

FOURTH ANNUAL REPORT

OF THE

COMMISSIONER

OF

PUBLIC ROADS

For the Year Ending October 31st,

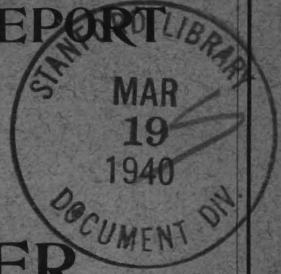
1897.



TRENTON, N. J.:

MACCRELLISH & QUIGLEY, STATE PRINTERS.

1898.





Long Branch and Asbury Park Road, Monmouth Co. After Improvement.



Hammonton and Absecon Road, Camden Co. After Improvement.

FOURTH ANNUAL REPORT

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New Jersey

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For the Year Ending October 31st,

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STANFORD LIBRARY

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NEW JERSEY STATE LIBRARY

OFFICE OF COMMISSIONER OF PUBLIC ROADS, }
TRENTON, N. J., November 30th, 1897. }

To the Governor and Legislature of New Jersey :

Pursuant to the requirements of the State Aid Law, I herewith submit the Fourth Annual Report of the Commissioner of Public Roads for the fiscal year ending October 31st, 1897, with such comments and suggestions as existing circumstances seem to require.

HENRY I. BUDD,
Commissioner of Public Roads.

REPORT.

In compliance with the Act of June 15th, 1895, we make the following statement of cost of roads.

They will claim a share of this year's State appropriation, as indicated by the figures below :

COST OF ROADS.

Atlantic County.

Hammonton and Absecon road,	10 miles
Cost,	\$12,308 22
State's share,	4,102 74
Total paid the County,	\$4,102 74

Burlington County.

Burlington and Florence road,	2½ miles
Cost,	\$8,286 18
State's share,	2,762 06
Rancocas Pike and Charlestown stone road,	4,259 feet
Cost,	\$3,493 26
State's share,	1,164 42
Pensauken Creek and West Palmyra road,	3,570 feet
Cost,	\$2,960 40
State's share,	986 80
Columbus and Bordentown road,	5 miles
Cost,	\$15,033 00
State's share,	5,011 00
Main Street road, Moorestown,	1 mile
Cost,	\$9,000 00
State's share,	3,000 00
Beverly and Delanco road,	2,666 feet
Cost,	\$2,985 90
State's share,	995 30
Total paid the County,	\$13,919 58

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Camden County.

Browning's road,	2 ¹ / ₁₀ miles
Cost,	\$15,191 43
State's share,	5,063 81
Market Street extension,	1 mile
Cost,	\$5,868 42
State's share,	1,956 14
White Horse road extension,	1,190 feet
Cost,	\$1,694 22
State's share,	564 74
Total paid the County,	\$7,584 69

Essex County.

Mount Pleasant avenue and Hanover Bridge road,	1 mile, 2,153 feet
Cost,	\$9,084 36
State's share,	3,028 12
Mountain avenue road,	1 mile
Cost,	\$4,754 52
State's share,	1,584 84
South Orange avenue,	2½ miles
Cost,	\$10,827 00
State's share,	3,609 00
Total paid the County,	\$8,221 96

Gloucester County.

Westville and Glassboro road,	5½ miles
Cost,	\$26,513 52
State's share,	8,837 84
Total paid the County,	\$8,837 84

Mercer County.

Lawrenceville and Princeton road,	4¾ miles
Cost,	\$40,455 06
State's share,	13,485 02
Total paid the County,	\$13,485 02

Middlesex County.

Metuchen and Perth Amboy road,	4¾ miles
Cost,	\$23,245 92
State's share,	7,748 64
Total paid the County,	\$7,748 64

COMMISSIONER OF PUBLIC ROADS.

Monmouth County.

Long Branch and Asbury Park road,	5 miles
Cost,	\$34,194 36
State's share,	11,398 12
Total paid the County,	\$11,398 12

Morris County.

Long Hill road,	2½ miles
Cost,	\$6,799 41
State's share,	2,266 47
Ledgewood, Succasunna and Kenville road,	2 miles
Cost,	\$7,678 56
State's share,	2,559 52
Chatham and Passaic River Bridge road,	1 mile, 3,341 feet
Cost,	\$6,693 30
State's share,	2,231 10
Total paid the County,	\$7,057 09

Passaic County.

Echo Lake road,	2 ² / ₈ miles
Cost,	\$13,318 62
State's share,	4,439 54
Rea Avenue,	4,285 feet
Cost,	\$3,254 58
State's share,	1,084 86
Little Falls road,	1½ miles
Cost,	\$9,623 25
State's share,	3,207 75
Total paid the County,	\$8,732 15

Somerset County.

Mountain avenue road,	2 miles, 988 feet
Cost,	\$9,225 39
State's share,	3,075 13
Union avenue road,	4 miles, 143 feet
Cost,	\$17,511 12
State's share,	5,837 04
Total paid the County,	\$8,912 17
Total cost to the State,	\$100,000 00
Appropriation,	100,000 00

Total cost of roads to both State and County are given further on in the more detailed statements of engineers and supervisors.

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Specifications for the following roads have been and are being prepared, some of which are under and are being placed under contract for construction under the State appropriation for the fiscal year beginning November 1st, 1897, and ending October 31st, 1898 :

ATLANTIC COUNTY.

Egg Harbor City and Mays Landing road—Gravel, . . . 6 $\frac{3}{4}$ miles

BURLINGTON COUNTY.

Farnsworth Avenue and Park Street road, Bordentown

—Stone, 1 mile, 3,220 feet
 London Bridge road, Burlington City—Stone, 3,882 feet
 Riverton and Riverside road—Stone, 3 $\frac{1}{10}$ miles
 Columbus to Jobstown Turnpike—Stone, 4 miles
 Pemberton and Brown's Mill road—Gravel, 6 miles

CAMDEN COUNTY.

Waterford road—Gravel, 11 miles
 Kalghn's Avenue extension—Stone, 1.67 miles

ESSEX COUNTY.

Grove Avenue road—Stone, 1 $\frac{1}{8}$ miles
 Grove Street road—Stone, 2 miles, 3,050 feet
 South Orange avenue—Stone, 3 $\frac{2}{3}$ miles
 West Livingston to Northfield road—Stone, 1 mile
 Bloomfield road—Stone, $\frac{1}{2}$ mile

GLOUCESTER COUNTY.

Swedesboro and Paulsboro road—Stone, 7 miles

MERCER COUNTY.

Trenton and White Horse turnpike—Stone, 2 $\frac{1}{2}$ miles
 Hutchinson's Mill road—Stone, 1 mile
 Trenton and Pennington turnpike—Stone, 7 miles

MIDDLESEX COUNTY.

Metuchen and Menlo Park road—Stone, 2 miles, 940 feet
 New Dover road—Stone, 1 mile, 4,001 feet
 Menlo Park and Iselin extension—Stone, 2 $\frac{3}{4}$ miles
 Middlesex avenue extension—Stone, 1 mile, 347 feet

MONMOUTH COUNTY.

Perrineville and Hightstown road—Ore, 3 miles, 3,258 feet
 Manalapan to Baird—Gravel, 1 $\frac{1}{2}$ miles

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MORRIS COUNTY.

Basking Ridge road, from Morristown to VanDoren's
 Mill—Stone, 4 miles, 3,974 feet
 Townsley Bridge and Williams' Corner road—Stone, . 2 miles, 260 feet

PASSAIC COUNTY.

Paterson and Hamburg turnpike—Stone, 3 $\frac{3}{8}$ miles

SOMERSET COUNTY.

