUNDATIONS.

The cross-section of sub-grade must conform in every respect to the cross-section of the road on plans, and will be rolled until smooth, firm and hard. If any depressions form under such rolling, the same shall be filled; any improper material shall be removed and good earth or other acceptable material substituted. When rock or bowlders occur they must be removed to a depth of at least 6 inches below sub-grade.

The sub-foundation of intersecting roads and of driveways leading to dwellings located along the road, if indicated on the plans, shall be properly graded and sub-foundation rolled.

Grading will not extend beyond the right-of-way of the road, excepting where otherwise shown in drawings.

After the road-bed has been prepared and properly rolled the same shall be inches below the intended surface of the roadway; the surface thereof shall not be disturbed by any unnecessary carting or hauling upon it, but if the surface is disturbed the same shall be re-formed and re-rolled before the spreading of foundation material.

25. FINAL FINISH OF SLOPES AND SHOULDERS.

The final finish of slopes and shoulders, in both excavation and embankment, must be completed before the spreading of the second course of road surface material. After such spreading no work will be allowed upon either slopes or shoulders that will tend to deposit any earth upon the work.

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26. SHOULDERING.

A shoulder of firm earth or gravel, found anywhere along the line of the road, is to be left or made on each side, extending at the same grade and curvature of road to side ditches or gutters. This shoulder is to be thoroughly rolled and compacted.

27. SIDE DITCHES OR GUTTERS.

The side ditches or gutters are to be excavated as per stakes furnished by engineer, in order to give an easy flow of water; no water shall be left standing on the road or in the ditches.

28. PAVED GUTTERS.

Gutters shall be paved with concrete, stone blocks, brick, cobble stones or riprap for the lengths and widths as shown on plans. The engineer may, however, change the location of paved gutters; he may increase the amount, which excess will be paid for as an extra at the unit price bid therefor only when ordered in the manner prescribed in Article 4.

If concrete gutters are used they shall rest on a sub-foundation of cinders or sharp sand, not less than six inches thick; the concrete shall be composed of broken stone, or screened gravel, and sand and Portland cement, in ratio of 5, 3, and 1, and shall be not less than 4 inches in thickness.

If stone blocks are used, they must rest on a bed of good sharp sand or gravel of a depth not less than.....inches below the blocks.

The blocks shall be laid vertically on edge and parallel with the line of the gutter. All end joints must be broken by a lap of at least three (3) inches.

After the blocks are laid as above specified, the surface of the blocks must be covered with fine, dry sand, which shall be swept until the joints are completely filled. The blocks shall be then carefully rammed to a firm, unyielding bed, with a uniform surface and with the proper grade and curvature. After ramming the blocks the surface of the same shall be again covered with fine, dry sand, and again swept until all the joints are filled. Brick gutters will be laid as provided for stone block, but the joint must be grouted with cement.

If cobble stones are used, the contractor shall proceed as above provided. The stones are to be set upon their small ends, with their greatest dimensions vertical and with their greatest horizontal dimensions parallel with the line of the gutter.

After the cobbles are laid as above specified, the same are to be covered with sand, rammed and again covered with sand, as provided above. All stones broken in ramming shall be removed and replaced with perfect stones. Riprap will be laid of the same stone and in the same manner as telford, except that the longest axis shall be parallel with line of gutter.

The cost of excavating for gutters must be included in the price bid for paving.

29. UNDERDRAINS.

Underdrains, as shown on plans, shall be constructed by the contractor when, where and as directed by the engineer. Additional underdrains, if found necessary, may be ordered in by the engineer as provided in Article 4, and when so ordered will be paid for as an extra at the unit price bid therefor, which will include the necessary excavation. They may be of the following type:

(a) Tile drains shall be ofinch round porous tile. The top of the

tile shall be at least inches deep, unless otherwise directed by the engineer and laid upon boards of not less than 6 inches in width and 1 inch in thickness; the joints shall be covered with salt hay, or material equally as good, and the trench filled with pervious earth.

(b) Stone drain may be used in place of the tile drain. A trench

.....wide and deep shall be excavated below the sub-grade, said excavation to be filled with loose broken stone to within inches of finished grade, then covered with salt hay or brush and fill completed with porous soil.

(c) French drain may be used. The trench shall be

wide and deep below sub-grade; at the bottom shall be placed a inch round, porous tile as above specified. The trench shall be filled with broken stone and finished as above specified.

30. PROVISION FOR DRAINAGE.

If it be necessary in the prosecution of the work to interrupt or obstruct the natural drainage of the surface, or the flow of artificial drains, the contractor shall provide for the same during the progress of the work in such a way that no damage shall result to either public or private interests. He shall be held liable for all damages which may result from any neglect to provide for either natural or artificial drainage, which he may have interrupted.

31. MANNER OF ROLLING.

In rolling, the roller must start from the side lines and work towards the center, unless otherwise directed. The rolling shall at all times be subject to the directions of the engineer and inspector. The rolling will, in all cases, be carried on until the work is approved by the inspector and engineer.

All rolling of stone work must be done with a ten (10) ton standard power macadam roller, so constructed as to give a compressing power of not less than four hundred (400) pounds per lineal inch on drivers; said roller must meet the approval of the engineer. Bituminous pavements may be rolled with an approved tandem roller, if the engineer so directs.

If required, rolling of gravel roads may be done with a horse-roller, acceptable to the engineer.

32. BROAD-TIRE WAGONS.

All wagons and carts used during the construction for hauling stone, earth, or any other materials must have tires not less than three and one-half ($3\frac{1}{2}$) inches in width.

33. OBSTRUCTIONS.

All obstructions to traffic between the curb lines must be removed by the contractor. (See Article 5.) The contractor will replace in proper position outside of said lines any obstruction so removed that is the property of any municipal body, also letter boxes. He will be required to reset all fences moved during the work that did not encroach on the right of way when work was begun, but not otherwise, unless the same are specifically mentioned.

34. RETAINING WALLS.

Retaining walls will be of concrete or rubble masonry.

Concrete will be composed of one part Portland cement,

parts sharp sand and parts of approved broken stone, slag or gravel will be mixed on boards by hand or in an approved batch mixer and used while fresh and without tempering. Masonry walls will be laid in cement mortar of one part cement and three parts of sharp sand. The stones will break joints longitudinally and transversely and the walls be thoroughly

bonded. The wall will be drained by weep holes of 4" tile spaced feet apart.

IV. MATERIALS.

35. GENERAL.

All materials used in building the road are to be furnished by the contractor. Samples of such materials as are hereinafter designated must be submitted with each bid or previously approved samples on file adopted with each bid. (See Proposal, page 34). Any proposal based on samples not complying with these specifications will be rejected.

Failure to file or adopt samples will cause rejection of the bid.

When samples are submitted, they must be filed with the engineer at his office and the State Commissioner of Public Roads at the Road Department at Trenton. This should be done at least ten days before the opening of bids so as to allow time to submit new samples in case of rejection. No samples will be received for examination after bids have been opened. These samples must be plainly labeled with the bidder's name, class of material and its origin.

Broken stone in five pound bags or boxes.

Binder, gravel and sand in five pound bags or boxes.

Gravel for concrete in five pound bags or boxes.

Slag for concrete in five pound bags or boxes.

Sand for bituminous concrete pavements or mortars in five pound bags or boxes.

Bituminous cements, fluxed and ready for use in one pound tins or cans.

Bidders will, in addition, submit samples of bituminous concrete pavements.

These samples must represent the physical structure and composition of the pavement as laid; they must be three in number for each style of pavement proposed, of the specified thickness and four inches square.

When previously approved samples are adopted, they will be designated by the numbers given such samples when approved and which are on file at the office of the State Commissioner of Public Roads at Trenton, and must be so recorded in the proposal. (See Article 49.)

All bituminous cements hereinafter specified, shall be shipped ready for use without further fluxing at the mixing plant or roadside. No bituminous materials shall be used until tested and released by the Department of Public Roads.

Samples of each carload or tank must be submitted. Such samples may be taken before shipment, under special arrangement in each case with the department, or in default thereof must be taken by the engineer or inspector on arrival at the terminal nearest the work or at any other convenient point.

36. TELFORD.

Telford base stone must be hard and tough.

No stone of greater length than ten (10) inches or width of four (4) inches shall be used, except each alternate stone on outer edge, which shall be double the length of the others and well tied into the bed of the road. All stones with a flat, smooth surface must be broken.

37. BROKEN STONE.

All stone must be as nearly cubical as possible, broken with the most approved modern stone crushing machinery. It must be of trap or approved native rock, free from all screenings, clay, soil or other objectionable substances, of uniform size and of the same kind and quality as sample. It must show a fresh, crystalline surface.

Macadam Foundation or two and one-half-inch stone shall be broken stone, which must pass through a three-inch ring and catch on a two-inch ring.

Macadam Second Course or one and one-half-inch stone shall be broken stone, which must pass through a two-inch ring and catch on a one-inch ring.

Macadam Special one and one-half-inch stone shall be broken stone, which will pass a two-inch ring and be retained on one and one-half inch ring.

Macadam Surface or three-quarter-inch stone shall be broken stone, containing not over 5 per cent. of material retained on one-inch circular openings or 8 per cent. which will pass one-half-inch circular openings.

Dustless Screenings shall be broken stone containing not over 5 per cent. of material retained on $\frac{3}{8}$ -inch circular openings or 8 per cent. which will pass one-quarter-inch circular openings.

Grit shall be broken stone containing not over 5 per cent. of material retained on $\frac{3}{8}$ -inch circular openings or over 4 per cent. which will pass $\frac{1}{8}$ -inch circular openings. It must be clean and free from dust or dirt.

Dust shall be broken stone and include all material which will pass one-quarter-inch circular openings, but must be free from soil, loam or clay.

Filler for use in bituminous mortars or bituminous concrete shall be Portland cement, ground limestone or trap rock dust, 85 per cent. of which must pass a 100-mesh sieve and 65 per cent. a 200-mesh sieve.

38. GRAVEL AND SAND.

Road Gravel A is to be composed of quartz pebbles, chert, sand, clay and oxide or hydrate of iron, in such quantities that the gravel will pack under pressure into a hard, dense pavement. It will be judged solely by comparison with the samples furnished.

Road Gravel B is gravel not deemed suitable for surface work, but may, on approval of sample by the Engineer and State Commissioner of Public Roads, be used for foundations of gravel roads.

Road Gravel A and B shall not contain over 20 per cent. of material which will be retained on two-inch circular openings.

Gravel for use in concrete shall be free from loam or clay. It must all pass $1\frac{1}{2}$ -inch circular openings and contain not over 45 per cent. of material which will pass $\frac{1}{2}$ -inch circular openings or over 5 per cent. of material which will pass $\frac{3}{8}$ -inch circular openings. Gravel containing not over 25 per cent. of clean sharp sand which is free of loam or clay, may be used without screening if it fulfills the requirements of the above specified gravel after the sand has been removed. It must, however, be first tested and approved by the State Department of Public Roads.

Sand, unless otherwise specified, shall be hard-grained quartz sand, uniformly graded in size, moderately sharp, free from loam, clay, lumps of ferruginous cemented sand or other foreign materials. If used in a bituminous concrete pavement or bituminous mortar, must contain not less than 15 nor more than 30 per cent. of material which will pass an 80-mesh sieve, or over 4 per cent. passing 200-mesh sieve.

39. STONE BLOCKS.

They shall be of the best quality of rock and subject to the approval of the engineer and inspector. Each block shall measure not less than eight (8) nor more than twelve (12) inches in length, not less than three and one-half ($3\frac{1}{2}$) nor more than four and one-half ($4\frac{1}{2}$) inches in width, and not less than seven (7) nor more than eight (8) inches in depth. All blocks shall be of the same quality as to hardness, color and grain. No outcrop, soft, brittle or laminated stone will be accepted. The blocks must be split and dressed so as to form, when laid, close end joints not exceeding one-half ($\frac{1}{2}$) inch in width, top and bottom, with fair and true surfaces on top, bottom and ends.

40. COBBLE STONES.

The cobbles must be good, hard, sound stone and of as uniform size as practicable. Medium size stone, not over five (5) inch face on its longest diameter, must be used, excepting for center line and side lines of gutter, where eight (8) inch stone may be used.

41. AGGREGATES FOR CONCRETE.

All stone or slag for concrete must have a fresh, clean surface, free from mud, dirt, clay or loam. It must have a crushing strength of not less than 800 lbs. per square inch.

42. CONCRETE.

All concrete shall have a crushing strength at the end of 7 days of not less than per square inch, at the end of fourteen days of not less than per square inch, and at the end of 30 days of not less than per square inch.

It must be uniform in structure and composition and not absorb over per cent. of water when dried in vacuum.

43. PIPES.

Round, porous tile shall be well burnt and true in form and size, free from cracks, chipping or other defects.

Vitrified tile shall be well burnt, true to form and size, free from cracks, blisters or other defects, of sufficient strength for the work and fitted with bell and spigot ends.

Cast iron pipe shall be true to pattern without cracks and uniformly coated with a bituminous paint.

44. BITUMINOUS CEMENTS.

Must be free from water, uniform and homogeneous. They must pass the requirements designated below for the respective type of pavement for which they are intended to be used.

45. ASPHALT CEMENTS.

Asphalt cements may be made from petroleum or from fluxed or unfluxed refined natural asphalts, and must be free from tar or tar products. Their chemical constituents and physical properties may vary with the character of the road surface for which they will be used.

	B		C		D		E		J		K	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1. Specific Gravity .....	.995	.....	1.000	.....	1.015	.....	1.010	.....	1.035	.....	1.010	.....
2. Penetration.....	.....	.....	120	140	60	90	140	160	55	85	.....	.....
3. Penetration after Evaporation.....	90	.....	50	85	45	65	50	90	40	60	90	120
4. Evaporation Loss.....	.....	20%	.....	5.0%	.....	5.0%	.....	5.0%	.....	.5%	28%	35%
5. Solubility in CS ₂ Residual Asphalts.....	99.5%	.....	99.5%	.....	99.5%	.....	99.5%	.....	99.7%	.....	99.5%	.....
6. Flash Point.....	.....	.....	175	.....	175	.....	175	.....	175	.....	.....	.....
7. Ductility at 50 Penetration.....	20	.....	25	.....	25	.....	25	.....	50	.....	25	.....
8. Viscosity	540	720	.....	.....	.....	.....	.....	.....	.....	.....	1300	1600
9. Paraffin Scale.....	.....	3.0%	.....	2.0%	.....	2.0%	.....	2.0%	.....	0.5	.....	3.0
10. Distillates— 0° to 150° C. of a Specific Gravity below .781 (62° B).....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8%	12%
“ 150° to 300° C. “ “ “ “ .802 (45° B).....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	18%	22%

The above tests are to be made in the manner designated herein below:

1. “Specific Gravity” is taken at 15.5° C. in a regular picnometer bulb, on grades C, E and K at 100 penetration. The bulb is first filled nearly full of the hot bitumen and, when cool, weighed. It is then placed in a bath of water kept at 15.5° C. for two hours, filled with distilled water at the same temperature and re-weighed.

2–3. “Penetrations” are taken at 25° C. with a Dow Penetration Machine, using a No. 2 needle applied for five seconds under a 100-gram load.

4. “Evaporation Loss” is determined by heating continuously twenty grams of the bitumen in a tin dish two and one-quarter inches in diameter by one inch deep for a period of five hours in a closed air bath kept at 163° C.

5. “Solubility” is the bitumen soluble in cold C. P. carbon bisulphide.