Harlingen road—Stone, 4 miles, 1,934 feet
 South Somerville road—Stone, 2 miles, 4,865 feet

UNION COUNTY.

New Providence and Passaic River road—Stone, . . . 3 miles

Total, 95 $\frac{3817}{4400}$ miles

Names and lengths of the roads built in 1897 :

ATLANTIC COUNTY.

Hammonton and Absecon road—Hammonton end, . . 10 miles

BURLINGTON COUNTY.

Burlington and Florence road, 2 $\frac{1}{2}$ miles
 Rancocas Pike and Charlestown stone road, 4,259 feet
 Pensauken Creek and West Palmyra road, 3,570 feet
 Columbus and Bordentown road, 5 miles
 Main Street road, Moorestown, 1 mile
 Beverly and Delanco road, 2,666 feet

CAMDEN COUNTY.

Browning's road, 2 $\frac{9}{10}$ miles
 Market Street extension, 1 mile
 White Horse road extension, 1,190 feet

ESSEX COUNTY.

Mt. Pleasant Avenue and Hanover Bridge road, . . . 1 mile, 2,153 feet
 Mountain Avenue road, 1 mile
 South Orange avenue, 2 $\frac{1}{2}$ miles

GLOUCESTER COUNTY.

Westville and Glassboro road, 5 $\frac{1}{2}$ miles

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MERCER COUNTY.

Lawrenceville and Princeton road, 4¾ miles

MIDDLESEX COUNTY.

Metuchen and Perth Amboy road, 4¾ miles

MORRIS COUNTY.

Long Hill road, 2½ miles

Ledgewood, Succasunna and Kenville road, 2 miles

Chatham and Passaic River Bridge road, 1 mile, 3,341 feet

MONMOUTH COUNTY.

Long Branch and Asbury Park road, 5 miles

PASSAIC COUNTY.

Echo Lake road, 2²/₈ miles

Rea Avenue, 4,285 feet

Little Falls road, 1½ miles

SOMERSET COUNTY.

Mountain Avenue road, 2 miles, 988 feet

Union Avenue road, 4 miles, 143 feet

Total, 66½ miles +

During the years 1893-1894 there was built in

Middlesex County,	16.09 miles
Mercer County,	12.78 " "
Camden County,	14.50 " "
Burlington County,	31.47 " "
Total number of miles built in 1893-1894,	74.76

During the year 1895 there was built in

Burlington County,	9¾ miles
Camden County,	8¼ " "
Essex County,	6½ " "
Gloucester County,	7¾ " "
Middlesex County,	7½ " "
Mercer County,	6 ² / ₈ " "
Total number of miles built in 1895,	46 ¹¹ / ₁₆

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During the year 1896 there was built in

Atlantic County,	12	miles
Burlington County,	11 $\frac{1}{80}$	"
Essex County,	6	"
Gloucester County,	6	"
Mercer County,	10 $\frac{19}{20}$	"
Middlesex County,	9	"
Monmouth County,	3 $\frac{3}{4}$	"
Salem County,	2 $\frac{2}{5}$	"
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Total number of miles built in 1896,	51 $\frac{23}{80}$.	

During the year 1897 there was built in—

Atlantic County,	10 $\frac{1}{2}$	miles
Burlington County,	10	"
Camden County,	4 $\frac{1}{8}$	"
Essex County,	5	"
Gloucester County,	5 $\frac{1}{2}$	"
Mercer County,	4 $\frac{3}{4}$	"
Middlesex County,	4 $\frac{3}{4}$	"
Morris County,	6 $\frac{1}{8}$	"
Monmouth County,	5	"
Passaic County,	4 $\frac{3}{4}$	"
Somerset County,	6 $\frac{1}{8}$	"
<hr/>		
Total,	66 $\frac{1}{2}$ +	"

The total amount expended by the State and the number of miles built in each county since the passage of the State Aid Law is as follows:

County.	Miles.	Amount.
Atlantic,	22 $\frac{1}{2}$	\$9,504 33
Burlington,	61 $\frac{1}{4}$	115,066 34
Camden,	27	63,777 46 $\frac{1}{2}$
Essex,	17	36,468 80
Gloucester,	19 $\frac{1}{4}$	32,372 80
Mercer,	28	97,833 00
Middlesex,	37	70,534 80 $\frac{1}{2}$
Morris,	6 $\frac{1}{8}$	7,057 09
Monmouth,	8 $\frac{3}{4}$	13,931 45
Passaic,	4 $\frac{3}{4}$	8,732 15
Salem,	2 $\frac{2}{3}$	1,635 66
Somerset,	6 $\frac{1}{4}$	8,912 17

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General summary of expenditures by the State :

Year.	Appropriation.	Expended.
1891,	\$20,000 00	
1892,	75,000 00	\$20,661 85
1893,	75,000 00	71,237 22
1894,	75,000 00	74,696 03
1895,	100,000 00	100,000 00
1896,	100,000 00	100,000 00
1897,	100,000 00	100,000 00
Total,	\$545,000 00	\$466,595 10

AMOUNT AVAILABLE FOR ROAD-BUILDING IN EACH COUNTY.

Under the State Aid Law the estimated cost of all improvements made under this act, together with the estimated cost of repairs of roads already constructed in any county in any one year, shall not exceed one-fourth of one per centum of the ratables of such county for the last preceding year.

The following table will show at a glance the limitations of expenditures in each county, also the amount that can be expended, provided the State appropriation is liberal enough to meet it. For example: Atlantic County, with ratables amounting to \$17,158,410, could expend per year if State appropriation was sufficient, \$42,896.02 of its own money and \$21,448 of the State's money, altogether \$64,344.02; a rate, if applied to all the counties, even with the cost of repairs to roads already built deducted, would in a few years cover all our leading roads with stone.

County.	Abstract of Ratables for 1896.	One-fourth of 1 Per Cent.
Atlantic,	\$17,158,410 00	\$42,896 02½
Bergen,	23,383,273 00	58,458 18¼
Burlington,	23,573,052 00	58,932 63
Camden,	33,562,691 00	83,906 72¾
Cape May,	5,392,105 00	13,480 26¼
Cumberland,	17,112,828 00	42,782 07
Essex,	186,997,000 00	467,492 50
Gloucester,	14,701,953 00	36,754 88¼
Hudson,	153,642,577 00	384,106 44¼
Hunterdon,	18,185,280 00	45,463 20
Mercer,	42,147,779 00	105,369 44¾
Middlesex,	27,413,898 00	68,534 74½
Monmouth,	45,127,079 00	112,817 69¾

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	Abstract of Ratables for 1896.	One-fourth of 1 Per Cent.
Morris,	\$26,058,776 00	\$65,146 94
Ocean,	6,322,151 00	15,805 37 ³ / ₄
Passaic,	55,371,263 00	138,428 15 ³ / ₄
Salem,	14,674,026 00	36,685 06 ¹ / ₂
Somerset,	17,758,654 00	44,396 63 ¹ / ₂
Sussex,	10,654,199 00	26,635 49 ³ / ₄
Union,	36,772,100 00	91,930 25
Warren,	18,418,954 00	46,047 38 ¹ / ₂

Description of Roads Improved in 1897.

ATLANTIC COUNTY.

Hammonton and Absecon Road, Twenty-two Miles Long.

This road is constructed of gravel, and passes over a sandy region, covered with pines and scrub-oaks, through Pomona, Egg Harbor City, Elwood, DeCosta and Hammonton.

It forms part of a continuous line from Camden to Atlantic City; was completed early in the season, and is now one of the most popular roads in the State. Over it thousands of bicycles are moving each day to and from Camden and Atlantic City. The number of travelers has so increased that the old wayside inns are not capable of feeding the people passing along its route, therefore necessitating the building of many new resorts where the numerous bands of bicycle-riders can easily regale themselves. It is a striking instance of how a good road will start into life and activity a barren section. The State has never made a better investment for the development of its unimproved resources.

The maximum grade is about two per cent.

The cost was about \$1,300 per mile, or a total of \$31,750.23.

Twelve miles of this road was built and paid for last year, costing \$16,204.77.

BURLINGTON COUNTY.

Columbus and Bordentown Stone Road, Five Miles Long.

This, the main road from Columbus to Bordentown, runs through Mansfield Square to the thriving village of Columbus, the center of a rich farming country, over a well-cultivated, alluvial, sandy-loam country, covered with some of the finest farms of the State. The old bed was a gravel turnpike, which had become so sandy it was difficult to carry the products of the farms to the markets of Columbus, Bordentown and Trenton.

Its construction commenced in the early spring, and was finished in October of the same year. It is built ten feet wide, of eight-inch macadam, four inches of 2½ and 3½-inch Byram rock in the bottom.

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This, after being thoroughly rolled, was covered with four inches of $1\frac{1}{2}$ -inch trap-rock and brought to a finish with $\frac{3}{4}$ -inch stone and screenings. It affords a very fine driveway for pleasure carriages and bicycles, and also a firm roadway for heavy draft wagons. A great deal of produce is carted over it to the manufacturing city of Trenton. Columbus being one of the largest milk-stations in the State, this road gives a large number of farmers an easy every-day passage to this shipping depot.

The maximum grade, one hill only, is about three feet to the hundred.

The cost of construction is \$15,822.64 $\frac{1}{2}$.

Pensauken Creek and West Palmyra Road, 3,570 feet long.

This road forms a connecting link between the stone roads that lie north of it and the Camden county system, and is the limit of Burlington county's building in that direction. It is built of macadam, twelve feet wide and eight inches thick. It passes through a sandy section, that is principally devoted to the raising of vegetables for the Philadelphia market. There are two forks to this road, which connect with the two bridges over the Pensauken creek. The completion of the Riverside and Riverton road will give a system of roads extending from Burlington through the southwestern end of the county towards Philadelphia, thus affording driving, cycling and easy movement of vegetables and fruits for a large section to the great markets of Camden and Philadelphia.

The maximum grade is 1 per cent.

The cost is \$2,960 40.

Charlestown and Rancocas Turnpike Road, 4,259 feet long.

The construction of this road is of macadam, twelve feet wide and eight inches deep, the bottom two and one-half and three-inch Byram rock, the upper stone one and one-half-inch trap, finished with three-fourths-inch stone and screenings. This road is a connecting link between the terminus of the Charlestown and Beverly stone road and the Beverly and Rancocas turnpike, thus enabling the residents of Mount Holly, the beautiful village of Rancocas and of this rich farming country to easily and cheaply pass immense quantities of produce over firm roads to the landings along the Rancocas creek and to the markets of Beverly and other river towns.

The maximum grade is two inches to the hundred feet.

The cost of the road is \$3,493.26.

Main Street, Moorestown, One Mile Long.

This road is the main street of Moorestown, a beautiful village of 2,000 inhabitants nine miles northeast of Philadelphia. It extends in a westerly direction along the main street from the Mt. Laurel stone road to the junction of the Haddonfield road, and was a portion of the Moorestown and Camden turnpike, which the citizens purchased, paying them \$2,400 for the same. There was a rubble pavement sixteen feet wide in the center of the street. This was removed and the material used to build two strips of rubble pavement, each four feet wide on the outer edges, and the balance of the rubble, eight feet, was utilized as a bottom course for the telford pavement. The finished improved road is forty feet wide. Eight feet in the center is telford, six inches thick, with four inches of macadam upon the same; twelve feet on each side of the telford is macadam, six inches thick, and four feet on the outer edges of the macadam is rubble.

This forms a very fine surface over which there is an immense traffic, not only for pleasure-carriages and bicycles, but thousands of heavily-loaded truck-wagons pass over it each year to the Philadelphia market.

To the building of this road the State and County agreed to contribute \$9,000, the State paying one-third of the same. The citizens desiring a wider and more expensive road than this contribution would build, the township authorities of Chester agreed to pay for all excess over said amount.

This is the beginning of the end of rubble pavements for country roads. Their lasting qualities will be eternal, for they are so rough that all teams avoid them when the dirt alongside is in condition to carry the traffic.

The maximum grade is $1\frac{1}{4}$ per cent.

The cost of the road is \$9,000.

Florence Road, Two and One-half Miles Long.

This road extends from Florence Station, on the Camden and Amboy railroad, to the iron pipe manufacturing town of Florence. This presents a new feature in construction, as a portion of it is bot-tomed with slag. It is built of macadam, twelve feet wide and eight inches thick. It passes through a sandy country over which many attempts have been made to construct a passable road, but all proved



Browning Road, Camden Co. Before.



Browning Road, Camden Co. After.

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failures, as the heavy carting and driving quickly wore out the cinders, slag and gravel that had been repeatedly placed over the sand. It now presents a smooth, solid surface, over which the 2,000 inhabitants of Florence can easily pass with any kind of a vehicle.

The maximum grade is about one foot to the hundred.

The cost of the construction is \$8,682.92.

Beverly and Delanco Extension, 2,666 Feet Long.

This road is the last remaining link completed, connecting the city of Burlington with the roads leading to Philadelphia. It lies in the city of Beverly. After its construction, the city will be chargeable for keeping it in repair. It is built of macadam, sixteen feet wide and eight inches thick.

Its completion allows bicycles and pleasure carriages to travel without break from eight to eighteen miles in many directions. It completes a line connecting the cities of Burlington, Beverly, Delanco, Riverside, Riverton, Palmyra and West Palmyra, embracing a large population.

The maximum grade is 1 per cent.

The cost is \$2,985.90.

CAMDEN COUNTY.

Browning Road, Two and Nine-Tenths Miles Long.

This road begins in the borough of Collingswood, in the township of Haddon, and extends in an easterly direction through said township to the borough of Merchantville, to where the said Browning Road terminates in the southerly side of the turnpike leading from Camden to Moorestown.

This roadbed was constructed to the width of twelve feet, and the manner of construction was a telford center eight feet wide, made of a bottom course of stone five inches thick, over which five inches of macadam, composed of one and one-half inch stone, was placed. Two macadam wings, each two feet wide and six inches deep, were placed on the sides of the telford, making the whole width of the road fourteen feet. The whole road was thoroughly rolled and brought to a fine surface finish. This road passes through a partially wild and partially fine trucking country. It forms a direct connection between the boroughs of Merchantville and Collingswood and the improved roads that lead to and from both of these villages, sav-

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ing three miles of travel over the old way by Camden to those moving from points east and north of Merchantville to the system of roads leading south of Camden towards Atlantic City.

The maximum grade of this road is about two per cent. reduced from four per cent.

The cost of the road is \$15,191.43.

White Horse Extension, 1,190 Feet Long.

This short piece of road completes the White Horse connection with the Haddonfield turnpike, forming a continuous line from Camden to the seashore. It is of telford construction, fourteen feet wide, twelve inches deep, and will be forced to endure a very heavy traffic, not only from the White Horse road, but from the large brick-yards in close proximity, carting bricks to the city of Camden.

The maximum grade is about 1 per cent.

The cost of the road is \$1,910.03.