6. “Flash Point” is determined in a New York State Closed Oil Tester.

7. “Ductility.” These tests are all taken at 25° C. on a Dow Ductility Machine. The briquette pulled is cast in a regular Dow mold. It is kept at 25° C. for two hours before testing. When softer than desired, the bitumen must not be heated above 204° C. during concentration.

8. “Viscosity.” An Engler Viscosimeter is used. The first 50 cm.³ only are recorded. Grade K at 25° C., all others at 90° C.

9. “Paraffin Scale” is determined by the distillation modification of the Holde Method.

46. TAB CEMENTS.

Tar may be either coal tar or petroleum tar. The former will be known as bituminous material M and N, and the latter S, T and U. They must be free from water and comply with the following requirements:

GRADES.

	M.		N.		O.		S.		T.		U.		V.	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1. Specific Gravity.....	1.22	1.30	1.15	1.22	1.20	1.28	1.14	1.16	1.115	1.175	1.120	1.155	.....	.....
2. Penetration.....							350		240	260				
3. Float Test, seconds.....	150	210					80	120	140	180	30	70		
4. Viscosity at 90° C.....			40	80	80	120	210	300	480	540	40	80		
5. Free Carbon.....	15.%	25.%	10.%	20.%	12%	20%		2.0%		2.0%		1.5%		
6. Evaporation Loss.....		10.%		30.%		15%		7.%		5.%		25.%		
7. Penetration of Residue.....							100		40		70			
8. Distillation 0°-170° C.....		0.1%		5.0%		0.1%		0.1%		0.1%		5.0%		
9. " 170°-300° C.....		15.0%		35.%		25.%		15.0%		15.0%		25.%		
10. Naphthalene content of total Distillates.....		5.0%		5.0%		5.0%		2.0%		2.0%		2.0%		

The above tests are to be made in the manner designated herein below :

1. Same as for asphalt cements.
2. Same as for asphalt cements.
3. The New York Testing Laboratory Viscosimeter is used. The water must be kept at 50° C.
4. The cement is first passed through a 20-mesh sieve, then tested as given for asphalt cements.
5. Carbon bisulphide is the solvent used, the material is filtered as soon as in solution.
6. Same as for asphalt cements, but for 21 hours at 105° C.
7. Same as for asphalt cements.
- 8-9. One hundred grams of the cement are distilled in a standard 250 cm.³ Engler Distilling Flask. The per cent. of distillate is determined by weight, and the heating is continuous.
10. The distillate is cooled to 0° C, and the naphthalene is filtered off and determined by weight.

PAVEMENT SAMPLES.

SUBMITTED BY	SURFACE PAVEMENT TYPES.			
	E-E.	G.	H.	J.
Amies Road Co.....			A701H	
Barber Asphalt Co....		B701G	B701H	
Dolorway Paving Co..				D701J
G. F. Brackett.....		G. F. B701G		
C. T. Eastburn.....	C. T. E. 701EE	C. T. E. 701G	C. T. E. 701H	
N. J. S. Road Dept.	N. J. 701EE	N. J. 701G	N. J. 701H	
Warren Bros. Co.....		W701G		
Atl. Westrumite Co..			A. W. Co. 701H	
Crossman Co.....				

ROAD METALS.

SUPPLIED BY	Broken Stone	Sand.	Gravel.	Slag.	Brick.
B. B. Crushed S. Co..	B. B. C. S. Co. 201				
Birdsboro T. R. Co..	B. T. R. Co. 201				
Commonwealth Q. Co.	C. Q. Co. 201				
Cow Bay Sand Pits...		C B. 301			
Hudson Co. Quarries...	H. Q. Co. 201				
Crossman Co.....		Cr. Co. 301			
D. R. Q. & C. Co.....					
E. J. Lavino & Co.....	E. J. L. & Co. 201				
Francisco Bros.....	Fr. Bros. 201				
Gen. Crushed S. Co...	G. C. S. Co. 201				
I. P. Goff.....		Goff 301			
Diamond Stone Co...	D. S. Co. 201				
J. Tilton.....		J. T. 301			
Wm. Dahm.....	Wm. D. 201				
Knickerbocker L. Co..	K. L. Co. 201				
Morris Co. C. S. Co...	M. Co. C. S. Co. 201				
Norcross & Edmunds...		N. & E. 301			
Penn Trap R. Co.....	P. T. R. Co. 201				
S. B. Twining Co.....	S. B. T. Co. 201				
Swedeland Slag Co...				S. S. Co. 501	
Wagner's.....		Wag. 301			
W. H. Ireland.....	W. H. Ir. 201				
Long Branch.....		L. B. 301			
Bush Pit.....		Bush 301			
Lukens & Yerkes.....	L. & Y. 201				
N. J. Trap Rock Co...	N. J. T. R. Co. 201				
August Thiel.....	Thiel 201				
N. Seyola.....	N. Se. 201				
Braun Bros.....	B. Bros. 201				
Eagle Rock Quarry...	E. R. Q. 201				

NOTE.—All the various sizes of broken stone (produced at any one quarry) are included under the one filing number. To adopt the products of any one quarry, write the filing number in the Proposal, thus B. T. R. Co. 201 will adopt all the various sizes of stone produced by Birdsboro Trap Rock Co.

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V. FOUNDATIONS.

50. GENERAL.

The roadbed, having been formed and rolled as hereinbefore specified, must be inspected and approved by the engineer and inspector before any material is placed thereon. No surface material will be spread on the foundation until the latter has been likewise inspected and approved.

The foundation will be of any of the following types, as designated in the Estimate of Quantities.

51. TYPE A. CONCRETE.

Concrete foundation shall be composed of one part of Portland cement,

..... of sharp sand, and of approved broken stone, slag or gravel by weight and inches in depth after completion. The concrete must be mixed until uniform and homogeneous in an approved concrete mixer of the batch type. Sufficient water must be used to make a soft semi-liquid mortar. It must be spread at once after mixing, tamped and floated until thoroughly consolidated and the mortar has been forced to the surface, filling all surface voids. No porous places or unfilled voids must show on the finished surface. It must be wet daily and protected from the sun, frost, travel, dust and mud for at least five days after laying. The required curvature and surface finish must be secured by the use of a templet. (Retempering or grouting will not be allowed.)

All concrete mixers must be provided with measuring pins or scales so arranged that the various materials can be accurately measured or weighed.

Expansion joints will be placed at distances of feet measured along the center line of the road. They shall be of the following type:

(a) The joint in this case will be $\frac{1}{2}$ inch wide and shall be filled flush with the top of the pavement with an approved bituminous cement. This cement shall be applied hot. The expansion joint and surface of the concrete adjacent this joint must be clean and entirely free from all dirt or other foreign material when the bituminous cement is applied.

(b) This expansion joint shall be formed of three thicknesses of tarred roofing felt number

(c) This joint shall be formed of two steel plates, weighing $7\frac{1}{2}$ pounds to the square foot, designed to mechanically lock with the concrete and separated from each other by two thicknesses of roofing felt number The plates shall be loosely connected with a bolt so as to allow motion and their upper edges shall be $\frac{1}{4}$ inch below the finished surface of the concrete.

When this foundation is intended to be used for surface pavement, Type D, the surface shall also be broomed with a steel broom until of a uniform character, free from all inequalities and slight depressions.

52. TYPE A-A.

Upon the foundation described under Type A, while the same is yet wet and soft, there shall be spread 100 pounds of special $1\frac{1}{2}$ -inch stone per square yard which shall then be forced into the concrete by light tamping, until the upper edges and corners of these stones are about $\frac{1}{4}$ -inch below the finished surface of the bituminous pavement and project from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch above the surface of the concrete. Should these stone sink below the surface of the concrete or be forced beneath the surface by improper tamping, additional stone must be applied at such points and retamped to the proper grade. The finished surface must be covered with partly imbedded stone firmly held in place. This foundation is to be used with EE Type of surface.

53. TYPE B. TELFORD FOUNDATION.

A bottom course of stone, of an average depth of inches, is to be set by hand as a close, firm pavement, the stones to be placed on edge, broadest edge down, lengthwise across the road in such manner as to break joints as much as possible, the breadth of the upper edge not to exceed four (4) inches. The interstices are then to be filled with stone chips, firmly wedged by hand with a hammer, and projecting points broken off.

54. TYPE C. MACADAM FOUNDATION.

A bottom layer of broken stone, consisting of two and one-half ($2\frac{1}{2}$) inch stone, shall be deposited in a uniform layer, having a depth of inches, and rolled repeatedly until compacted to the satisfaction of the engineer and inspector.

The depth of loose stone in this and all other courses must be measured by blocks the required thickness of the said loose stone. These blocks must be placed at frequent intervals amid the loose stone when being spread.

55. BINDER ON THE FOUNDATION.

On the first course of stone, whether type B or C, a quantity of stone screenings, gravel or sand, or mixture thereof, will be spread in uniform layers, and the whole rolled until the stone ceases to sink or creep in front of the roller. The binder shall not be applied in sufficient quantity to completely cover or form a coating upon this course of stone. Before, and until the second course of stone is spread, the first course must be firmly bound together, of the proper grade and curvature, and free from all ruts or loose surface stone.

56. TYPE D. GRAVEL B FOUNDATION.

When road gravel B is to be used as foundation material it will be spread over the sub-foundation to a depth of inches in the middle and inches at the shoulders. The material will then be brought to

a smooth, even and hard surface by rolling or scraping or both, as directed by the engineer, and, if deemed necessary by him, shall be watered so as to secure proper consolidation. The depth of gravel in this and all other courses must be measured by blocks or boards of the proper dimensions.

VI. ROAD SURFACES.

57. GENERAL.

Under this heading will be included all work and material necessary to complete the road from the foundation up. In all cases where bituminous cement is used the foundation must be dry and swept clean of superfluous binder or loose stone when the surface pavement is laid. No travel will be allowed on or over the bituminous material until the work is complete.

The finished surface in all cases must conform to that shown on cross sections and profile and be smooth. No depressions or elevation will be allowed.

The furnaces or ovens used for heating all mineral aggregates must be so constructed that the latter will be uniformly heated and be approved by the State Department of Public Roads. The temperature of these mineral aggregates when ready to be coated with the bitumen, must not be less than 120° C. or over 200° C. The mixing of all mineral aggregates with a bitumen, must be done in an approved asphalt mixer which will uniformly coat these aggregates with the bitumen.

All bituminous cements having a penetration of less than 300 at 25° C. must be heated in approved heaters which will heat them uniformly without burning or coking. The bitumen must have a temperature of not less than 120° C. when used and be free from unmelted lumps, but at no time shall it be heated above 200° C.

The contractor must keep on hand a regular asphalt thermometer and provide such measures or scales as the department may deem necessary to secure the required amount of bitumen or to determine the amounts of the various ingredients composing the mineral aggregate, needed to make the pavement of the proper composition.

All stone and bituminous surfaces must be rolled in a manner satisfactory to the engineer.

58. TYPE A. MACADAM.

Shall consist of one and one-half ($1\frac{1}{2}$) inch stone. This shall be spread in a uniform layer having a depth of _____ inches, loose measure, and rolled until thoroughly settled into place to the satisfaction of the engineer and inspector.

Binder shall consist of screenings, gravel, sand or a mixture thereof as ordered by the engineer. It shall be applied in thin layers and not rolled until dry. The application of binder with intermittent rolling shall continue until the voids have become filled in the $1\frac{1}{2}$ -inch stone. Water shall then be applied in such quantities that a wave of mud forms in front of the roller. The rolling shall continue until the pavement is thoroughly consolidated.

When the one and one-half ($1\frac{1}{2}$) inch stone has been rolled, a coat of

fifty (50) per cent. of three-quarter ($\frac{3}{4}$) inch stone and fifty (50) per cent. of screenings, properly mixed, is to be spread, of sufficient thickness to make a smooth and uniform surface, then again rolled until the road becomes thoroughly consolidated, hard and smooth.

Any depressions formed during the rolling, or from any other cause, are to be filled with one and one-half ($1\frac{1}{2}$) inch stone, or three-quarter ($\frac{3}{4}$) inch stone, or both, and screenings, approved by the engineer, and the roadway brought to the proper grade and curvature, as determined by him.

Water must be applied in such quantities, at such times and in such manner as directed by the engineer or inspector.

59. TYPE B. MACADAM WITH A BITUMINOUS DRESSING.

The second course of one and one-half ($1\frac{1}{2}$) inch stone shall be spread

..... inches thick, loose measure, and rolled as directed for Type A. It shall be bound with screenings, sand or a mixture thereof. This binder should be dry when spread and rolled until it has fallen into the voids. Just enough should be added to fill the voids, but not sufficient to form a layer on top of the one and one-half ($1\frac{1}{2}$) inch stone. Water shall then be applied in such quantity that a wave of mud is formed in front of the roller. The rolling must continue until the mass is thoroughly consolidated, hard and smooth. When dry the road shall be swept with a street sweeper until free from all loose material and until the ends of the $1\frac{1}{2}$ -inch stone show on the surface.

The exposed ends of these stones must be perfectly clean and free from all

foreign material when the oil is applied. Bituminous cement B or will then be applied at the rate of 5 pounds of bitumen per square yard from an approved pressure distributor at a temperature of not less than

..... This cement must be spread in two coatings if so ordered by the Department; but can only be applied during clear, hot weather. The road surface shall be moistened just before the cement is applied only when so ordered. Sand or grit or both previously distributed along the work will then be applied to a thickness of three-quarters ($\frac{3}{4}$) of an inch. The road should not be rolled until the sun has drawn the bituminous cement as near the surface as possible. Should bituminous material appear on the surface, more sand or grit will be applied at these points and the road re-rolled. A thin coating of sand or grit must cover the finished work.

60. TYPE C. BITUMINOUS MACADAM.

The second course of one and one-half ($1\frac{1}{2}$) inch stone shall be spread

..... inches thick, loose measure, and rolled as directed for Type A. The voids shall then be filled with dustless screenings and grit until about 75 per cent. of them have been filled. This material must be dry when spread and the road rolled repeatedly until the fine stone has settled into the voids.

Bituminous cement shall then be spread by hand or by an approved pressure distributor in a uniform layer at the rate of 10 pounds of bitumen per square yard. A layer of grit and dustless screenings shall be

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spread at once and the road rolled until firmly consolidated. A second application of bitumen shall then be made at the rate of 5 pounds per square yard, covered at once with a coating of grit and the road again rolled until it has the proper density and surface.

The stone must be dry when coated with the bitumen and the road protected from travel from the time the top course is spread until the bitumen has been applied.

The bitumen must have a temperature of not less than 120° C. or over 180° C. when applied.

61. TYPE D. CONCRETE SURFACE.

This pavement shall be foundation Type A. It must be protected from travel for at least 10 days after being laid. It must be finished as described in section 51, Foundation Type A.

62. TYPE E. BITUMINOUS MORTAR MACADAM.

The second course shall consist of special one and one-half ($1\frac{1}{2}$) inch stone. It shall be spread two inches thick, loose measure and brought to the proper grade and curvature of the finished pavement. These stones must be consolidated by rolling, before the application of the mortar. Bituminous mortar as specified in Type E shall be spread in one or two courses as directed by the State Department of Public Roads at the rate of 75 pounds per square yard for unemulsified bitumens and 100-120 pounds per square yard for emulsified bitumens. The first application shall be about 50 pounds per square yard and rolled well into the voids before the second application is made. The stone must be dry and clean when this mortar is spread. After being rolled, all travel must be kept off these stones until they have been covered with the mortar.