Market Street Extension, One Mile Long.

This road connects the Mount Ephraim and the Gloucester stone-road with the improved streets of Gloucester City and the Gloucester City ferry to Philadelphia.

The construction is of telford center, 14 feet wide, 12 inches deep. The city of Gloucester has continued the paving with the macadam from this to the curb; thus the construction covers the whole bed of the street.

It passes principally through the outlying parts of the city of Gloucester, and forms a fine passage for the immense number of truck teams that daily pass over the Mount Ephraim stone-road to the city of Philadelphia.

The maximum grade is about 1 per cent.

The cost of the road is \$6,224.46

ESSEX COUNTY.

Mountain Avenue Road, One Mile Long.

This road runs through a flat farming section, and connects the Passaic county stone-roads with the Essex county system at Montclair Heights, forming a continuous line of improved roadway from

the city of Newark to Little Falls, there joining with the roads leading to Paterson.

It is of telford construction, fourteen feet wide and ten inches thick. The country around is of a drift formation. Boulders, more or less, cover the surface; the boulders were turned into the trench, thoroughly wedged to a depth of five and six inches for a foundation; over this a covering of ledge trap-rock, one and one-half inches in size, was spread to the depth of four inches.

The maximum grade of this road is 2 per cent.

The cost of the road is \$4,754.52.

*Mount Pleasant Avenue and Hanover Bridge Road, One Mile
2,153 Feet Long.*

This road begins at the end of the present pavement near Livingston, and runs to the Passaic river at Hanover Bridge, connecting there with the Morris county system. It is of telford construction, sixteen feet wide and twelve inches deep; eight inches of boulder-stones from the side fences were placed in the bottom, and four inches of crushed ledge-trap, one and one-half inches in size on the surface, finished with three-quarter inch stone. This road completes Mount Pleasant avenue to the Morris county line, making a continuous improved avenue from the city of Newark to the county boundary.

The maximum grade is 8.32 feet in 100.

The cost of the road is \$9,084.36.

*South Orange Avenue Road, Essex County, Three and Three-fourths
Miles Long.*

This road is twelve feet wide and eight inches deep. It commences at the foot of the Second Orange Mountain, and runs west, over said mountain, through a rough country covered with timber and boulders. Trap-boulders form the bottom course to the depth of five inches; the surface is formed of crushed trap, three inches deep. It is an expensive road to grade, on account of the deep cuts required to overcome the steep ascent. There are a few dairy farms along its line, but its principal service will be in furnishing a short route for the farmers of Passaic Valley to the markets of Orange and Newark.

This road has been widened to seventy-five feet to accommodate a contemplated trolley line without interfering with the macadam bed. The city of Newark has located one of its most picturesque parks in

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one of the wildest sections along this line. This route is the most direct from the Oranges to Morristown, and was once used as a stage road between the two places. On account of the heavy grading, the contractor has not succeeded in completing more than two and one-half miles this year.

The maximum grade was reduced from 15 to 7 per cent.

The cost of the whole road will be about \$19,000.

GLOUCESTER COUNTY.

Westville and Glassboro Road, Five and One-Half Miles Long.

This road, eleven and one-half miles long, six of which were constructed last year and five and one-half this year, passes over and through an alluvial, sandy, and sandy loam country, the roads of which, at most seasons of the year, are almost impassable from the depth of sand. There is a large amount of truck and fruit growing along its line, which has, before this, been forced to make a long detour in order to reach a gravel road to move towards the Philadelphia markets. This road, now completed, gives to the thriving glass-manufacturing city of Glassboro, the towns of Dilkesborough, Hurffville and Fairville, and the surrounding trucking and fruit-growing lands easy communication with the markets of Philadelphia and Camden.

The road is ten feet wide, with a telford bottom of six inches and a macadam superstructure of four inches; the whole cross-section ten inches deep, with a shoulder seven feet wide of clay and gravel to the ditch line. The grading along this road was comparatively light, and formed but a small part of the cost of the construction.

The maximum grade is 2 per cent.

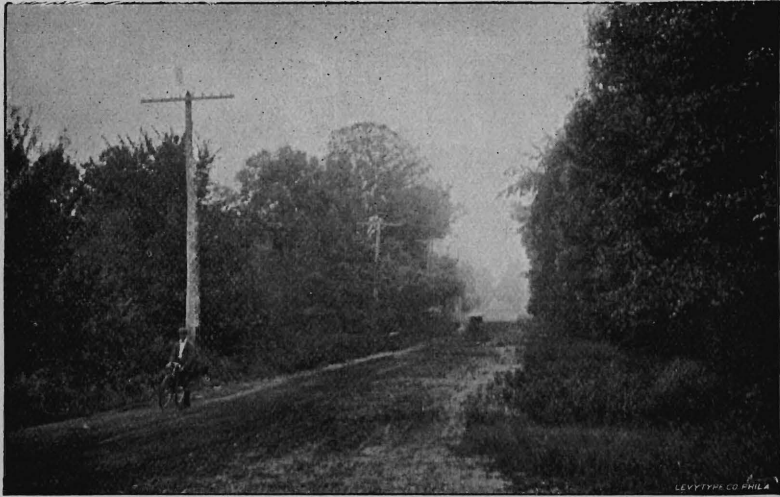
The cost is \$28,635.58.

MONMOUTH COUNTY.

Long Branch and Asbury Park Road, Five Miles Long.

This road is built of macadam and telford, fourteen feet wide, eight and one-half inches thick; total width, twenty-six feet.

This is one of the finest boulevards that has been constructed under State aid. The county and State paid for the stone construction, and the numerous villages that lie along its route paid for the gravel construction. It presents a smooth, hard surface for all kinds of vehicles, and during the summer season the immense number of visitors at



Perth Amboy and Metuchen Road, Middlesex Co. Before.



Perth Amboy add Metuchen Road, Middlesex Co. After.

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these thickly-populated resorts make almost constant use of it. Hundreds of carriages and thousands of bicycles pass each day over it. The stone surface makes easy draft for heavy wagons ; the gravel, pleasant travel for light carriages and bicycles. This, the ideal plan of construction, gives a desirable road for all classes, under all conditions of weather, at all seasons of the year. The freeholders have provided a water-plant for easily and cheaply watering the road-bed, which should be duplicated by the freeholders of the different counties. Their plant consists of a gasoline engine, pump and water-tank, located over a stream, which, at the cost of about fifty-five cents a day, furnishes sufficient water to properly moisten the road-bed. The material of this bed was made from trap-rock from Bergen Hill. The gravel came from the local beds near Long Branch.

The maximum grade of the road is about 2 per cent.

The cost of the road is \$46,304.11.

MIDDLESEX COUNTY.

Perth Amboy and Metuchen Road, Four and Three-Quarter Miles Long.

This road is constructed of macadam, twelve feet wide and eight inches deep ; four inches of ballast stone, two and one-half inches in size, in the bottom and four inches of one and one-half inch trap on the top.

This road connects Metuchen with the city of Perth Amboy, and is part of what is now a continuous improved highway between the cities of New Brunswick and Perth Amboy. The country over which it passes is partly improved in many places. The stone used in its construction was trap-rock, and was obtained from the Moore quarries on the Delaware river and from the Bergen Hill quarries near Jersey City.

This, with the road to Rahway, built last year, gives this portion of Middlesex County and Perth Amboy about all the outlets that will be needed for some time.

The maximum grade was 5 per cent. reduced to 3 per cent.

The cost of the road is \$23,245.92.

MERCER COUNTY.

Lawrenceville and Princeton Road, Four and Three-quarter Miles Long.

This road is a continuation of the Trenton and Lawrenceville road, and runs through a well-improved farming district, over sandy loam,

boulder and shale soils. It forms a very important link between the growing educational centers of Lawrenceville and Princeton, and will, in time, be part of a continuous improved road from Trenton, through Princeton and Millstone, to New Brunswick and Somerville, connecting with the macadam system of the upper portion of the State.

This has been an expensive road, partly on account of overcoming the steep gradients and the extra filling and bridging over the heavy flood-streams.

The construction of this road has been telford and macadam—mostly telford foundation, eight inches deep, covered with macadam four inches thick, making the whole depth twelve inches. It has been more expensive than is absolutely necessary for the traffic, costing more than twice the sum per mile than we now deem necessary for a road that will wear equally as long before re-surfacing becomes necessary.

This road was commenced in 1896, but was not completed until 1897; therefore, claims this year's appropriation.

The maximum grade is 6 per cent., reduced from 12 per cent.

The whole cost of the road is \$54,838.16.

MORRIS COUNTY.

Long Hill Road, Two and One-half Miles Long.

This road is constructed of trap-rock, obtained from the local trap quarries in this vicinity, and is ten feet wide, a portion six inches thick and a portion four inches thick. It runs along a trap ridge called Long Hill, and extends from Millington station, on the Delaware and Lackawanna railroad, to Williams' Corner, in Passaic Township. It overlooks a beautiful valley, covered with fine farms and villa sites. In this valley and on this ridge many wealthy New Yorkers are building handsome country seats. When its eastern and western connections are built, it will afford pleasant passage for many that now have to travel over rough and at times impassable roads.

The maximum grade is 6.5 per cent., reduced from 9.5 per cent.

The cost is \$7,514.81.

Succasunna, Mount Arlington and Young's Corner Road in Roxbury Township, Morris County, Two Miles Long.

This road runs through a good farming country. The soil over which it passes is clay and sandy loam. The road is of macadam

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construction, twelve feet wide, six inches thick. It connects several small towns with the railroad stations of the New Jersey Central and Delaware and Lackawanna railroads. This road, like many others in this county, is built of native rock. The native rock answers for the bottom of the roadbed, but the surface should be of best trap. As the railroads passing through trap ridges cross or come very near these roads, transporting the best of trap from these quarries that lie farther east, could be easily and cheaply done. It is the opinion of many of the freeholders of this county that they have made a great mistake in surfacing their roads with this bastard granite, as it already shows evidence that it will not be of sufficient endurance to make an economical road material.

The maximum grade is 5.50 per cent., reduced from 7.75 per cent.

The cost is \$8,347.42.

Chatham and Passaic River Road, Morris County, One and One-half Miles Long.

This road passes from the village of Chatham to the bridge at Passaic river, and connects Morris county with the Essex county system of roads now being constructed in the eastern part of Essex. It runs along very good farming land, which overlooks the rich bottoms of the Passaic river. In this part of the county the dairy interest is quite large, and there is a great deal of travel each day to and from the station at Chatham. During the winter season a large amount of feed is carted from the station to and from the many farms along the Passaic river, so there is no road of as short a length that furnishes, at so little cost, an outlet for so large a section of country.

This road is of macadam construction, twelve feet wide, six inches deep; stone two and one-half inches in the bottom and one and one-half inch on the top. It is made of the best trap-rock obtained from quarries near Chatham. All of these roads pass over alluvial and drift soils, and connect the residents thereof with important railroad centers.

The maximum grade is 4 per cent., reduced from 6.5 per cent.

The cost is \$7,188.25.

PASSAIC COUNTY.

Rea Avenue, Four-Fifths of a Mile Long.

This road is constructed of the best trap-rock obtainable in the vicinity of Paterson. It is sixteen feet wide and four inches deep.

It passes from Fourth avenue to Cherry lane road, a new avenue, which lessens the distance between the City of Paterson and the farming community that lies beyond.

The maximum grade is 2 per cent.

The cost is \$3,688.23.

Little Falls Road, One and One-Half Miles Long.

This road is sixteen feet wide and four inches deep, and connects the Passaic County system of stone roads with the Essex County system, at or near Little Falls. It gives an easy movement for travelers from Newark in Essex County, to Paterson in Passaic County. It passes through a trap-rock ridge, one of the toughest in the State, which had to be blasted three to five feet deep the whole width of the cut, affording an abundance of material for the metaling of the road-bed and much to spare. On account of this formation, the excavation has been expensive.

The maximum grade is 9.50 per cent., reduced from 13.00 per cent.

The cost is \$9,990.59.

Echo Lake Road, Passaic County, Two and Forty-six Hundredths Miles Long.

This road is fourteen feet wide and four inches thick. It has been under construction for the best part of two years on account of its heavy grading and litigation of rival contractors. It is constructed with local stone (bastard granite), crushed from ledges alongside of the road.

It now gives easy passage from the railroad station at Charlottsburg, where before existed a heavy grade, to Echo and Greenwood lakes (pleasure resorts), and to the several farms in this picturesque country, where many of the inhabitants of the cities around New York bay find cool summer homes.

The maximum grade is 9.98 per cent. per 100 feet, reduced from 13.32 per cent.

The cost is \$14,943.75.

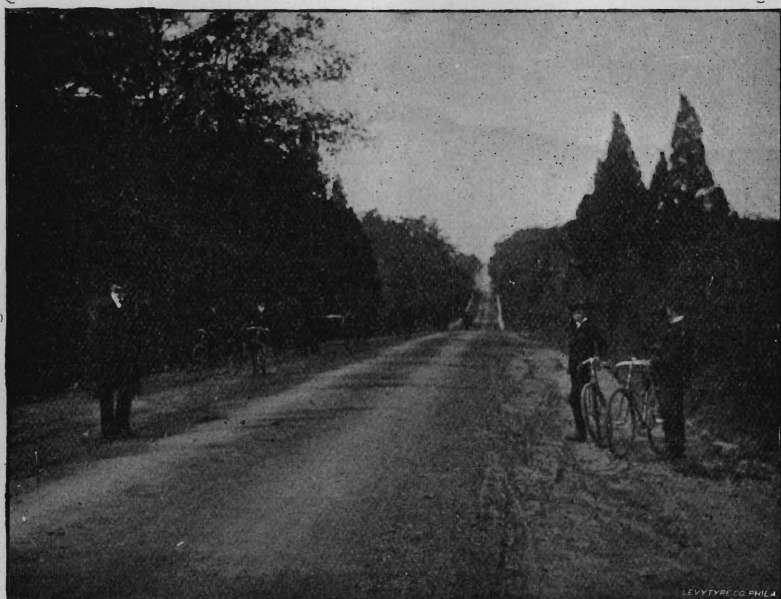
SOMERSET COUNTY.

Somerville and Bound Brook Road, Four Miles Long.

This road runs through a red-shale farming country, and is mostly sixteen feet wide and eight inches thick.



Montclair and Little Falls Road, Passaic Co. Showing Cut and Grading on Top of Orange Mountain.



Montclair and Little Falls Road, Passaic Co. Showing Road after Grading on Top of Orange Mountain.

It is of macadam construction with the exception of a small portion—six hundred feet—which is rock foundation. This rock construction consists of stones carefully laid, not in telford style, on the low meadows that intervene between the farming land and the village of Bound Brook. Over this one and one-half inch trap-rock of best quality has been placed. After leaving the streams the road is eight-inch macadam throughout the remainder of its length. It passes through one of the finest farming sections of sunny Somerset, and affords a fine outlet for the hay, grain and fruit which is largely carted to the Plainfield and Jersey City markets. The rock of this vicinity is a close-grained trap of best quality, and lies in great abundance for many miles along the ridge that forms the northern boundary of this valley. Millions of tons of trap, mined by nature, await the crushers in quantities sufficient to macadamize the roads of this and other States.