63. TYPE E E.

Upon foundation A-A there shall be spread seventy pounds of bituminous mortar per square yard. This mortar must be spread in a uniform layer. It must be spread only during warm, clear, dry weather.

The bituminous mortar must contain not less than eight or more than eleven per cent. of bitumen soluble in carbon bisulphide. The exact amount of bitumen to use between these limits shall be determined by the State Department of Public Roads.

Bituminous cements may be used.

The mineral aggregate shall consist of sand and approved filler. Trap rock grit must be used when so ordered. Screenings that have been tested and approved may be used. These ingredients shall be proportioned in the manner designated by the State Road Department. The sand used must comply with the requirements of Article 38.

Natural rock asphalt may be used as a bituminous mortar. It must be uniformly impregnated with not less than 7 per cent. of bitumen, thoroughly ground and contain no lumps which will not pass one inch circular openings.

The bituminous mortar must have an average temperature of not less than 110° C. when delivered on the road if prepared by the hot mixing method. It must be prepared in a manner approved by the State Department of Public Roads.

64. BITUMINOUS CONCRETE PAVEMENTS.

Bituminous concrete pavements are defined as pavements composed of stone, clean sand and a satisfactory filler, bound together with bituminous cement.

The proportion of the different sized ingredients forming the mineral aggregate given herein below for the different types of pavements, shall be determined by weight. The exact amount of bitumen to use and the penetration it shall have between the limits defined herein for each type of pavement, shall be determined by the State Department of Public Roads.

The sand used must comply with the requirements of Article 38.

These pavements must present an even uniform surface, free from depressions which will hold water. They must be of uniform composition, thoroughly bonded together, water-tight and must weigh not less than 115 pounds per square yard per inch of specified thickness.

Porous spots which remain wet after the surrounding surface has dried must be replaced with proper material.

They must be not less than.....inches thick after ultimate compression.

65. HOT MIXED.

All pavements which are composed of a mineral aggregate held together with a bituminous cement and are mixed and laid while hot, must conform to the following additional requirements:

The pavement must be prepared from bituminous cement D or J.

The plant used to prepare these pavements must be of the "batch type." It must be provided with separate chambers for heating and mixing the ingredients. If the drier is not completely emptied of each batch mixed, then the plant must have a rotary screen with 1, $\frac{1}{2}$ and $\frac{1}{8}$ inch circular openings to screen the heated mineral aggregate. Other sizes must be added when so ordered. The bins into which the hot screened aggregate falls, must be divided to correspond to the different sized openings in the rotary screen.

The paving mixture, when dumped on the roadbed ready to be spread, must have a temperature of not less than 120° C. If any segregation of the mineral aggregate takes place during hauling from the mixing plant, the whole must be uniformly remixed before any part of this load is spread. If the temperature of the mixture has fallen below 110° C. before it is in the proper condition to spread, it must be reheated.

The paving mixture shall be spread evenly on the foundation with hot iron rakes and shovels. The rolling shall be done as quickly as possible after the material is spread, while it is still hot and pliable. When the paving mixture is hauled on the road in dump wagons it shall be kept covered in transit, dumped on platforms and shoveled into place. As soon as spread the paving mixture shall be rolled. Rolling must be steadily kept up until all roller marks shall disappear, and the surface gives indications of no further compressibility.

The paving shall be done so that the number of joints between the hot and cold material may be reduced to the minimum. When it is not practicable to lay it continuously and a joint is unavoidable, the edge of the cold material shall be cut off in a straight line at an obtuse angle to the surface

and far enough back from the edge thus cut off to insure a smooth and even surface after completion. Where the joint is to be made, the surface must be painted over with bituminous cement, the hot material raked over the edge and thoroughly rolled. The surface of all finished joints must be on the same plane as the finished surface of the pavement. Joints that project above or are below the general plane of the surface, must be brought to the proper grade or remade. The faces of the curb and gutter, iron castings, etc., shall be painted with the bituminous cement before the paving mixture is laid.

As soon as possible after the rolling of the mixture is finished, and while the surface is still fresh and clean, and, if possible, while warm, a seal coat of approved bituminous cement of a proper consistency to be flexible when cold, shall be spread over the surface. It shall be applied while at a temperature, to be fixed by the State Department of Public Roads, of from 135° to 200° C, depending on the bituminous cement used, and evenly spread with rubber squeegees. Only a sufficient coat shall be spread to flush the surface voids without leaving an excess. Immediately over this a top dressing of sand, fine clean gravel, or screenings, or a mixture thereof, free from dust, which must be perfectly dry and heated in cold weather, shall be uniformly spread and thoroughly rolled into the surface. A small surplus of this dressing shall be left upon the surface.

When the work has been completed as specified above, additional compression in the wearing surface shall be secured by rolling with a ten (10) ton power macadam roller if ordered by the State Department of Public Roads or the engineer.

66. TYPE G 1.

The mineral aggregate shall consist of from 55—60 per cent. Trap Rock Grit, from 40—35 per cent. sand and from 4—8 per cent. of filler by weight.

The paving mixture must contain from six and one-half to nine per cent. of bitumen by weight.

67. TYPE G 2.

The mineral aggregate shall consist of three-quarter inch stone or dustless screenings, sand and filler. These ingredients shall be mixed in the following proportions: stone, 60—70 per cent.; sand, 35—25 per cent.; filler, 3—7 per cent.

The paving mixture must contain from six to eight per cent. of bitumen by weight. Upon the approval of the Department approved screenings can replace part of the sand.

68. TYPE G 3.

The mineral aggregate must all pass one and one-half inch circular openings. It shall consist of broken stone, screenings, sand and filler so proportioned and graded that the resulting mixture shall have the following composition:

Amount passing $1\frac{1}{2}$ in. and retained on $\frac{1}{2}$ in. circular openings, 40—60 per cent.

Amount passing $\frac{1}{2}$ in. and retained on $\frac{1}{4}$ in. circular openings, 10—20 per cent.

Amount passing $\frac{1}{4}$ in. circular openings and retained on 10-mesh sieve, 5—10 per cent.

Amount passing 10-mesh and retained on 30-mesh sieve, 5—10 per cent.

Amount passing an 80 and retained on a 200-mesh sieve, 3.75—7.50 per cent.

Amount passing a 200-mesh sieve, 2.50—5.0 per cent.

Balance shall pass a 30 and be retained on an 80-mesh sieve.

The paving mixture must contain from 6.5—8.5 per cent. of bitumen by weight.

69. TYPE G 4.

The mineral aggregate must all pass one and one-half inch circular openings. It shall consist of trap rock, stone screenings, sand and filler, so proportioned and graded that the resulting mixture shall have a composition that will not depart from the following composition as given herein more than the specified limits stated below:

Amount passing openings $1\frac{1}{2}$ in. dia. and retained on openings $\frac{3}{4}$ in. dia., 38 per cent.

Amount passing openings $\frac{3}{4}$ in. dia. and retained on openings $\frac{1}{4}$ in. dia., 21 per cent.

Amount passing openings $\frac{1}{4}$ in. dia. and retained on 10-mesh sieve, 11 per cent.

Amount passing 10-mesh sieve and retained on 80-mesh sieve, 20 per cent.

Amount passing 80-mesh sieve and retained on 200-mesh sieve, 6 per cent.

Amount passing 200-mesh sieve, 4 per cent.

The limits of variation in composition from that given above shall not be over 10 per cent. for all material passing $1\frac{1}{2}$ in. openings and retained on the $\frac{1}{4}$ in. opening, not over 7 for that passing $\frac{1}{4}$ in. opening and retained on 80-mesh sieve, not over 5 per cent. for that passing an 80 and retained on a 200-mesh sieve and not over 2 per cent. for that passing the 200-mesh sieve.

The paving mixture must contain from 6.5—8.5 per cent. of bituminous cement by weight.

70. TYPE H. COLD MIXED.

All pavements which are composed of a mineral aggregate held together with a bituminous cement, and are mixed without heating the mineral aggregate, and laid while cold, must conform to the following additional requirements:

Pavements of this type must be prepared from bituminous cements E or

..... and may be laid either in one or two courses. When laid in two courses the bottom course must not be less than $1\frac{1}{2}$ inches thick after ultimate compression. The aggregate for the bottom course must not contain material larger than $1\frac{1}{2}$ -inch stone, or contain over thirty per cent. of material which will pass openings one-half inch in diameter. This course of stone must be uniformly coated with sufficient asphalt to bind it firmly together. It must be laid and rolled to the proper grade and curvature before the top course is applied unless otherwise ordered by the State Department of Public Roads.

The top course must not contain any material which will not pass openings $\frac{3}{8}$ -inch in diameter. It must contain not less than five per cent., nor more than nine per cent., by weight, of bitumen soluble in cold carbon bisulphide

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the exact amount to be determined between these limits by the State Department of Public Roads.

After the bottom course has been spread, it must be protected from all travel and kept free from dust or dirt until the top course has been spread and rolled into place or sealed in the manner specified hereinbelow. If the bottom course gets wet after being spread, it must be allowed to dry out before being rolled or covered with the top course. When dry it must always be covered with the top course at once, after being properly rolled, and in no case shall the bottom course be spread over three hundred feet in advance of the top course, nor shall over fifty feet be left uncovered during the night.

When pavements of this type are laid in one course, they will be sealed by painting the surface with a squeegee coat of hot bituminous cement, when required by the State Department of Public Roads. This cement must be the same used in preparing the pavement, and must be applied at a temperature between 135° C. to 180° C. by a distributor which has been approved by the State Department of Public Roads. Immediately after this coat of bitumen has been spread, and while the same is yet hot, sand, fine clean gravel or screenings, or a mixture thereof, shall be spread over its surface and rolled at once.

71. TYPE I. GRAVEL.

If road gravel A is used for the whole construction, from sub-foundation up, it will be spread over the road at a depth of about inches at the center and at the shoulders, loose measure, and shall be thoroughly consolidated by rolling or scraping as directed by engineer until the surface is hard, smooth and the whole thoroughly compacted to a depth of inches on center line and of at the shoulders. The depth of gravel in this and all other courses must be measured by blocks or boards of the proper dimensions.

If road gravel B is used as a foundation, a coating of road gravel A will be applied of about inches all over the road and consolidated as above provided to a total depth of inches on center line and inches at the shoulders.

72. PAVING OF ENTRANCES.

This work will be done in the case of roads using stone as mineral aggregate, as described for Type A, the one and one-half ($1\frac{1}{2}$) inch stone being laid on the sub-foundation to a depth of four (4) inches, loose measurement,

In the case of gravel roads, the paving will be of gravel A andinches deep compacted. In both cases the paving will extend to the lines of right of way, except where otherwise shown on drawings.

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VII.

ENGINEER'S ESTIMATE OF QUANTITIES, COST OF MATERIALS AND CONSTRUCTION.

<i>Items.</i>	<i>Description.</i>	<i>Quantities.</i>	<i>Unit Price.</i>	<i>Total Cost.</i>
		<i>Cubic Yards.</i>		
Excavation,	In road earth.....			
	Outside road earth.....			
	Rock			
Extra embankment, in place.....				
Foreign material for sub-grade, in place.....				
			
Concrete for foundation.....				
			
Gravel for foundation.....				
			
" " surface				
			
		<i>Square Yards.</i>		
*Foundation, Type				
			
			
			
*Road Surface, Type				
			
		<i>Cubic Yards.</i>		
Paved Gutters, Concrete	lineal ft.			
	" "			
		<i>Square Yards.</i>		
Stone Block.....	" "			
Brick	" "			
	" "			
Cobble Stone.....	" "			
	" "			
Riprap				

* When gravel or concrete is used, give quantities in cubic yards.

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<i>Items.</i>	<i>Description.</i>	Inches. <i>Quantities.</i>	<i>Lineal Feet.</i>	<i>Unit Price.</i>	<i>Total Cost.</i>
Underdrains,	Tile				
	Stone	"			
	French	"			
Culverts,	Vitrified pipe.....	"			
	"			
	"			
	"			
	Cast Iron pipe.....	"			
	"			
	"			
	Concrete	"	<i>Cubic Yards.</i>		
				
				
	Grubbing		<i>Acres.</i>		
				
				
Materials for Maintenance.....			<i>Tons.</i>		
	Broken Stone, 1½"				
	" " ¾"				
	" " Screenings				
	Gravel or Binder.....				
	Bituminous ".....				
Estimated contract price..... \$					
Engineering					
Supervision					
Total estimated cost.....					

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These quantities are the result of careful calculation, but are to be considered as approximate. The contractor is expected to satisfy himself as to the nature, character and quantity of material and labor required by a personal examination of the work contemplated. The governing body reserves the right to increase or decrease any of the items in the above estimate of quantities, subject, however, to the provisions of Article 4. Such increases or decreases will be allowed for at the unit price bid.

The above-named items will be the only ones on which the price of the work will be figured.

The lump sum bid, based on the above estimates, will be the amount of the contract. If for any reason any extra work will be required to be done in excess of the amount estimated, the same must be done in the manner prescribed in Articles 4, 20, 28 and 29 or the State will not pay any part of the cost thereof.

73. INVITATION TO BID.

Bidders are requested to bid on any or all of the following combinations, using the blank hereto attached for that purpose. The broken stone when used will be trap rock; an alternative bid may be made on approved native rock.

Foundation Type.

Road Surface Type.

- | | |
|--------------|-----------|
| 1. Type..... | Type..... |
| 2. Type..... | Type..... |
| 3. Type..... | Type..... |
| 4. Type..... | Type..... |
| 5. Type..... | Type..... |

Engineer.

Approved.....19.....

The.....

County.

Recommended for approval.....19.....

State Highway Engineer.

Approved.....19.....

State Commissioner of Public Roads.

PROPOSAL.

To the.....

County of.....and State of New Jersey:

GENTLEMEN—The undersigned hereby declare..... that..... he.....

ha..... carefully examined the annexed specifications, the drawings therein referred to, and the site of the work, and will provide all necessary machinery, tools, apparatus and other means of construction, and do all the work and furnish all the material called for by said specifications in the manner prescribed therein and in accordance with the requirements of the engineer and inspector under them, and that samples as required in Article 35 of broken stone, binder, sand, sand-gravel, slag, brick, bituminous cement and bituminous

pavement marked

have been submitted
— adopted and

that offer to do the work at the following prices:

NOTE.—For list of approved samples on file see Article 49. For materials not filed or previously approved, samples must be submitted.

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<i>Work and Materials.</i>		<i>Quantity.</i>	<i>Unit Price.</i>		<i>Total Price.</i>
		<i>Cubic Yards.</i>			
Excavation,	in road.....		\$.....		\$.....
	outside road.....				
	rock				
Extra embankment,	in place.....				
	Foreign material for sub-grade, in place.....				
	Concrete for Foundation				
	Gravel for Foundation				
	Gravel for Surface				
	<i>Type.</i>	<i>Square Yards.</i>			
*Foundation.					
*Surface,					

* When gravel or concrete is used, give quantities in cubic yards.

Work and Materials.		Quantity.	Unit Price.	Total Price.
Paved Gutters,	Concrete	<i>Cubic Yards.</i>		
	Stone block	<i>Square Yards.</i>		
	Brick			
	Cobblestone			
	Riprap			
Underdrains,	Inches. Tile	<i>Lineal Feet.</i>		
	" "			
	Stone			
	French			
Culverts,	Vitrified " pipe			
	" "			
	Cast Iron " pipe			
	" "			
Grubbing,	" "	<i>Cu. yds.</i>		
	Concrete			
	.....	<i>Acres.</i>		
			
Materials for Main- tenance.	Broken Stone 1½	<i>Tons.</i>		
	Broken Stone ¾			
	Broken Stone Screenings			
	Gravel or Binder			
	Bituminous Binder			
			

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Lump sum prices for all work and material necessary for the complete and finished road, including maintenance for one year from date of acceptance:

Materials for Foundation	{	Trap Rock.....
	