The maximum grade is 5.217 per cent. reduced from 8.466 per cent.

The cost is \$19,496.37.

Mountain Avenue Road, Somerset County, Two Miles Long.

This road extends from North Plainfield to the center of the bridge over Green brook, the easterly line of Somerset county. It is sixteen feet wide and ten inches thick. It consists of six inches of rock foundation and four inches of one and one-half inch macadam. On account of the immense amount of loose trap-rock that lies along the base of the mountain running parallel with this road, and the desire of the property-holders for a road cheaper than telford, with more foundation than eight-inch macadam, this form was adopted. The rock foundation differs from telford in manner of laying. The stone is hand-laid, stone fitted to stone and wedged with smaller stone, but not placed on edge as with telford. This bed was then covered with a light coat of gravel, clay and sand, and thoroughly rolled; upon this the crushed trap was placed. It makes, to all appearances, a very good road, over which passes a great deal of heavy traffic; but we shall always be fearful that the large stones will work to the surface. The advocates of this form claim that roads of rock bottom constructed in this vicinity a number of years ago are now as firm as when first built. If their contention proves true, it presents a rapid and cheaper plan, where the elements have detached plenty of broken rocks of the proper size, for the cost is less than a carefully-laid telford foundation.

The maximum grade is 3.17 per cent., reduced from 3.35 per cent.

The cost is \$10,118.82.

FOURTH ANNUAL REPORT

COMMENTS ON THE OPERATION OF THE STONE ROAD LAW.

The average cost per mile has been this year reduced fully one-third. Some roads have been built at from \$3,000 to \$4,000 per mile in neighborhoods where they have been costing from \$6,000 to \$9,000 per mile, and the wearing ability, before re-surfacing becomes necessary, will be equally as great, in many cases longer.

Opposition to the law has been changed to so much enthusiasm for it that more roads are being applied for than can be built in many years under the present State appropriation; consequently we are aiming to spread the appropriation over from thirty to forty per cent. more roads than were formerly built.

The rapidly increasing desire for good roads has caused an unexpected demand for the road reports, so great that the 1896 edition was long ago exhausted; consequently, inability to fill several hundred requests for same. The Printing Committee declined to have a second edition of this report printed, so there has been a necessity of reprinting in this report laws and other information for which there are numerous inquiries.

The workings of the law have proved very satisfactory in all localities where the improvements have been made. The desire of a few is that the State should pay a greater share, the answer to which is that while the petitioned roads under the present law are several years ahead of the funds to build, there is no needed change to the law except to amend so as to increase the State appropriation.

As under our State Aid Law there are each year so many new persons entering into road building, it seems necessary, in order that the roads shall be properly and economically built, that our report should take on an educational character; therefore we have quoted largely from our own experience, and from many of the leading authorities of this and other countries. Our report, having such a large circulation, will at least, if properly consulted, be a manual and a partial guide for the road builders of our State.

PUBLIC ROADS UNDER STATE AID LAW.

There is no abatement in the interest manifested in the construction of roads in the different counties of the State. Many new counties are grasping the idea that under the State Aid Law they can easily and economically cover their leading thoroughfares with stone; consequently, the demand for new roads is so great that it is

quite a problem, under the limited appropriation, to select the ones that should be first improved.

The State this year has added about seventy miles of new macadam roads to the number already constructed. The outlay on the part of the State has been \$100,000, and on the part of individuals and counties, about \$250,000. The expense of the State is nominally one-third, yet many townships grade the roads, for the sake of having the improvement, build new bridges and culverts through the towns and cities, and often build the roads wider than the State allows payment for. The object of the State aid being to spread this money over as great a distance as possible, does not often permit of roads being built more than sixteen feet wide in the cities and twelve feet wide in the country. Very many towns and cities wish to cover the whole width of the street with the pavement, and they do so by township, city or personal contributions. By this and other means the money that is yearly laid out in road-building amounts to much more than the \$300,000 which the State and counties nominally appropriate each year for the extension of the system.

A large part of the State money this year has been utilized in completing links which will make complete thoroughfares from the lower end of the State, through the principal cities and towns, to the upper end of the State. Another year promises to complete all the missing links, so that one will be able to travel on a macadam road from Atlantic City to Jersey City, and from Paterson almost to the western boundaries of the State. Nearly all of the prominent towns and cities of the State now have macadamized roads from their centers to the farming districts; some have one, some two, others three, and more have five or six roads of this style, the large cities having many, radiating like spokes from a wheel.

Union, Essex, Morris and Passaic, having built many miles of roads under the County Law, are now embracing the State Aid Law, and extending their unfinished lines into and through their farming districts. Counties which at first were mandamus-ed are rapidly falling into line, so no persuasion is now needed to induce farmers to avail themselves of the State bounty. At first they were suspicious of the law for fear it would immeasurably increase their taxes, but they have found by experience that it sits but lightly upon them, and is a small expense compared with the saving by the more easy passage of their produce to market, and by the inducement it offers to the city people to become visitors and locaters upon their lands. They are now finding it as easy to go from the country home to the school-house, market, lecture-room and church as it is for the people

to pass from their homes in the cities to the same places ; thus they have all the delights of rural existence and the advantages offered by the towns of the daily mail, social intercourse with neighbors, etc.

New Jersey is most wonderfully situated between two of the largest cities of the country, and its good roads are drawing an immense amount of capital from both of these cities to settle within its borders. Being so favorably situated as regards the numerous corporations that use its laws for incorporation and for railroad lines to pass over, it receives such a large revenue from these corporations, miscellaneous and otherwise, that the State Aid is not a tax upon its citizens. Farmers and those less favored in the race of fortune are rapidly learning that by this method they can obtain these substantial improvements without submitting to an onerous tax. When the road law was first started, the people had to be persuaded to accept its benefits, but now, on account of insufficient appropriation, there has to be more of a hold back policy. Should the State ever make a yearly appropriation of \$300,000, we can expend for road-building each year over \$1,000,000, and thus rapidly become the most desirable State in the Union for residence and business.

Many inventors and the Office of Road Inquiry at Washington are urging upon the farmers of different sections the trial of steel tracks for roads. Over steel rails not more than one-fifth of the power will have to be exercised that would be required over a macadamized road ; consequently, the argument in favor of using steel rails seems strong, but the conservative habits of our people are such that it seems difficult to get them started in new methods, but our most hopeful ones anticipate that there will soon be experimental lines upon some of our leading highways.

WIDE TIRES.

It is not only necessary to make good roads ; it is also necessary that they shall remain good. For this reason all European countries advanced in roadmaking have laws regulating the width of tires used on wagons, carts and vehicles for heavy draught.

In France, the width of tires ranges from three to ten inches, usually from four to six. Every market-wagon and tonnage-wagon is a roller ; the forward axle is about fourteen inches shorter than the rear axle, so that the hind-wheels run in a line about an inch outside the level rolled by the fore-wheel.

In Germany, wagons used for drawing earth, brick, stone and similarly heavy loads, must have a width of tire at least four inches.

In Austria, all wagons built to carry a load of more than two and one-quarter tons must have tires at least four and one-third inches in width. In lower Austria, a rim of four and one-half inches is required for wagons drawn by two horses.