	
		NOTE.—Name all materials to be used in constructing foundation.

Materials for Road Surface	{	Trap Rock.....
	
	
		NOTE.—Name all materials to be used in constructing surface.

Foundation.	Road Surface Type.	Lump Sum Bid.
Type	{	\$.....
	
	
	
Type	{
	
	
	
Type	{
	
	
	

Accompanying this proposal is a certified check for the sum of one thousand (\$1,000) dollars, payable to the order of your financial officer, which check is to be forfeited as liquidated damages if, in case this proposal is accepted, the undersigned shall fail to execute a contract with your honorable body, under the conditions of this proposal, within the time provided for by the foregoing advertisement for proposals, otherwise said check is to be returned to the undersigned.

Signed :

Address

NOTE.—Opposite items where no quantities are specified, the contractor will name price per unit of measure for each class of work called for, but will not include same in his total column.

Certificate for Rights of Way.

I hereby certify that, as to the road described in the foregoing specifications and shown in the drawings therein named, I hold for the benefit of

..... all the
 necessary conveyances, grants, etc., for all lands needed for said road, and
 releases of damages by reason of the construction of said road, excepting as
 to the lands of.....

.....

 and that as to these lands, the said
 has by resolution, ordered its solicitor to proceed at once, on the approval
 by the State Commissioner of Public Roads, of the contract herewith, to
 condemn all such rights in said lands as are needed for the said construction.

Certificate as to Samples.

We hereby certify that all samples, proportions and grading of aggregates required by the foregoing specifications, and the contract herewith, have been duly filed or adopted and accepted as satisfactory.

.....
Engineer.

.....
State Chemist.

.....
Highway Engineer.

CONTRACT.

This agreement, made the day of
in the year of our Lord one thousand nine hundred
between THE
....., party of the first part, and

party of the second part,

Witnesseth, That the said party of the second part, for and in consideration of the payments hereinafter specified and agreed to be made by the party of the first part, hereby covenants and agrees to furnish and deliver all the materials, to do and perform all the work and labor required to be furnished and delivered, done and performed in and about the improving of

beginning at

and extending to

in the township of a distance of

in strict and entire conformity with the plans on file in the engineer's office and with the specifications hereto annexed and duly approved by resolution of

..... adopted the day of
 in the year of our Lord one thousand
 nine hundred and approved by the State Commissioner
 of Public Roads on the day of

in the year of our Lord one thousand nine hundred
 which said plans and specifications are hereby made part of this agreement
 as fully and with the same effect as if the same had been set forth at length
 in the body of this agreement.

The party of the second part will make payment of all proper charges
 for labor and materials required in the aforementioned work, and indemnify
 and save harmless the party of the first part, its officers, agents and servants,
 and each and every of them, against and from all suits and costs of every
 name and description, including royalty fees or claims for the use of patented
 materials or pavements, and from all damages to which the said party of the
 first part or any of its officers, agents or servants may be put, by reason of
 injury to the person or property of others resulting from carelessness in the
 performance of said work, or through the negligence of said party of the second
 part, or through any improper or defective machinery, implements or appli-
 ances used by the said party of the second part in the aforesaid work, or
 through any act or omission on the part of the said party of the second part,
 or his agent or agents.

In consideration of the premises the party of the first part hereby agrees
 to pay to the party of the second part for said work, when completed in
 accordance with the said specifications, the sum of

payments to be made as provided in said specifications upon presentation of
 the proper certificates of the engineer and inspector and upon the terms set
 forth in the annexed specifications.

This contract to be binding upon

....., the party of the first part, its successors or assigns, and upon

the party of the second part

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In Witness Whereof,

....., has caused this instrument to be signed
by its, attested by its clerk and its corporate seal to be
hereunto affixed, pursuant to a resolution of said passed
for that purpose, and the said party of the second part ha.....

set..... hand..... and seal..... the day and year first above written.

[SEAL]

Attest

[SEAL]

Clerk.

Signed, sealed and delivered
in the presence of

Any changes in the terms; quantities, materials or methods hereinbefore
described must have the written approval of the State Commissioner of
Public Roads.

Recommended for approval 19.....

State Highway Engineer.

This contract approved this day of, 19.....

State Commissioner of Public Roads.

SURETY CORPORATION BOND.

KNOW ALL MEN BY THESE PRESENTS, That we.....

..... principal, and

a corporation organized and existing under the laws of the State of
and duly authorized to do business in the State of New Jersey, surety, are
held and firmly bound unto the.....

in the sum of.....

..... dollars,

lawful money of the United States of America to be paid to the said

or to its certain attorney, successors or assigns, to which payment well and
truly to be made we do hereby bind ourselves, our successors, heirs, executors,
administrators and assigns, jointly and severally, firmly by these presents.

Sealed with our seals and dated this day of,

A. D. nineteen hundred and

THE CONDITION OF THIS OBLIGATION IS SUCH, That if the above bounden

.....
shall well and truly perform his part of the contract hereto annexed, and
make payment of all proper charges for labor and materials required in the
aforementioned work, and indemnify and save harmless the party of the first
part, to the contract annexed, its officers, agents and servants, and each and
every of them, against and from all suits and costs of every name and de-
scription, including royalty fees or claims for the use of patented materials
or pavements, and from all damages to which the said party of the first part,
to the contract annexed, or any of its officers, agents or servants may be put,
by reason of injury to the person or property of others resulting from care-
lessness in the performance of said work, or through the negligence of said
party of the second part, or through any improper or defective machinery,
implements or appliances used by the said party of the second part in the
aforesaid work, or through any act or omission on the part of the said party
of the second part, or his agent or agents, and all the covenants and condi-

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tions of said contract perform, as the said contract, covenant and conditions may have been changed or modified as therein provided, then this obligation to be void, otherwise to remain in full force and virtue.

.....
.....
.....
.....
.....

SIGNED, SEALED AND DELIVERED
IN THE PRESENCE OF

.....

BE IT REMEMBERED, on this day of
..... in the year of our Lord one thousand nine
hundred and before me, a Master in Chancery of
the State of New Jersey, personally appeared

.....
.....
.....

who acknowledged that they signed, sealed and delivered the foregoing bond as their voluntary act and deed for the uses and purposes therein expressed.

PERSONAL BOND.

KNOW ALL MEN BY THESE PRESENTS, That we, _____

_____ and _____ of the County

of _____ and State of New Jersey, are

held and firmly bound unto _____

_____, in the sum of _____

_____ dollars, lawful money of the United States,

to be paid to the _____

its successors or assigns, to which payment well and truly to be made, we bind ourselves, our heirs, executors and administrators, jointly and severally, firmly by these presents.

Sealed with our seals and dated this _____ day of

_____ A. D. nineteen hundred and _____

THE CONDITION OF THIS OBLIGATION IS SUCH, That if the above bounden

_____ shall well and truly perform his part of the contract hereto annexed, and make payment of all proper charges for labor and materials required in the aforementioned work, and indemnify and save harmless the party of the first part, to the contract hereto annexed, its officers, agents and servants, and each and every of them, against and from all suits and costs of every name and description, including royalty fees or claims for the use of patented materials or pavements, and from all damages to which the said party of the first part or any of its officers, agents or servants may be put, by reason of injury to the person or property of others resulting from carelessness in the performance of said work, or through the negligence of said party of the second part, or through any improper or defective machinery, implements or appliances used by the said party of the second part in the aforesaid work, or through any act or omission on the part of the said party of the second part, or his agent or agents, and all the covenants and conditions of said contract

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perform, as the said contract, covenant and conditions may have been changed or modified as therein provided, then this obligation to be void, otherwise to remain in full force and virtue.

SIGNED, SEALED AND DELIVERED
IN THE PRESENCE OF

BE IT REMEMBERED, on this day of
..... in the year of our Lord one thousand nine
hundred and before me, a Master in Chancery of
the State of New Jersey, personally appeared

who acknowledged that they signed, sealed and delivered the foregoing bond as their voluntary act and deed for the uses and purposes therein expressed.

This Bond approved this day of A. D. 19

....., *Director.*

*Finance
Committee.*

Approved this day of 19

.....
State Commissioner of Public Roads.

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NINETEENTH ANNUAL REPORT.

JUSTIFICATION OF SURETY.

STATE OF NEW JERSEY,

COUNTY OF.....

} ss.

On this day of A. D. 19.....

before me, a Notary Public in and for the County and State aforesaid, personally appeared

who, being duly sworn, on his oath declares that he is a resident of the County of in the State of New Jersey; that he is a freeholder in said County, and that he owns real estate in said County, in his own right, to the amount of

over and above all his indebtedness and after all his debts are paid, and over any contingent liability by reason of being bail, surety, endorser or guarantor.

Subscribed and sworn to before me, this day of

..... A. D. 19..... I hereby certify that the contents of

the above have been carefully made known to affiant before execution.

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STATE OF NEW JERSEY,

COUNTY OF.....

} ss.

On this day of A. D. 19.....
before me, a Notary Public in and for the County and State aforesaid, personally appeared

who, being duly sworn, on his oath declares that he is a resident of the County of in the State of New Jersey; that he is a freeholder in said County, and that he owns real estate in said County, in his own right, to the amount of

over and above all his indebtedness and after all his debts are paid, and over any contingent liability by reason of being bail, surety, endorser or guarantor.

Subscribed and sworn to before me, this day of A. D. 19..... I hereby certify that the contents of the above have been carefully made known to affiant before execution.

This Bond approved this day of A. D. 19....., *Director.*

Finance
Committee.

Approved this day of 19.....

State Commissioner of Public Roads.

Appendix B.

PUBLIC ROAD LAWS.

CHAPTER 395.

AN ACT to provide for the permanent improvement and maintenance of public roads in this State (Revision of 1912).

BE IT ENACTED by the Senate and General Assembly of the State of New Jersey:

1. The board of chosen freeholders of any county in this State may, at any time, by resolution, direct that any public road or section of road except a city street located within said county, being at least thirty-three feet in width, and at least one mile in length, or, being less than one mile in length, is an extension of or connection with some permanently improved or paved road or street, be improved by the construction of a macadamized road, or a telford or other stone road, or a road constructed of gravel, oyster shells or other similar materials, with or without plastic binder, in such manner that the same, of whatever materials constructed, shall, with reasonable repairs thereto, at all seasons of the year, be firm, smooth and convenient for travel. When more roads are applied for than can be constructed in any one year, the board of chosen freeholders and State Commissioner of Public Roads shall have power and authority to select from the roads petitioned for the ones first to be constructed, having first regard to the most important roads and the distribution of the benefits of this act to all parts of the county. The board of chosen freeholders may, before approval of any road, require as a condition of said approval that the township or townships or other municipalities through which said road runs shall pay ten per centum of the cost of said improvement, said payment to be applied to the county's share of the cost of the improvement of said roads constructed under this act.

Improvement
of roads.

Materials used.

Roads design-
ated.

Part payment
by townships.

2. The said board, after passage of the resolution, shall cause a survey of said road so to be improved to be made, and plans, cross-sections and specifications of the work to be done on the same to be prepared. The survey shall indicate the width and length of said road, and shall also show how much of said road may be improved by deviation from the then existing lines, but no survey shall be commenced until the written consent of the State Commissioner of Public Roads shall have been first obtained. When the said plans, cross-sections and specifications shall have been prepared, they shall be submitted to the board of chosen freeholders for its approval or rejection. If such board shall approve the same, they shall then be submitted to the State Commissioner of Public Roads for his approval or rejection, whose duty it shall be, before approving of said plans, cross-sections and specifications, to ascertain, by personal inspection or otherwise, the natural character of the soil upon which such road is proposed to be constructed, and any and all other facts that he may deem important. If, after examination of the plans, cross-sections and specifications he ap-

Surveys and
plans.

Approval by
freeholders.

Examination
and approval
by commission-
er of roads.

Maximum expenditure yearly.	proves their scope and detail, and by an inspection of the road, as aforesaid, he shall be satisfied as to the advisability of the improvement of the road as contemplated, and that the State's share of the cost of the construction of said road, together with its share of the cost of the construction of all other roads or sections of roads in this State, under plans and specifications previously approved by him, will not in any one year exceed the sum of five hundred thousand dollars, or such sum as shall in each year be appropriated for that purpose, then he shall approve in writing thereon said plans, cross-sections and specifications, otherwise he shall reject the same.
Bids invited.	3. Within thirty days after approval of the plans, cross-sections and specifications by the State Commissioner of Public Roads, it shall be the duty of the board of chosen freeholders to advertise for bids for said work in two of the public papers printed in said county, and they may also advertise in one engineering journal published in the city of New York, for three weeks successively, at least once in each week. The first publication of which advertisement shall be at least seventeen days before the date fixed therein for the receipt of bids. This advertisement shall state the place where bidders may examine said plans, cross-sections and specifications, and the time and place where bids for said work will be received by the board of chosen freeholders, or a committee of said board. Each bidder must accompany his bid with a certified check, payable to the county collector, for one thousand dollars, as a guarantee that if said work be awarded to him he will enter into a contract with the said board for the same. This contract must be executed, together with a bond of the successful bidder, in the penal sum of at least the estimated cost of said work, with two or more sureties, freeholders of the county, or a surety or trust company created by this State, or a surety or trust company of another state, authorized to transact business within this State, to be approved by the director of the board of chosen freeholders and the finance committee thereof, conditioned for the faithful performance of said work in strict conformity with the plans, cross-sections and specifications for the same, within thirty days from the awarding of the contract. The contract and bond, before any work is done thereunder, must be exhibited to the State Commissioner of Public Roads for his approval, in writing, thereon, and said commissioner is hereby authorized, whenever, in his judgment, the best interests of the county require him so to do, to reject the same, in which case he shall write upon said contract the word "rejected," and append thereto his signature and official title of office, and said contract and the bond required to accompany the same shall, from the time of such rejection, be absolutely null and void, but such rejection shall in no wise operate to prevent said board from readvertising for bids and proceeding thenceforth under the provisions of this act; <i>provided</i> , such action is taken within four months after such rejection, otherwise said approval shall be null and void. The time and manner of payment for work done under any contract awarded under this act shall be set forth in said contract, but at least five per centum of the contract price shall not be paid to the contractor until after the expiration of one year from the completion of the work and acceptance thereof in writing by the Commissioner of Public Roads.
Guarantee of bidder.	
Contract.	
Approval of contract and bond.	
Proviso.	4. The road improvement contemplated under this act shall include the construction of the road and its intersections with other public roads, the restoration or construction, as herein provided, of proper and adequate entrances to properties, the building of any essential walls in cuts or for slopes, and of all necessary facilities
Five per cent. withheld for a year.	
What included in road improvement.	

for drainage in improvement aforesaid, also the planting of shade trees, such works as may be necessary to preserve existing shade trees and such treatment of adjacent forest lands as may be needed to make the road and its borders an effective fire break.

When the State Commissioner of Public Roads shall deem an existing bridge or culvert in a road to be improved as unsafe, unsuited or inadequate to the need of the road or traffic which it serves, or of such design or character as requires too frequent repairs, or the cost of a structure yet unbuild as too great for the public body charged with such construction, he may make written agreement therewith to bear a part of the cost of such new structure under conditions and for a design approved by him, but in no case in excess of twenty per centum of such cost. Such bridge and culvert building may be included in the road contract, or separately contracted for and advertised in the engineering journal as hereinbefore specified. Every such separate contract must be approved by the commissioner. All advertisements shall be made as required by this act and bids received shall give separately the price of each bridge or culvert when the same are included in the road contract.

For the purpose of estimating the State's share of the cost of the work under this act, said cost shall include that of supervision and engineering.

The board of chosen freeholders may, after the execution and approval by the State Commissioner of Public Roads of a contract or contracts for improvement under this act, make without public advertisement, supplemental contracts for additional work found to be necessary as a part of such improvement; *provided* such contracts shall not cover any additional mileage or length of road, nor alter the general character of the improvement; *and provided further*, that before any such contracts shall become binding, and before any work shall be done thereunder, they shall be submitted to and approved by the State Commissioner of Public Roads in the same manner as hereinbefore provided in the case of contracts let after public advertisement.

The State's share of or contribution to the cost of any improvement under this act shall be forty per centum of the total estimated cost thereof, except when otherwise provided in this act or when the same is left to the discretion of the State Commissioner of Public Roads.

5. A true copy of the specifications, bid, contract, bond, justification of surety and summary of all bids received (including any rejected and the cause therefor), certified to be such by the director of the board of chosen freeholders, shall, immediately after the awarding of any contract, be furnished by the board of chosen freeholders to the State Commissioner of Public Roads, to be filed and remain of record in the office of such commissioner.

6. The State Commissioner of Public Roads is empowered to employ as need arises, a staff of qualified road inspectors, certified as such by the Civil Service Commission, at salaries not exceeding nine hundred dollars per year, and such proper itemized and reported expenses (not in excess of one hundred and fifty dollars per year) as the said commissioner may allow. Such staff shall not exceed ten in number, shall be decreased for reduction of force whenever possible, and may be removed for cause, or assigned to any work appertaining to roads which the commissioner may elect.

When needed by numbers of contracts under way, additional like qualified road inspectors may be employed at three dollars per each day of actual service, that each contract may have at least one inspector, or two when the character and extent of the work demands the same. All inspectors shall be paid from the State's

As to bridges.

Costs included in State's share.

Supplemental contracts incident to work.

Proviso.

Proviso.

State's share of cost.

Copy of all papers filed with road commissioner.

Road inspectors.

Salaries and expenses.

Number of inspectors.

Additional inspectors.

appropriated share of the cost of the road and credit for these payments shall be allowed the State in fixing its share of such cost.

Partial payments on contract.

7. Where any contract provides for partial payments based upon the amount of work done, it shall be the duty of the inspector, in conjunction with the engineer, as each payment becomes due, to present to the board of chosen freeholders a certificate, signed by such inspector and engineer, in which certificate shall be stated, as near as can be, the amount of work done for which payment is to be made, and that the same has been done, in all respects, in strict conformity with the contracts, plans and specifications. When the work done under any contract shall have been fully completed, the inspector and engineer shall prepare a detailed and itemized statement, in quadruplicate, of the cost of the improvement, one copy whereof shall be filed with the board of chosen freeholders, one with the clerk of the county and two with the State Commissioner of Public Roads.

Final report.

Payments by State.

8. The State's share of the cost of all roads constructed under this act, not exceeding in any one year the sum of five hundred thousand dollars, shall be paid out of the State Treasury, out of any moneys not otherwise appropriated, if the same be first appropriated in the annual appropriation act. The Governor and State Commissioner of Public Roads shall certify from time to time to the State Comptroller the amount to be paid to any county, township, town, borough, village or other municipality for such year, and the State Comptroller shall draw his warrant on the State Treasurer in favor of the county collector or collector of the township, town, borough, village or municipality, as the case may be, for the amount so certified, and the State Treasurer shall thereupon pay the same.

Partial payments to municipalities.

When any contract provides for partial payments based upon the amount of work done, the intent of this act is that partial payments to any county, township or municipality shall be certified as aforesaid, provided the amount so certified is not in excess of the State's proportional share of that paid on account of the contract or contracts for work done by said county, township or municipality as provided in section seven of this act.

County's share appropriated annually.

9. On or before the time fixed by law for the closing and final adoption of the annual tax budget of the county, the board of chosen freeholders of such county shall appropriate either in the annual tax budget or separately the county's share or portion of the estimated cost and expense of all work contracted for under the provisions of this act since the day fixed by law for the closing and final adoption of the annual tax budget of the county in the year next preceding which shall be the total cost of such work less the amount certified to be paid by the State.

Amount certified to county tax board.

The sum or sums so fixed and appropriated shall be certified to the county board of taxation and shall be included in the assessment of county taxes and shall be assessed, collected and paid over to the county in the same manner and at the same time that other county taxes are assessed, collected and paid over; if a deficiency shall exist in consequence of the cost and expense exceeding the estimate, or in consequence of the receipt of a lesser sum from the State as its share of said total cost and expense than shall have been estimated or fixed, the board of chosen freeholders shall have authority to borrow, on temporary loans, such deficiency, and shall include the amount of the same with accrued interest in its next annual budget and the same shall be assessed, collected and paid over as other taxes are assessed, collected and paid over, or the same may be raised by an issue of bonds either separately or in conjunction with an issue to meet and pay the cost and expense of

In case of deficiency.

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improving any other road under this act, and in the same manner as herein provided for issuing bonds of the county.

If, for any reason, there be a surplus, the same shall be retained and used in the improvement of other roads under this act or in repairs to roads improved under this act.

If surplus.

10. The board of chosen freeholders may, instead of certifying to the county board of taxation the county's share of the cost of any work done under this act, as required by the ninth section of this act, by resolution, adopted by a vote of at least two-thirds of all its members, issue bonds of the county for its proper share of the cost of said work which shall be an amount not exceeding the total cost of such work, less the amount certified to be paid by the State.

Bonds may be issued instead.

11. From and after the date of the approval by the State Commissioner of Public Roads of any contract under this act for the improvement of any road, such road shall forever thereafter be a county road. Any road improved under the provisions of any previous act entitled "An act to provide for the permanent improvement of public roads in this State," any road accepted by any board of chosen freeholders under chapter one hundred and fourteen of the laws of one thousand nine hundred and four, and any road acquired under chapter one hundred and twenty-one, laws of one thousand nine hundred and ten, shall forever thereafter be a county road, and the duty of keeping the same in repair shall devolve exclusively upon the board of chosen freeholders and the county supervisor, as hereinafter mentioned, and all other powers and duties respecting such roads shall be imposed upon and vested in the said board of chosen freeholders, to the exclusion of all township, town, borough, village or other municipal officers. No power conferred on any of said governing bodies shall in any way divest the board of chosen freeholders of their right to construct across or under the sidewalks the necessary culverts or other provisions for the maintenance of such county roads. If any such road shall become out of repair, and shall not be repaired within sixty days after notice in writing so to do, given by the State Commissioner of Public Roads to the board of chosen freeholders, or to its director, the said Commissioner of Public Roads shall certify to such neglect or refusal to the State Comptroller, who shall withhold payment to such county of any moneys already apportioned, or that may thereafter be apportioned, to such county by the State, and no payment shall be made to said county until the State Commissioner of Public Roads shall certify to the State Comptroller that said road has been placed in a good state of repair.

Roads chargeable to counties.

Sidewalks and drains.

Proper maintenance.

12. After the first county road shall have been constructed under this act in any county, it shall be the duty of the board of chosen freeholders to appoint some suitable person as county supervisor of roads, and a qualified civil engineer as county engineer, and each of whom, before assuming the duties of his office, shall make and subscribe an oath or affirmation that he will faithfully perform all the duties of his office to the best of his ability and understanding. Such supervisor and engineer shall hold office for five years and until his successor is appointed and qualified. Each shall give bond to the board of chosen freeholders in the penal sum of one thousand dollars, conditioned for the faithful performance of the duties of his office, with such surety or sureties as the board shall approve. The said engineer shall receive such compensation for his services as the said board shall determine and said supervisor shall receive a salary and allowance for expenses, both fixed by said board, but said compensation or salary is not to be reduced during the said engineer's or supervisor's term of office.

County engineer and supervisor.

Oath.

Term.
Bond.

Compensation.

The said engineer or supervisor may be dismissed at any time by the governing body after a proper hearing upon proof sustaining to

Subject to dismissal.

Proviso.

New engineer
or supervisor.

Money for
road main-
tenance.

Repairs. etc.

Payment for
land acquired
for roads.

If necessary
may borrow.

Land acquired
by consent or
condemnation.

Highway may
be vacated.

Improvement
by individual
property
holder.

Such road
if accepted,
deemed county
road.

Change of
location.

the satisfaction of said body charges preferred by the said body or the State Commissioner of Public Roads for incompetency, neglect, disability or other cause; *provided, however*, that the said engineer or supervisor shall have the right to appeal to the State Highway Commission for hearing, review and final adjudication, from any order of dismissal, within fifteen days of the adoption thereof. In the event of such dismissal the said board shall immediately appoint a new engineer or supervisor to hold for the full term of five years from date of appointment. The said board of chosen freeholders shall appropriate all moneys necessary to keep any and all roads constructed under this act in good repair and free from obstructions, and if the board shall have no money which may be lawfully used for such purposes, it shall have the power to borrow the same on the credit of the county, until the next annual taxes shall have been levied and collected. The cost of all repairs and removal of obstructions shall be paid by the county collector, upon the order of the board of chosen freeholders, and all bills for repairs and removal of obstructions shall be verified by affidavit, and shall be certified to be correct by the county supervisor of roads.

13. Whenever it is deemed necessary and advisable by the board of chosen freeholders of any county to acquire lands for the purpose of laying out, widening, changing the location of or straightening any road improved or to be improved under this act all cost and expense of obtaining and acquiring such land by whatsoever method the same may be acquired may be paid out of any moneys applicable for road improvement purposes, or, if there be no money on hand for such purpose, said board may borrow the necessary sum or sums on temporary loans, upon the credit of the county, until the next annual taxes shall be levied and collected or such sum as may be necessary may be raised by an issue of bonds, either separately or in connection with and as part of any other bond issue under the provisions of this act. The said board of chosen freeholders is hereby authorized to agree with the owner or owners of any lands required for the foregoing purposes, as to the compensation to be paid by said board for a conveyance of said land or lands, and in case said board cannot agree with the owner or owners of any land for the acquisition of the same for the foregoing purposes said board shall have the power to acquire said lands by condemnation, in the manner prescribed by law, and the said board is also authorized to vacate any part of any public highway that may be rendered unnecessary for public travel by the widening, straightening, altering or changing of location thereof.

14. If all the owners of property abutting on any road or highway, in any county, which has not been improved, or is not undergoing improvement, desire said road, or any section thereof, to be improved, and shall certify, in writing, to the board of chosen freeholders, that they are willing to bear the entire expense of such improvement, the county engineer, or other competent engineer, shall prepare plans, cross-sections and specifications for the work to be done on such road, or any section thereof, so to be improved, and shall submit the same to the owners, and if satisfactory to such owners, they are hereby authorized to enter into contract for such work, said contract to be first submitted to the board of chosen freeholders for its approval. Upon the completion of the work to the satisfaction of the county supervisor and the board of freeholders, and upon the submission to said board of proper receipts showing full payment for all work done, the said board of chosen freeholders may, by resolution, declare that said road, or any portion thereof, be thereafter a county road. The location of any portion of said road may be changed, if deemed desirable, upon acquiring the con-

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sent, in writing, of the owner or owners of land abutting on such portion of road so to be changed, and upon acquiring, without expense to the county, the land necessary for such change. The county supervisor shall be paid the sum of twenty-five dollars for supervising said work, to be paid by said owners.

Supervisor's
fee.

15. The board of chosen freeholders shall have full power to lay out, open, construct and improve, when such contemplated work is shown on the approved plans and cross-sections, all necessary approaches to any properties along the line of such road which may have been destroyed or damaged by any alteration in the existing grade, whether within or without the line of such road, and all costs and expenses incurred therefor shall be paid by the said board of chosen freeholders in the same way and manner as other work done under this act is paid for.

Approaches
to properties.

16. Whenever any public road is sought to be improved under the provisions of the fourteenth section of this act, upon which road any lands or real estate owned by the State of New Jersey may front or border, the board of managers, or other body having the control and management of said lands and real estate, are hereby authorized to consent to the improvement of said road and to enter into contract for the same in the manner directed by said section, and to pay for said improvement out of any moneys appropriated to said board of managers or other governing body.

Road improve-
ment along
State prop-
erty.

17. Whenever it shall be deemed necessary by the State Commission of Public Roads to close a road or section thereof which is being constructed, improved or repaired under this act, in order to permit a proper completion of such work, he shall execute a certificate and file the same with the clerk of the board of chosen freeholders of the county in which such road is situated. Such certificate shall state the necessity for closing such road and describe the portion thereof to be closed; not more than one mile of any road shall be closed at any one time. The board of chosen freeholders shall thereupon close the same to public travel by erecting suitable obstruction and posting conspicuous notice to the effect that the road is closed.

Right to
close road
temporarily.

18. It shall be lawful for the boards of chosen freeholders of two or more counties to agree, by resolution passed separately in each board, to improve, under the provisions of this act, a road, in whole or in part, which is on the dividing line or runs into or through such counties.

Joint improve-
ment by
counties.

In such case they shall make all necessary surveys and prepare proper plans, cross-sections and specifications, which, on approval by resolution passed separately by each board, shall be certified to the State Commissioner of Public Roads for action thereon. If approved by said commissioner, each board is authorized to appoint members thereof to serve as a joint committee to advertise for and receive bids, as specified in this act, for said improvement. The bids shall be opened and read in public meeting and thereafter the members of the joint committee shall report the amount of the bids with recommendations to their respective boards. The contract shall be awarded, by resolution of each board voting separately, to the lowest responsible bidder, and shall be approved or rejected, as provided in this act, by the State Commissioner of Public Roads. As nearly as may be possible, all proceedings concerning the improvement under this section, shall conform to those prescribed in this act.

Plans, etc.

Joint com-
mittee.
Bids received
and contract
awarded.

The contract awarded shall specify the proportion which each county shall bear of the cost of the improvement exclusive of the State's share, and each county shall be liable for that amount alone.

Proportional
share of cost
stated.

Part received
by each
county.

Proviso.

Extent of
act; cities
excepted.

Powers and
duties of local
officials.

Provision
for funds.

Control of
roads so built.

Road in city.

Proviso.

Agreement
binding.

Bonds may
be issued.

Of the share of the cost of the improvement paid by the State, each county shall receive such proportionate part as it bears of the cost of the improvement to the counties and in the manner as specified for payment to a county for road improvement within its own territory; *provided, however*, that if, in the judgment of any of the boards, parties to said agreement, the burden of the cost of improvement aforesaid is too great to incorporate in the annual tax levy for any one year in that county, then such board, by a resolution adopted by a vote of at least two-thirds of its members, may raise the sum necessary for the payment of its share of the cost by an issue and sale of bonds.