In the State of Michigan, persons using wide tires receive a rebate of one-fourth their road-tax. The States of New York, California, Ohio, Indiana, Kentucky, Vermont, Pennsylvania, Massachusetts, Connecticut have laws pertaining to the width of tires

Experience goes to show that broad tires are very much to be preferred for drawing loads through fields and on farm roads, as they sink less deeply into the soft earth and employ less draught to move them.

You can haul 505 pounds more on good, hard, sandy roads with a four-inch tire with the same amount of power exerted than you can with a one and one-half inch tire.

You can haul 471 pounds more on level gravel-roads with a four-inch tire with the same amount of power exerted than you can with a one and one-half inch tire.

Towns and cities are no less affected by narrow tires than are rural districts, and it is a little short of absurd that property-owners should go to the expense of laying expensive pavements while those most benefited continue to destroy them with narrow tires. Coal-carts, drays, tonnage and express-wagons on narrow tires should soon become a thing of the past.

To understand the evil effects of narrow tires one has only to observe an empty, springless wagon jolting along the highway, or a loaded wagon ploughing its way through the crust of a gravel road in fall or spring. At all times narrow tires on wagons of heavy draught are the greatest destroyers of roadways.

To get the most benefit from road expenditure, to lessen the cost of road-making and maintenance, narrow tires must be discarded by those engaged in heavy teaming on our roads.

Broad tires, on the contrary, are in a way a benefit rather than a detriment to roads. Their broad surfaces perform the work of rollers in keeping a smooth and compact roadway free from ruts. Wide tires, more than any other means that can be adopted, distribute wear over the surface of the road. Narrow tires do the work of a pick on a roadway, while broad tires do the work of a pounder. The one tears up, the other consolidates.

Statistics show that the relative ease with which a team will haul a ton weight are in the following proportional pulls, required to be exerted by a team per ton weight on the various classes of level roads, as follows:

Earth-road in fair condition, 130 to 160 pounds per ton pull or resistance.

Gravel or hard earth, 60 to 100 pounds' pull per ton.

Macadam in good order, 40 to 60 pounds' pull per ton.

Granite block, smooth and good, 25 to 40 pounds' pull per ton.

Brick pavement, good, 20 to 30 pounds' pull per ton.

Asphalt pavement, good, 15 to 25 pounds' pull per ton.

BROAD TIRES.

It being absolutely necessary to preserve our roads from the destructive effects of narrow tires, the Legislature of 1897 passed the following act, which was vetoed by the Governor because it applied to cities as well as rural communities, and would therefore be very onerous for the cities.

If amended so as to apply only to rural communities, all objections would be answered.

We publish this and the Rhode Island Law, so that those interested in preserving roads may study the salient features of each and be prepared with something tangible for the consideration of our next Legislature :

AN ACT to encourage the use of broad tires on wagons and carts by a rebatement of taxes.

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

1. Township committees or governing bodies of any municipality be and they are hereby directed to allow a rebate of taxes for township, road or street purposes, to all owners of wagons, carts or vehicles having tires of not less than three and one-half inches in width, used in said township or municipality for transportation of goods, wares, merchandise, produce, or for general farm, freight or express purposes, drawn by two or more horses or mules, or a team composed of one horse and one mule ; said rebate shall be three dollars for each wheel in habitual use on the highways of this state on the first day of April, anno domini one thousand eight hundred and ninety-nine ; *and provided further*, that the owner of each vehicle having tires of not less than four inches in width, upon which there is a difference of at least eight inches in the length of the front and rear axle, so constructed that the front and rear wheels will not come in contact with the same road surface while the vehicle in moving in a

straight line, shall receive, in addition to the above rebate, a further rebate in his or her tax as aforesaid of four dollars for each vehicle of this class for each and every year that said vehicle is habitually used upon the highways of this state; and *provided further*, that on April first, or when the regular tax assessment is made during the year one thousand eight hundred and ninety-nine, and during each and every year thereafter, it shall be the duty of the assessor to inquire for and assess any and all wagons, carts or vehicles capable of conveying wares, merchandise, produce, freight, or express goods, drawn by two or more horses or mules as aforesaid, used upon the highways of this state; said vehicle shall be subject to a special road tax of fifty cents for each wheel of a less width of tire than three and one-half inches, said special road tax to be assessed and collected as other taxes, and to be applied to the road fund within said municipality.

2. This act shall take effect immediately.

State of Rhode Island and Providence Plantations.

CHAPTER 456.

AN ACT to regulate the width of tires upon vehicles using the highways of the State.

Passed May 18, 1897.

Section 1. From and after the first day of April, A. D. 1902, no vehicle shall be driven or used on any highway in this State unless the width of the tires on each of the wheels of such vehicle shall be proportioned to the size of the axle of such vehicle, as follows: The word axle as used in this act shall be deemed to mean an axle of iron or steel, or of other material not greater in load-carrying capacity; the axle measurements herein mentioned shall be deemed to mean the size in inches of either the diameter or the square of the axle at the shoulder thereof, and the word tire shall be deemed to mean a flat, smooth band or hoop of iron or steel; the proportion hereinbefore referred to shall be as follows:

Size of axle.	Minimum width of tire.
1 $\frac{3}{8}$ inches,	1 $\frac{5}{8}$ inches
1 $\frac{1}{2}$ inches,	1 $\frac{3}{4}$ inches
1 $\frac{5}{8}$, 1 $\frac{3}{4}$ inches,	2 $\frac{1}{2}$ inches
1 $\frac{7}{8}$, 2, 2 $\frac{1}{8}$ inches,	3 $\frac{1}{2}$ inches
2 $\frac{1}{4}$, 2 $\frac{3}{8}$, 2 $\frac{1}{2}$, 2 $\frac{5}{8}$ inches,	4 inches
2 $\frac{3}{4}$, 2 $\frac{7}{8}$, 3 inches,	5 inches
Larger than 3 inches,	6 inches

Section 2. No vehicle which shall, subsequent to the first day of April, A. D. 1898, be provided with a new wheel or wheels, and no vehicle the wheel or wheels of which shall, subsequent to said date, be new-rimmed with either bent rims or piece felloes, shall be driven or used on the highways in this state, unless the tire on the wheel or wheels thereof are proportioned to the size of axle thereof as provided in section one of this act.

Section 3. This act shall not apply to the apparatus of fire departments, nor to vehicles used upon rails or tramways laid in the highways, or carriages with rubber tires.

Section 4. Every person who shall drive or suffer to be driven any vehicle upon any highway of this state in violation of the provisions of this act, shall be fined not less than ten nor more than twenty dollars for each offence, and it is hereby made the duty of chiefs of police, surveyors of highways and town sergeants to prosecute all violations of this act, and they each shall be exempt from giving surety for costs on any complaint for such violations.

Section 5. All fines collected for violation of the provisions of this act shall be paid to the use of the town or city in which the offence is committed.

TOLL-ROADS.

In response to the general desire that toll-roads in our State shall become a thing of the past, the Legislature at its last session passed an act entitled "An act to provide for the acquirement of turnpike roads for free public use." Under the provisions of this act, petitions for the purchase of two turnpikes have been presented to the State Commissioner of Public Roads, namely, the Camden, Ellisburgh and Marlton stone road and the Westfield and Camden turnpike, part stone and part gravel. The Governor has appointed commissioners to estimate and determine the fair and just value of the said two roads.