19. The provisions of this act shall extend to townships, towns, boroughs, villages, or any municipality or municipalities except cities, and no road shall be built within any city under this act. The common council or other governing body, the assessor or assessors, the mayor or other chief executive officer, the clerk and collector, or other financial officer, respectively, of any township, town, borough, village, or other municipality, shall have the power and shall perform all the duties as are in this act cast upon the board of chosen freeholders, the county board of taxation, the director of the board of chosen freeholders, the county clerk and county collector, respectively. Any of said municipalities may raise, by taxation, funds with which to pay for the cost of the construction of any road or roads, or may issue bonds for the payment of the same, in the same manner, as nearly as may be, as the board of chosen freeholders may do under this act, it being the expressed intention of this section to confer upon townships, towns, boroughs, villages or other municipalities, full power to improve any road, or section of road, under the provisions of this act, all proceedings conforming, as nearly as may be practicable, to the provisions of this act. Any such road, or section of road, so constructed by any township, town, borough, village, or other municipality, other than by the county, shall be exclusively under the jurisdiction and control of such township, town, borough, village, or other municipality, and shall be repaired and maintained by such municipality.

20. Whenever any road, or section of road, constructed by the board of chosen freeholders, shall lie within the corporate limits of any city, said road shall be exclusively under the jurisdiction and control of such city, and shall be repaired and maintained by the same; *provided, however*, that this provision shall not extend to roads now maintained under the act entitled "A supplement to an act entitled 'An act to authorize the board of chosen freeholders of any of the several counties in this State to lay out, open, construct, improve and maintain a public road therein,'" approved April seventh, one thousand eight hundred and eighty-eight, approved March twenty-fourth, one thousand eight hundred and ninety-eight.

21. A resolution passed by the township committee of any township, or the governing body of any other municipality, through which said road runs, to pay ten per centum of the cost of said improvement provided for in the first section of this act, shall be binding upon such township, or such other municipality, as the case may be.

22. Whenever any township or other municipality shall have undertaken to pay ten per centum of the cost of any improvement under the provisions of this act, either by resolution of the township committee or other governing body, or otherwise; and if in the opinion of any such township committee or other governing body, to be determined by resolution of such township committee or other governing body, it would be too burdensome on the taxpayers of such township or other municipality to place in the tax

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levy for any fiscal year the portion of the expense of said improvement to be borne by it, then it shall be lawful for such township committee or other governing body to issue a bond or bonds for the amount undertaken to be paid as aforesaid by such township or other municipality.

23. Whenever any public road has been or shall hereafter be improved under the provisions of this act and in the course of improving such road the grade of the roadbed shall have been or shall be changed so that it shall not conform to the grade of the remaining portion of the road, including the sidewalks, it shall be lawful for the municipal authorities of each municipality through which such road passes to cause the remaining portion of such road within the limits of their several municipalities to be graded and formed so as to conform in grade to that established for the roadway constructed under the provisions of this act and to cause such work to be done under the same proceedings and in the same manner as may be provided by law in their several municipalities for the grading of the streets of such municipalities.

Sidewalks
made to conform to grade.

The proper municipal authorities of any municipality through which any such road may run shall have full power and authority to make any municipal improvement upon or within any such road within the limits of their several municipalities which may be authorized by law to be made in any of the other public streets or roads of such municipalities; *provided, however*, no such improvement shall be made by such municipal authorities which may in any way interfere with or impair the roadway improved under the provisions of this act without the approval and consent of the board of chosen freeholders of the county within which such road may be located.

Municipal
improvements.

Proviso.

The cost and expense of any of the public improvements authorized by this section shall, so far as the same can be, be assessed upon the lands and real estate specially benefited by the improvement in proportion to the benefit received; and no lot or parcel of land shall be assessed more than it is so specially benefited, and such assessment shall be made in the same manner and under the same procedure as is directed by law for the making of other assessments for street improvements within every such municipality.

Property assessed for
benefits.

Nothing in this act contained shall be construed in any way to impose upon any such municipality therein referred to any part of the cost of the maintenance and repair of the roadway of any road improved under the provisions of this act.

Act, how construed.

24. Whenever the owners of fifty-one per centum of the frontage of property abutting any road proposed to be improved under this act by any board of chosen freeholders shall petition the governing body in which their lands and the said road or section of road shall lie, praying that said road or section of road be improved and paved for its entire width, from gutter to gutter, and agreeing to pay the entire added cost due to said increased width of improvement and pavement, it shall be lawful for said governing body, by and with the consent of the State Commissioner of Public Roads, to enter into a contract with the said board of chosen freeholders to pay such additional cost, which contract shall fix and prescribe the times and manner of payment by said municipality to said board of chosen freeholders of such added cost.

Petition to
pave improved
road

Agreement to
pay cost.

Such cost and expense so contracted to be paid by the municipality shall be assessed and collected by said municipality upon and from the lands abutting upon said road or section of road so improved in the same manner as other assessments for benefits for improvements are authorized to be assessed and collected in such municipality.

Assessment
and collection.

If municipality
undertakes
improvement.

If the improvement contemplated is being undertaken by municipal instead of county authority such extended improvement shall be authorized by the petition herein provided for, the consent of the municipal authorities of such municipality and the consent of the State Commissioner of Public Roads and the said additional cost shall be assessed and collected as herein provided.

Name of
bonds.

25. All bonds authorized to be issued by this act by the board of chosen freeholders, or any municipality, shall be known as "Road Improvement Bonds."

Rate.

Such bonds shall be of such denomination, bear such rate of interest, not exceeding five per centum (5%) per annum, and be payable at such places and such times, not exceeding thirty years from their date (except bonds issued to provide funds for extraordinary repairs or reconstruction which shall be payable in not exceeding five years from their date) and be in such form as the board of chosen freeholders or governing body of any municipality issuing such bonds shall by resolution determine.

Time.

Details of
bond issue

Said bonds shall be signed by the director and clerk of the board of chosen freeholders of the county, sealed with the seal of such board and countersigned by the county collector of the county, and in the case of a municipality other than a county shall be signed by the mayor, or chief executive officer, or the chairman or presiding officer of the governing body thereof, and by the clerk thereof, and sealed with the seal of said municipality, and countersigned by the chief financial officer thereof. The said bonds may be either coupon or registered, or coupon bonds with the privilege of registration as to principal only, and of conversion into bonds registered as to both principal and interest, and the faith and credit of the county or municipality issuing them, shall be pledged for their payment. Such bonds shall recite that they are issued pursuant to the authority of this act and of the resolution authorizing the issuance thereof, which shall be conclusive evidence of their validity, and of the regularity of their issuance.

Provision
for interest
and maturity.

There shall be raised by taxation annually after the issuance of any such bonds a sum sufficient to meet and pay the interest thereon, as the same accrues, and a sum to be paid into a sinking fund which will, together with the accumulations thereof, provide a fund sufficient to meet and pay the principal of said bonds at maturity; *provided, however*, that if such bonds be so issued that they are payable in annual installments substantially equal in amount, the first of which installments shall be payable in two years from the date of such bonds and the last installment to be payable within thirty years from such date, the board or body authorizing such bonds, in lieu of providing for a sinking fund to meet the principal of said bonds shall cause to be raised by taxation in each year in which an installment of principal shall be payable an amount sufficient to meet the said installment, in addition to the annual tax during the life of the bonds to provide for the payment of the interest accruing thereon.

Proviso.

Use of funds
received from
registration of
motor vehicles.

26. In order to enable the Commissioner of Public Roads to execute the provisions of section thirty-seven of an act of the Legislature of this State entitled "An act defining motor vehicles and providing for the registration of the same and the licensing of the drivers thereof; fixing rules regulating the use and speed of motor vehicles; fixing the amount of license and registration fees; prescribing and regulating process and the service thereof and proceedings for the violation of the provisions of the act and penalties for said violations," approved April twelfth, one thousand nine hundred and six, said commissioner is hereby authorized to issue to the public body charged with the maintenance of any improved

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roads, his certificate setting forth the amount set aside by him for the repairs of such road from moneys under his control available for road repairs. On receipt of suitable certificate from the proper officer that said road has been repaired, said commissioner is authorized to approve said certificate for payment, and its amount shall then be paid as provided by section eight of this act; or, said commissioner may advertise for sealed proposals for the repair of any such road and award a contract to the lowest responsible bidder, reserving to himself, however, the right to reject any and all bids.

Payment on receipt of proper certificate.

27. Whenever any improved public road in this State is in need of extraordinary repairs or reconstruction, the public body charged with its care shall prepare specifications and any plans and cross-sections necessary to explain and describe the repairs contemplated and forward the same to the State Commissioner of Public Roads. The said commissioner is authorized, in his discretion, to approve of such specifications, plans and cross-sections, and to certify what amount of State moneys he will set aside for the repair of such roads. On his approval and issue of certificate as this act provides said public body shall advertise for bids, and otherwise proceed as this act directs.

Unusual repairs or reconstruction.

If such public body shall not have sufficient funds wherewith to pay its share of the cost of such repairs, then it shall be lawful for said public body to issue bonds in a sum not exceeding the sum to be advanced by the State Road Commissioner for and towards such repairs as stated in his certificate, to defray and pay its share of the cost.

Bonds may be issued.

28. It shall be lawful for boards of chosen freeholders, or other governing body charged with the construction, maintenance and repair of roads to acquire lands for gravel pits, stone quarries, or other natural deposits of road building materials advantageously located for use in their jurisdiction and to pay for the same from funds available for the construction, maintenance and repair of roads.

Authorities may acquire quarries, gravel pits, etc.

29. When a road plan involving the treatment of trees or forests is to be made the State Commissioner of Public Roads shall notify the State Board of Forest Park Reservation Commissioners, which shall cause to be prepared such plans and specifications as shall be necessary for the completion of said treatment, the cost of which shall be taken as part of the cost of the road. In all that relates to the choice, planting, or care of trees, the decision of the Forest Park Reservation Commission shall be final. In all that affects the location of trees, or their influence upon the road, the decision of the State Commissioner of Public Roads shall be final. If the State Commissioner of Public Roads and a local governing body having authority in respect to roadside trees shall be unable to agree regarding the removal or treatment of any tree standing within the line of any road to be improved, according to this act, the two interests shall submit the case to the Forest Park Reservation Commission, and its decision shall be final and binding upon all parties.

As to trees; their location and treatment.

What authority to determine.

30. In case, for any reason, any section or sections of this act shall be questioned in any court and shall be held to be invalid or unconstitutional, no other section or sections or part hereof shall be affected thereby.

Constitutionality of sections.

31. All acts and parts of acts inconsistent with the provisions of this act be and the same are hereby repealed; *provided*, that this repealer shall not revive any act heretofore repealed, nor shall any proceeding for the improvement of any public road entered into before the passage of this act abate, but such proceedings shall con-

Repealer. Proviso.

tinue as prescribed in the act under which the improvement was commenced or may be proceeded with under the provisions of this act.

32. This act shall take effect immediately.

Approved April 15, 1912.

CHAPTER 396.

AN ACT to establish a State system of highways, providing for their construction, improvement, maintenance, repair, and regulation of the use thereof and for a road fund and its disbursement in lawful expenditures appertaining to roads.

BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey:*

System of roads:

1. The State Highway Commission is hereby authorized and directed to establish what shall be known as the State Highway System; a comprehensive scheme of roads, improved or unimproved, and of routes for roads unbuilt, which shall be ultimately a continuous or inter-communicating system of improved State highways throughout the State.

What scheme to include.

2. It is the intent of this act that the State Highway System shall include: such roads, highways, turnpikes or toll roads as may be later acquired, or any parts or portions thereof, as now are or will form, main-traveled roads of reasonably direct route between the county seats of the several counties of the State; existing improved highways being chief lines of travel between seaside resorts and large centers of population; important roads affording outlets at the boundaries of the State or which, in the judgment of the commission, by the character and amount of travel upon them are in repair and maintenance costs an inequitable burden upon local districts and fall properly in the State Highway System, the Ocean Highway and the Delaware River Drive.

Plans of proposed system.

3. The State Commissioner of Public Roads is hereby directed to have prepared and submit to the State Highway Commission a map or plan of the State showing a proposed State Highway System, together with necessary explanatory report upon its scope and merit. Such plan shall distinguish by suitable legend upon it between county, township or other road, whether improved or unimproved with the mileage of each, the character of its construction or improvement and the location and character (as fixed or movable, of wood, steel, concrete-arch, etc.), of its principal bridges. It shall include in the proposed system such roads as are specifically mentioned in this act by name or by location between definitely named places, together with such others as the said commissioner may direct.

Distinguishing features.

Matters to be considered in taking over road.

4. In taking over any road as a State highway, selection by the State Highway Commission shall be guided by the character and amount of travel thereon, its consequent relative importance in the system and with due regard to the mileage of roads heretofore improved in each county and to the burden of maintenance and repair costs therein which it is the intent of this act to relieve. On such basis the distribution of the benefits of this act among the several counties of the State shall be made as equitably as the funds available and circumstances will permit.

Adoption of system.

5. With such modification of the said mapped system as they may elect within the intent of this act, the State Highway Commission shall adopt the same as the State Highway System.

Within the same restrictions the commission may, from time to time, add to the system, and amend or change the same on account of difficulty or excessive cost of construction or maintenance or for other adequate unforeseen contingency; *provided, however*, that the aggregate mileage of the system shall not exceed fifteen hundred (1,500) miles.

Altering system.

Proviso.

6. When in their discretion circumstances will permit, the State Highway Commission shall have the State Commissioner of Public Roads take over from the governing body having jurisdiction thereof, and with its assent, any highway, or portion thereof, improved or unimproved, which is included in the Highway System. When so taken over it shall become and be known as a State Highway, and its further improvement, maintenance and repair shall be at the expense of the State and under the jurisdiction of the State Department of Public Roads; *provided, however*, that whenever the governing body or other jurisdiction from which said road is taken over, has rights or benefits by virtue of an understanding, agreement or contract with any street railway company, other company, firm or corporation, to repair, maintain or construct any part of such highway, or to deliver or execute any other service or obligation with respect thereto, the said undertaking shall remain in force and all such contractual or agreement rights and benefits shall pass to and be taken over for the State by the State Department of Public Roads. All the terms, conditions and requirements of such agreements or contracts shall be fulfilled to the State by said street railway company, other company, firm or corporation, in the same manner as if they had been originally made between the State and said companies, firm or corporation.

Roads taken over by commissioner.

Proviso.

Fulfillment of obligations.

7. The State Commissioner of Public Roads shall give to the body having jurisdiction over any highway written and ample notice of intention to take over such highway with the date when the State will assume its care and maintenance. If at the date of said notice such body has executed any contract for the improvement of such highway, the further operation of this act with respect thereto shall be suspended until the completion of such improvement. At such time it shall become a State highway.

Notice of intent to assume care of road.

8. Whenever a State highway, or any portion thereof, is eliminated from the State Highway System by resolution of the State Highway Commission, the status of such highway shall revert to that existing prior to the passage of this act and its repair and maintenance to the governing body or bodies within which it lies.

Reversion of abandoned road.

9. The State Commissioner of Public Roads is hereby directed to take charge of the construction, improvement, maintenance and repair of State highways, maintain the same in good order and, under the provisions of this act, to promote the extension and improvement of the State Highway System whenever opportunity and conditions permit.

Commissioner of roads to take charge.

All such work shall be done at the expense of the State, and in accordance with plans and specifications prepared by the State Department of Public Roads and under the direction and supervision of the said commissioner.

Work done by State.

10. For purposes of administration (and because of the character of their duties and the possible division of the State Highway System into districts), the present State Supervisor of Roads shall be known as the State Highway Engineer and the present assistant State supervisors as division highway engineers.

Title of officers.

When, through absence or disability, the State Commissioner of Public Roads is unable to perform the duties and exercise the powers of such office, the State Highway Engineer (present State Supervisor), shall perform and exercise such duties and powers.

Acting commissioner.

Additional engineers.	11. In addition to the above officials, now authorized by law, the State Commissioner of Public Roads is empowered, when the need (confirmed by the State Highway Commission) arises, to employ at the compensation fixed by law, not more than two additional division highway engineers (competent engineers, one of whom shall have had experience in the design and construction of bridges). He may employ also such draughtsmen, clerical or office help, foremen, laborers and such temporary or permanent resident engineers as shall be needed for the efficient and economical administration and execution of the powers and duties of the State Department of Public Roads. The said resident engineers shall be, whenever practicable and consistent with efficiency, the county engineers of the several counties of the State, and said offices shall not be deemed incompatible. For this purpose the State Commissioner of Public Roads and board of chosen freeholders of any county shall make a written agreement, to be approved by the State Highway Commission, defining the service and duties of said engineer, fixing his compensation and the relative parts of same to be paid by the county and the State, and such service may be per year, or part or parts thereof, as need may require; <i>provided, however</i> , that the joint compensation by State and county to said engineer shall be in no case less than that received by him as said county engineer, and the time and manner of the payment of this compensation shall be as nearly as possible that now in force; <i>provided, however</i> , that said agreement may be terminated by adequate notice in writing by either party and in case of its lapse, for this or any cause, the status of said engineer with reference to the county employing him shall revert, in all respects, to that existing prior to the passage of this act.
Assistants.	
County engineers appointed when proper.	
Agreement made with engineer	
Proviso.	
Proviso.	
Rules and regulations formulated by commissioner.	12. The State Commissioner of Public Roads is hereby authorized and empowered to formulate and adopt such rules and regulations and prescribe such duties, for the conduct of the business, work and general administration of the State Department of Public Roads, its officers and employes, as are not expressly provided by this act nor by existing law, and are not inconsistent with the intent or spirit thereof. Except where otherwise provided by this act, or other existing law, all employes and appointees of the said department, for cause and after hearing, shall be subject to removal or discharge by the commissioner. He may purchase such materials and equipment as shall be necessary for the competent, efficient and economical administration of the State Department of Public Roads.
Tenure of subordinates.	
Maximum load, height, and width of vehicles.	13. No person shall drive on any State highway any vehicle weighing, with its load, more than thirty thousand (30,000) pounds, nor more than twelve feet in height from the lower rim of the wheel to the highest point of the vehicle or its load, nor more than nine feet in width over any part of the vehicle or its load.
Tires of motor vehicles.	When used on a State highway, no motor vehicle tire shall be fitted with any blocks, hobs, studs or other projections, and no wheels shall be locked so as not to revolve.
No injurious materials allowed.	No person shall place or allow to fall on any State highway any broken glass, pottery or sharp object, nor any substance injurious to the surface of the road or to person, health or property of parties using the same, or residing along the line thereof.
Property along road protected.	No person shall in any way interfere with or injure any road-sign, tree, handrail, wall, bridge, culvert or other public property within the lines of any State highway.
Penalty.	Any person, firm, company or corporation violating any of the above provisions in any manner or method, or who wilfully damages, injures or destroys any such highway or its appurtenances shall be liable to a fine of not less than ten dollars (\$10) nor more than twenty dollars (\$20) for each and every offense together with the

costs of prosecution, to be recovered by an action in debt in the name of the State, before any court of competent jurisdiction by the State Department of Public Roads; said fines shall be paid into the State treasury to the credit of the funds available for construction, maintenance and repair of roads.

14. Hereafter no consent, grant or franchise affecting any portion of a State highway, or of any road included in the State Highway System, shall be given for the construction of a railroad or street railway thereon except upon approval of and under conditions acceptable to the State Highway Commission; nor shall any person, firm, company or corporation enter upon or construct any works in or upon any State highway, except under such conditions and regulations, approved by the commission, as the State Commissioner of Public Roads may prescribe. Whenever any encroachment may exist without warrant of law in any road when taken over as a State highway, the State Commissioner of Public Roads shall notify the Attorney-General, who shall proceed to cause the same to be removed as by law provided.

Consent to use road must be secured.

Removal of encroachments.

Any person, firm, company or corporation guilty of any violation of this section shall be liable to a fine not exceeding one hundred dollars (\$100) for each such day's violation, and the costs of prosecution to be recovered by an action in debt in the name of the State before any court of competent jurisdiction by the State Department of Public Roads. Said fines shall be paid to the State treasury to the credit of the funds available for construction, maintenance and repair of roads.

Penalty.

Any such violation may be removed from any State highway as a trespass by a bill or petition filed by the State Commissioner of Public Roads in the Court of Chancery.

Violation a trespass.

15. For any road in the State Highway System prior to its taking over as a State highway, as provided by this act, no consent, grant or franchise for the laying in or upon it of any railroad or street railway crossing, gas pipe, water pipe, electric conduits, or other piping, telegraph, telephone, electric light or power poles, shall be given except under such restrictions, regulations and conditions as are approved and officially made known by the State Commissioner of Public Roads to the body with authority to issue such privilege. No issue of such consent, grant or franchise by any public body, except as hereinafter provided, shall operate as a waiver of liability in favor of the person, firm, company or corporation laying or erecting such works in or upon such highway or any portion thereof. Any violators of this provision shall be liable to a fine not in excess of fifty dollars for each day's violation and the costs of prosecution, recoverable by the county or township and payable to the county or township collector to the credit of the appropriation for the construction, maintenance and repair of roads.

Any privileges granted subject to certain restrictions.

Liability not waived.

Penalty.

16. No State highway shall extend into or through any city nor shall anything herein contained, or the classification of the State Highway System into districts, be construed as including or in any manner interfering with the roads, streets and highways in any of the cities, boroughs or incorporated towns of the State; *provided, however,* that where a street or series of streets, approved by the State Commissioner of Public Roads, serve through such municipality as connecting State highways or as outlets to such at the boundary of the State, and are maintained under condition stipulated by said commissioner, he may by written agreement with the governing body of said municipality provide for the State's bearing a just proportion, approved by the State Highway Commission, of the cost of maintenance of said streets, and said commissioner may terminate such agreement for adequate cause.

Cities not included in system.

Proviso.

Taking over
certain roads.

17. Whenever an unimproved road, or an improved road in need of extensive repairs, included in the State Highway System but not yet taken over is constructed, reconstructed or reimproved, with or without State aid, such road on the completion of the work to the approval of the State Commissioner of Public Roads, shall be taken over as a State highway.

Sharing cost
with free-
holders.

18. Whenever in the discretion of the said commissioner it is desirable to have constructed, reconstructed or improved by the State, any built or unbuilt portion of the State Highway System, it shall be lawful for such commissioner for the State to enter into written agreement, to be approved by the State Highway Commission, with the boards of chosen freeholders, or other body of competent jurisdiction and power, to equitably share the cost. On completion of the work, said portion of the system to become a State highway.

Proposition
assumed by
State.

19. For the purpose of extension, construction, improvement, maintenance, repair or straightening of the State highways, it shall be lawful for the State Commissioner of Public Roads, with the assent and approval by the State Highway Commission of its terms and conditions, to enter into written agreement with any board of chosen freeholders, or other public body, or any person or corporation, for co-operation on an equitable basis of share in cost of such work, and to assume any portion, not exceeding sixty per centum of that cost. Such board or public body may raise their proportionate share of such cost in accord with the provisions of any law providing for State aid in road improvement or maintenance. Upon approval by the said commissioner of the certificate of the inspector and engineer in charge of the work that the same has been satisfactorily completed in whole or in part, according to contract, plans and specifications, the disbursing officer of said board or body shall pay its share of the whole or partial cost to the State Treasurer to the credit of funds available for road improvement, maintenance and repair.

How amount
raised.

Payment to
State Treas-
urer.

Right to ac-
quire necessary
materials.

The said commissioner for the above purposes and with the approval as aforesaid of the State Highway Commission may enter into a contract with any person, company, firm or corporation, public or private, for the acquisition of any necessary lands, or of gravel pits or other natural deposits of road materials advantageously located to the State highways, and may take title in the name of the State. Any public body may raise its agreed proportionate share of such cost as hereinbefore provided.

Additional
powers con-
ferred on com-
missioner.

20. In the construction, repairs and maintenance of State highways the said commissioner shall possess and exercise in addition to those conferred by this act, all those rights and powers, not incompatible with his office nor prohibited by law, which are now exercised by overseers of roads and boards of chosen freeholders in road construction, repair and maintenance and, when authorized by resolution of the State Highway Commission, in the acquisition of turn-pikes and toll roads.

Not to build
bridges,
trestles.

21. Nothing in this act shall be construed as authorizing the State Department of Public Roads to construct or enter into contracts or agreements for the furnishing, building or rebuilding of bridges, trestles or equivalent structural work, over navigable waters or streams, nor for bridges, or equivalent structures and culverts, generally; *provided, however*, that where the State Commissioner of Public Roads deems the cost of such building, rebuilding or betterment of such structure, according to plans and specifications he approves, as too great a burden for the public body responsible for its care, he may, with approval by the State Highway Commission of terms and conditions, enter into agreement with such responsible

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public body providing for the State's bearing a portion of such costs, but in no case in excess of twenty per centum of that cost.

22. All work of construction or building of unimproved roads and of extensive repairs to improved roads, taken over as State highways shall be by contract. The State Commissioner of Public Roads shall have made a proper survey of the road and have prepared the necessary plans and specifications showing and describing the work to be done and the materials to be supplied and also make estimate of the cost of the construction and improvement in accordance therewith.

He shall advertise for bids on the work and materials covered by the plans and specifications, and may divide the same into several contracts, but all bids for the whole or subdivided shall be submitted at the one time. Such advertisement shall be by public notice published for at least three weeks before the contract may be awarded, at least once a week in each of two newspapers printed in the county or counties where such road is located, in one other in Trenton, and may be inserted in an American engineering periodical. The advertisements shall give a brief description of work and materials required, specify where plans and specifications can be seen or had, the hour, date and place where the sealed proposals will be received and publicly opened and read, and other pertinent information the commissioner may include.

The commissioner may reject any bid not in accord with the advertisement or specification, or for other irregularity, or may reject any or all bids if the prices for work or materials is excessively above the estimated cost. He shall prepare a list of the bids, including any rejected and the cause therefor, and award the contract to the lowest responsible bidder, subject, however, to its ratification by the State Highway Commission, to whom it shall be submitted, together with the summary of bids, within fifteen days from the date of the award. The award shall be final on written approval of a majority of said commission given separately or in session, or whenever empowered so to do by their resolution, by approval of its presiding officer when other than the said commissioner, and then further endorsed by the State Treasurer.

A certified check equal to at least ten per centum of the bid must accompany the same drawn to the order of the State Treasurer, and shall be held as security that if awarded the contract, the bidder will deliver the same, within ten days from the ratification of the award, properly signed and secured by a bond as hereinafter set forth. In case of the bidder's failure so to do, said check shall be forfeited to the State as liquidated damages, and shall be applied to funds available for the construction, improvement and maintenance of roads.

Contracts may provide for partial payments on work of construction or maintenance, but not in excess of eighty per centum of the value of the work done. Where, however, the contract provides that a portion of the work may be deferred with the approval of the State Commissioner of Public Roads, the sum withheld from the contractor may be not less than twenty-five per centum in excess of the value of such deferred work.

23. The funds provided to meet lawful expenditures appertaining to roads, as required under this act or any other law, shall constitute a State Road Fund. It shall include the appropriations made therefor by the Legislature, the receipts from motor vehicle licenses, and from fines for violations of this act and of chapter 113, laws of 1906, its amendments and supplements, as therein provided.

24. Expenditures from this fund shall be: For the extension, construction, maintenance and repair of State highways; for State aid

Work done
by contract.

Plans and
specifications.

Proposals
invited.

Advertisement.

Rejection of
bids.

Award.

Guarantee to
accompany bid.

Partial pay-
ments on ac-
count.
Deferred
work.

State road
fund.

Authorized
expenditures.

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to counties and municipalities, as provided by law, in the permanent improvement of roads, in acquisition of turnpikes or toll roads, in maintenance and repair of improved roads and in bridge and culvert work; for the maintenance and administration of the State Department of Public Roads, the salaries or wages of its lawful officers, clerical, office help and employes, the traveling expenses of such actually and necessarily incurred while in discharge of their official duties, and such other reasonable and proper expenses itemized and reported to the department, incurred while actually on the business of the State, as the State Commissioner of Public Roads shall direct and approve.

Discretionary
payments.

25. In so far as the appropriation act, or other law, does not provide for any of the above specific purposes, the State Commissioner of Public Roads shall determine the amounts, subject to approval of the State Highway Commission, which shall be apportioned to State highways and for State aid, and said commissioner shall decide within lawful discretion the sums to be apportioned for other purposes. Nothin herein shall authorize a change in any compensation fixed by law.

How pay-
ments made.

26. Payments for State aid in improvement or maintenance of roads, or in other authorized grant, and for salaries, wages, expenses of administration or other lawful expenditure shall be made as provided by law.

Payments on
contracts.

Payments on lawful contracts entered into by the State Commissioner of Public Roads for construction, maintenance and repair of roads or other allied authorized work, shall be made upon the said commissioner's approval for payment of the certificate of the engineer and inspector in charge of the work. Such certificate shall set forth the amount then due under the contract, and that the work done, service performed and materials furnished fully comply with the terms and requirements of the contract, plans and specifications.

Annual report
to Comptroller.

27. At the end of each fiscal year the State Commissioner of Public Roads shall make to the State Comptroller a full financial report showing the available unexpended balances in the several accounts before cited, also all outstanding liabilities, under contracts or other financial obligations to counties, municipalities, person, firm or corporation.

Constitution-
ality of sec-
tions.

28. In case for any reason any section or sections of this act shall be questioned in any court, and shall be held to be invalid or unconstitutional, no other section or sections, or part hereof, shall be affected thereby.

Repealer.

29. All acts or parts of acts inconsistent herewith are repealed and this act shall take effect immediately.

Approved April 15, 1912.

CHAPTER 397.

AN ACT to further amend an act entitled "An act giving the State Commissioner of Public Roads a fixed salary, instead of per diem pay, and limiting the expenses connected with the office," approved March twenty-fifth, one thousand eight hundred and ninety-six, and all amendments thereto.

BE IT ENACTED by the Senate and General Assembly of the State of New Jersey:

Section 1
amended.
Salary and
allowance to
commissioner.

1. The first section of said act shall be amended to read as follows:
1. The annual salary of the State Commissioner of Public Roads shall be five thousand dollars, and he shall be allowed a sum not to exceed seventeen thousand dollars per year, or so much thereof as

shall be necessary for clerk hire, wages of assistants not provided for in this act, stationery, postage, expressage, and such expenses of all officers and employees of the department as are actually and necessarily incurred in the performance of their official duties.

2. The second section of said act shall be amended to read as follows:

Section 2
amended.

2. He shall be allowed the sum of four thousand dollars per year for the employment of the supervisor appointed under chapter 155, laws of 1900, who shall be known as the State Highway Engineer and who shall be a competent civil engineer, and a further sum not to exceed seven thousand two hundred dollars per year for salaries of not to exceed four assistants to said supervisor, who shall be competent engineers and who shall be known as Division Highway Engineers. The Assistant Supervisors of Roads, appointed under chapter 236, laws of 1909, shall become two of said Division Highway Engineers. One of such staff shall have had experience in bridge design and construction.

Engineer and
assistants;
allowance for
salaries.

In the absence or disability of the said commissioner the said State Highway Engineer shall exercise all the powers and fulfill all the duties of said commissioner.

Acting com-
missioner.

3. Upon the passage of this act, and thereafter before entering upon the discharge of his duties, the State Commissioner of Public Roads shall give bond in the sum of twenty thousand dollars conditioned for the faithful performance of his duties. Such bond shall be with two or more sureties, freeholders of this State, or a surety or trust company of this State, or a surety or trust company of another State authorized to do business in this State, said bond with sureties to be approved by the Governor, he shall also take oath of office before one of the justices of the Supreme Court similar to that now required of the State Comptroller, which bond and oath of office shall be filed in the Department of State.

Surety of
commissioner.

The State Supervisor—State Highway Engineer—shall qualify in like manner with bond and sureties in the sum of five thousand dollars.

Bond of
engineer.

4. All acts and parts of acts inconsistent herewith are hereby repealed and this act shall take effect immediately.

Repealer.

Approved April 15, 1912.

CHAPTER 398.

A FURTHER SUPPLEMENT to an act entitled "An act constituting and appointing a State Highway Commission and defining its powers and duties," approved March thirtieth, one thousand nine hundred and nine.

BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey:*

1. There shall be added to the State Highway Commission, as an additional member thereof, the State Treasurer.

Treasurer a
member of
commission.
Duties of
commission.

2. It is hereby made the further duty of the said commission to establish a State highway system and otherwise to carry into effect the provisions of an act entitled "An act to establish a State system of highways, providing for their construction, improvement, maintenance, repair and regulation of the use thereof, and for a road fund and its disbursement in lawful expenditures appertaining to roads."

3. All acts and parts of acts inconsistent with this act are hereby repealed.

Repealer.

4. This act shall take effect immediately.

Approved April 15, 1912.

Appendix C.

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

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

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

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

A road 8 feet wide and 4 inches deep will require 875 tons of stone per mile.

" 8	"	" 6	"	"	1,312½	"	"	"
" 8	"	" 8	"	"	1,750	"	"	"
" 8	"	" 10	"	"	2,187½	"	"	"
" 8	"	" 12	"	"	2,625	"	"	"
" 9	"	" 4	"	"	984⅜	"	"	"
" 9	"	" 6	"	"	1,476 ⁹ / ₁₆	"	"	"
" 9	"	" 8	"	"	1,968¾	"	"	"
" 9	"	" 10	"	"	2,460 ¹⁵ / ₁₆	"	"	"
" 9	"	" 12	"	"	2,953⅞	"	"	"
" 10	"	" 4	"	"	1,093¾	"	"	"
" 10	"	" 6	"	"	1,640⅝	"	"	"
" 10	"	" 8	"	"	2,187½	"	"	"
" 10	"	" 10	"	"	2,734⅜	"	"	"
" 10	"	" 12	"	"	3,281¼	"	"	"

A road 11 feet wide and 4 inches deep will require 1,203 $\frac{1}{8}$ tons of stone per mile.

"	11	"	"	6	"	"	1,804 $\frac{11}{16}$	"	"	"
"	11	"	"	8	"	"	2,406 $\frac{1}{4}$	"	"	"
"	11	"	"	10	"	"	3,007 $\frac{13}{16}$	"	"	"
"	11	"	"	12	"	"	3,609 $\frac{3}{8}$	"	"	"
"	12	"	"	4	"	"	1,312 $\frac{1}{2}$	"	"	"
"	12	"	"	6	"	"	1,968 $\frac{3}{4}$	"	"	"
"	12	"	"	8	"	"	2,625	"	"	"
"	12	"	"	10	"	"	3,281 $\frac{1}{4}$	"	"	"
"	12	"	"	12	"	"	3,937 $\frac{1}{2}$	"	"	"
"	13	"	"	4	"	"	1,421 $\frac{7}{8}$	"	"	"
"	13	"	"	6	"	"	2,132 $\frac{13}{16}$	"	"	"
"	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 $\frac{1}{8}$	"	"	"
"	14	"	"	12	"	"	4,593 $\frac{3}{4}$	"	"	"
"	15	"	"	4	"	"	1,640 $\frac{5}{8}$	"	"	"
"	15	"	"	6	"	"	2,460 $\frac{15}{16}$	"	"	"
"	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 $\frac{1}{8}$	"	"	"
"	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 $\frac{1}{8}$	"	"	"
"	19	"	"	6	"	"	3,117 $\frac{3}{16}$	"	"	"
"	19	"	"	8	"	"	4,156 $\frac{1}{4}$	"	"	"
"	19	"	"	10	"	"	5,195 $\frac{5}{16}$	"	"	"
"	19	"	"	12	"	"	6,234 $\frac{3}{8}$	"	"	"

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A road 20 feet wide and 4 inches deep will require 2,187½ tons of stone per mile.

"	20	"	"	6	"	3,281¼	"	"	"
"	20	"	"	8	"	4,375	"	"	"
"	20	"	"	10	"	5,468¾	"	"	"
"	20	"	"	12	"	6,562½	"	"	"

TABLES.

As many persons interested in the construction of stone roads are asking questions about their cost, we enclose a table to show at a glance the number of square yards at different widths in a mile of road; also the cost at different widths, and various prices per square yard. Any variations from these prices can be quickly ascertained by adding, subtracting, multiplying and dividing for a less or greater width. For example, a road eight feet wide has 4,693 1-3 square yards in one mile. To obtain the number of square yards in a road having a width of nine feet, add one-eighth to the foregoing figures, and in one having a width of seven feet, subtract one-eighth; in one of twice the width given in the table, multiply by two.

SQUARE YARDS IN ONE MILE OF

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

8 feet wide, or 4,693⅓ square yards, at 25c. per sq. yd.....	\$1,173 33⅓
10 " 5,866⅔ " 25c. "	1,466 66⅔
12 " 7,040 " 25c. "	1,760 00
14 " 8,213⅓ " 25c. "	2,053 33⅓
16 " 9,386⅔ " 25c. "	2,346 66⅔
18 " 10,560 " 25c. "	2,640 00

8 " 4,693⅓ " 30c. "	1,408 00
10 " 5,866⅔ " 30c. "	1,760 00
12 " 7,040 " 30c. "	2,112 00
14 " 8,213⅓ " 30c. "	2,464 00
16 " 9,386⅔ " 30c. "	2,816 00
18 " 10,560 " 30c. "	3,168 00

8 " 4,693⅓ " 35c. "	1,642 66⅔
10 " 5,866⅔ " 35c. "	2,053 33⅓
12 " 7,040 " 35c. "	2,464 00
14 " 8,213⅓ " 35c. "	2,874 66⅔
16 " 9,386⅔ " 35c. "	3,285 33⅓
18 " 10,560 " 35c. "	3,696 00

8 feet wide, or	4,693 $\frac{1}{3}$	square yards, at 40c. per sq. yd.	.....	\$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 $\frac{1}{3}$	"	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 $\frac{1}{3}$	"	45c. "	2,112	00
10 "	5,866 $\frac{2}{3}$	"	45c. "	2,640	00
12 "	7,040	"	45c. "	3,168	00
14 "	8,213 $\frac{1}{3}$	"	45c. "	3,696	00
16 "	9,386 $\frac{2}{3}$	"	45c. "	4,224	00
18 "	10,560	"	45c. "	4,752	00
8 "	4,693 $\frac{1}{3}$	"	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 $\frac{1}{3}$	"	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 $\frac{1}{3}$	"	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 $\frac{1}{3}$	"	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
8 "	4,693 $\frac{1}{3}$	"	60c. "	2,816	00
10 "	5,866 $\frac{2}{3}$	"	60c. "	3,520	00
12 "	7,040	"	60c. "	4,224	00
14 "	8,213 $\frac{1}{3}$	"	60c. "	4,928	00
16 "	9,386 $\frac{2}{3}$	"	60c. "	5,632	00
18 "	10,560	"	60c. "	6,336	00
8 "	4,693 $\frac{1}{3}$	"	65c. "	3,050	66 $\frac{2}{3}$
10 "	5,866 $\frac{2}{3}$	"	65c. "	3,813	33 $\frac{1}{3}$
12 "	7,040	"	65c. "	4,576	00
14 "	8,213 $\frac{1}{3}$	"	65c. "	5,338	66 $\frac{2}{3}$
16 "	9,386 $\frac{2}{3}$	"	65c. "	6,101	33 $\frac{1}{3}$
18 "	10,560	"	65c. "	6,864	00
8 "	4,693 $\frac{1}{3}$	"	70c. "	3,285	33 $\frac{1}{3}$
10 "	5,866 $\frac{2}{3}$	"	70c. "	4,106	66 $\frac{2}{3}$
12 "	7,040	"	70c. "	4,928	00
14 "	8,213 $\frac{1}{3}$	"	70c. "	5,749	33 $\frac{1}{3}$
16 "	9,386 $\frac{2}{3}$	"	70c. "	6,570	66 $\frac{2}{3}$
18 "	10,560	"	70c. "	7,392	00
8 "	4,693 $\frac{1}{3}$	"	75c. "	3,520	00
10 "	5,866 $\frac{2}{3}$	"	75c. "	4,400	00
12 "	7,040	"	75c. "	5,280	00
14 "	8,213 $\frac{1}{3}$	"	75c. "	6,160	00
16 "	9,386 $\frac{2}{3}$	"	75c. "	7,040	00
18 "	10,560	"	75c. "	7,920	00

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8 feet wide, or	4,693 ¹ / ₃	square yards, at	80c. per sq. yd.	\$3,754	66 ² / ₃
10 "	5,866 ² / ₃	"	80c.	"	4,693 33 ¹ / ₃
12 "	7,040	"	80c.	"	.....	5,632 00
14 "	8,213 ¹ / ₃	"	80c.	"	.....	6,570 66 ² / ₃
16 "	9,386 ² / ₃	"	80c.	"	.....	7,509 33 ¹ / ₃
18 "	10,560	"	80c.	"	.....	8,448 00
8 "	4,693 ¹ / ₃	"	85c.	"	.....	3,989 33 ¹ / ₃
10 "	5,866 ² / ₃	"	85c.	"	.....	4,986 66 ² / ₃
12 "	7,040	"	85c.	"	.....	5,984 00
14 "	8,213 ¹ / ₃	"	85c.	"	.....	6,981 33 ¹ / ₃
16 "	9,386 ² / ₃	"	85c.	"	.....	7,978 66 ² / ₃
18 "	10,560	"	85c.	"	.....	8,976 00
8 "	4,693 ¹ / ₃	"	90c.	"	.....	4,224 00
10 "	5,866 ² / ₃	"	90c.	"	.....	5,280 00
12 "	7,040	"	90c.	"	.....	6,336 00
14 "	8,213 ¹ / ₃	"	90c.	"	.....	7,392 00
16 "	9,386 ² / ₃	"	90c.	"	.....	8,448 00
18 "	10,560	"	90c.	"	.....	9,504 00
8 "	4,693 ¹ / ₃	"	95c.	"	.....	4,458 66 ² / ₃
10 "	5,866 ² / ₃	"	95c.	"	.....	5,573 33 ¹ / ₃
12 "	7,040	"	95c.	"	.....	6,688 00
14 "	8,213 ¹ / ₃	"	95c.	"	.....	7,802 66 ² / ₃
16 "	9,386 ² / ₃	"	95c.	"	.....	8,917 33 ¹ / ₃
18 "	10,560	"	95c.	"	.....	10,032 00
8 "	4,693 ¹ / ₃	"	\$1.00	"	.....	4,693 33 ¹ / ₃
10 "	5,866 ² / ₃	"	1.00	"	.....	5,866 66 ² / ₃
12 "	7,040	"	1.00	"	.....	7,040 00
14 "	8,213 ¹ / ₃	"	1.00	"	.....	8,213 33 ¹ / ₃
16 "	9,386 ² / ₃	"	1.00	"	.....	9,386 66 ² / ₃
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 $1\frac{1}{2}$ to give the number of cubic yards of loose gravel required to make the within depths of compact gravel.

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

THE FOLLOWING TABLE SHOWS THE NUMBER OF MILES OF ROAD BUILT IN EACH COUNTY, IN EACH YEAR, SINCE THE PASSAGE OF THE STATE AID LAW, ALSO THE TOTAL NUMBER OF MILES BUILT EACH YEAR AND THE TOTAL NUMBER OF MILES BUILT IN EACH COUNTY.

COUNTY.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.	1911.	1912.	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.	No. Miles.	No. Miles.	No. Miles.	No. Miles.	No. Miles.	No. Miles.	No. Miles.	No. Miles.	No. Miles.	No. Miles.
Atlantic					12.	10.	6.84	4.03		7.03	20.10	13.	1.	1.51		6.408	13.94	7.24	8.077			111.175
Bergen											1.02		9.375	2.22	.42	1.14	9.595	10.533			3.607	37.910
Burlington		10.54	20.46	9.75	11.02	10.48	15.03	18.36	8.93	17.36	19.131	27.98	2.48		2.51	3.11	7.55	.132		2.9	8.095	195.818
Camden		13.62		8.25		4.125	12.79	2.23	1.	4.48	8.80	9.50	5.985	1.40		20.51	2.33	2.43	5.113	4.987		107.550
Cape May										6.00	5.394	6.20	0.15	2.63		4.00	3.399	11.87	3.042		16.809	59.494
Cumberland												1.22									19.141	20.361
Essex				6.5	6.	4.01	6.67	12.07	9.60	9.36	8.723	5.79	8.545	8.24		7.115	12.623			8.157	1.414	115.717
Gloucester				7.75	6.	5.5	7.59	11.40	6.04	17.44	6.875	7.73					5.74			3.594	2.169	87.828
Hudson									2.44						2.32						.785	5.545
Hunterdon															5.55	5.37	6.478	5.857	1.000	9.207	4.394	37.866
Mercer			9.46	6.40	10.95	4.75	2.704	10.83	9.16	10.37	15.89	12.3	7.55	16.18		5.85	7.85	2.25		5.308	5.506	143.308
Middlesex	10.55	3.18	2.36	7.68	8.43	4.75	6.164	13.10	9.01	6.12	14.95	9.52	12.42	8.335	4.981	5.13	17.674	13.613	1.685	5.158	3.470	168.280
Monmouth					3.75	5.	5.1	14.46	5.64	6.67	13.25	17.67	5.21	7.47	3.36	2.18	11.54	7.085	8.226	9.607	1.173	127.391
Morris						6.13	6.3	10.46	6.53	4.306	10.079	7.13	5.98	3.59	5.94	.69			6.585	2.938		76.658
Ocean											3.9	9.97	11.83	7.16		6.91	11.006	2.867		5.379	19.675	78.697
Passaic						4.79	5.48	8.67	6.73	3.987	6.57	6.09	1.54	5.38	3.88	4.132	4.99		.789	2.786	.528	66.342
Salem					2.67			2.17	2.05		2.51	4.61	7.477				2.906	7.78	3.31	1.779	5.049	42.311
Somerset						6.22	7.27	6.6	6.65	7.93	5.88	6.24	10.68	2.685	5.6	7.284	4.37	5.365	1.268	5.155	10.343	99.540
Sussex .....										.893		4.03	1.695	.98						3.455	3.278	14.331
Union									3.432		2.141		.63		4.01	2.336	4.232	7.757		4.427	3.520	32.485
Warren .....								.08		7.43	8.792	3.94	13.09				7.95	1.92		12.265		55.467
Total built each year	10.55	27.34	32.28	46.33	60.82	66.655	81.938	114.46	77.212	109.376	154.005	152.92	105.637	67.78	38.571	82.165	134.173	86.709	42.550	86.925	105.678	1,684.074

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