The commissioners on the part of the Camden, Ellisburgh and Marlton turnpike have completed their work, and have estimated and determined the fair and just value of said road, ten miles long, to be \$43,043.50, of which Camden county's share will be \$37,373.48 and Burlington county's share will be \$5,670.02. The State Commissioner has ratified the action of the commission, and now, if the freeholders of the respective counties purchase the same, the property-holders along the line of said road will be required to pay \$4,304.35, the State one-third, amounting to \$14,347.83 $\frac{2}{3}$. The county of Camden will be required to pay \$21,178.30 $\frac{8}{15}$ and the county of Burlington will pay \$3,213.01 $\frac{2}{15}$. The State's share will have to be paid out of the appropriation for the fiscal year commencing November 1st, 1897, and ending October 31, 1898, which will leave that much less for the building of new roads, and will make the \$100,000 appropriation, which is now far from being sufficient for the building of the many roads applied for, much reduced, still further accentuating the necessity for additional appropriation for the improvement of public roads.

This year's policy steadily followed will, in a very few years, make free roads of all the toll-roads of the State.

COMMISSIONER OF PUBLIC ROADS.

AN ACT to provide for the acquirement of turnpike roads for free public use.

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

1. Whenever there shall be presented to the state commissioner of public roads a petition signed by the owners of at least two-thirds of the land and real estate fronting or bordering on any turnpike road, praying that said road may be acquired for free public use, and setting forth that they are willing that the peculiar benefits conferred on the lands fronting or bordering on said road shall be assessed thereon to an amount not exceeding ten per centum of the entire cost of the said road, then the governor shall appoint five commissioners from the county or counties through which the said road runs ; the said commissioners, when appointed, shall take an oath or affirmation faithfully and fairly to perform their duties, and shall thereupon proceed to estimate and determine the fair and just value of the said road, having given ten days' notice of the time and place when and where they will meet to hear any representation in behalf of the said corporation or of the board or boards of chosen freeholders of the various counties through which the said turnpike runs, or of the applying freeholders in the said matter ; said notice shall be served upon the president or other chief officer of said corporation, upon the director or clerk of the said board or boards of chosen freeholders, and shall be published at least one week prior to the time of meeting in one newspaper published in each county through which said turnpike runs ; such meeting shall be adjourned from time to time at the discretion of the said commissioners ; when the said commissioners shall have arrived at a price or value of the said turnpike road satisfactory to themselves they shall report the same to the road commissioner, who may thereupon ratify the same and report it to the board or boards of chosen freeholders of the counties through which the said road runs, who may thereupon purchase the same ; and they are hereby empowered to make temporary loans upon the credit of the said county or counties for the acquirement of the said roads as aforesaid.

Turnpike roads may be acquired for public use.

Commissioners appointed.

Hearings had.

Notice given.

Temporary loans may be made.

2. One-third of the cost of all roads so acquired under this act shall be paid for out of the state road appropriation ; *provided*, that the amount so paid shall not in any one year exceed the amount of twenty thousand dollars ; if one-third of such cost shall exceed the sum of twenty thousand dollars, the said sum of twenty thousand dollars shall be apportioned by the governor and the state commissioner of public roads among the counties of this state in proportion to the cost of the roads

Cost.

Proviso.

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acquired by them for such year as shown by the statement of cost filed in the office of the state commissioner of public roads ; the governor and the said commissioner shall, between December fifteenth and thirty-first in each year, certify to the state comptroller the amount to be paid to each county for such year, and the state comptroller shall thereupon draw his warrants in favor of the respective county collectors for the sums certified to as aforesaid upon the state treasurer, who shall pay the same out of any moneys in the state treasury not otherwise appropriated ; *provided further*, that the cost of all turnpike roads acquired under this act in any county in any one year, together with all roads built or repaired, shall not exceed one-fourth of one per centum of the ratables of such county for the last preceding year.

Proviso.

Assessors to include certain amount in county taxes.

3. On or before August first in each and every year it shall be the duty of the board of chosen freeholders to certify to the county board of assessors, either in the annual tax budget or separately, the two thirds of the cost of all turnpike roads acquired so as aforesaid during the year, and the county board of assessors shall include the sum so certified in the county taxes assessed for such year, and the same shall be assessed, collected and paid over to the county in the same manner and within the same time that other county taxes are assessed, collected and paid over ; if a deficiency shall exist in consequence of the receipt of less than one-third of the cost from the state treasury, the board of chosen freeholders shall have authority to borrow on temporary loans to the amount of such deficiency until the next annual taxes shall be assessed, collected and paid over to the county.

Deficiency.

If the road is in more than one county.

4. If the said road shall run through more than one county the petition to the state commissioner of public roads shall be signed by at least two-thirds of the owners of the land and real estate bordering on said road in each county before the governor shall be required to appoint the five commissioners mentioned in the first section of this act ; and each of the said counties shall bear the expenses of the acquirement of the said road in proportion to the length thereof within the said counties, and all proceedings after the appointment of the said five commissioners that may be required by virtue of this act shall be had separately and independently in each of the said counties.

Road to be free and maintained by county.

5. Any road so acquired shall forever thereafter be a free country road, and the duty of keeping the same in good order and repair shall devolve upon the county officers in like manner as heretofore provided for free stone roads.

Benefits assessed by commissioners appointed by court.

6. When the said turnpike roads shall have been so acquired the board of chosen freeholders shall apply to the circuit court.

COMMISSIONER OF PUBLIC ROADS.

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of the county for the appointment of commissioners to estimate and assess the peculiar benefits conferred by such acquirement upon the lands and real estate bordering on the road so acquired, of the time and place of which application notices shall be given by ten days' publication in two daily newspapers printed and circulating within the said counties, then by two weeks' publication in two weekly newspapers printed and circulating therein, at which time and place or at such other time and place as the court shall designate, shall without unnecessary delay, appoint three commissioners, who shall be freeholders and residents of the county in which the application is made, to assess the benefits aforesaid; the said court shall have power to remove any commissioner and appoint another in his place and also fill any vacancy that may occur in the office of any commissioner at any time.

7. The said commissioners shall then proceed in like manner as the commissioners appointed to assess the benefits conferred by the improvement of the public roads of this state under and by virtue of an act of the legislature entitled "An act to provide for the permanent improvement of the public roads of this state," approved March twenty-second, one thousand eight hundred and ninety-five, and the supplements thereto, and the report of the said commissioners when filed and approved shall be a lien upon the properties assessed in like manner, and the said assessment shall be collected in like manner as the assessment in the said last act last before mentioned.

Method of
assessing
benefits.

8. This act shall take effect immediately.

Approved May 11, 1897.

FOURTH ANNUAL REPORT

MACADAM AS IT SHOULD BE.

“A common method of construction at present is to spread a layer of rock of the required thickness upon the properly prepared sub-grade, then to cover the rock with a layer of screenings, the whole to be then well watered and thoroughly rolled with a roller not less than ten tons in weight. The practice has always been to consider the macadam thoroughly rolled and finished when it presents a hard and smooth surface, and under our specifications, when in this condition no additional work or attention can be required of the contractor.

“An analysis of that which constitutes properly built macadam brings out at once the imperfections of the above method. Macadam rock should have sufficient hardness to resist the wearing action of wagon traffic, and the powder of the rock, when fresh, should have sufficient cementing qualities to bind the stones together, and the powder and screenings should be no more in quantity than sufficient to exactly fill the voids and interstices between the stones. It is quite impracticable to accurately measure the depth of a layer of screenings when spread over the uneven surface of a layer of broken rock, and it is equally impracticable to ascertain if a given layer of screenings has entirely filled all the voids under the influence of the roller. A layer of screenings, when rolled dry, will rapidly settle into the interstices of the rock, and will soon disappear entirely, while the same layer, if thoroughly wet before rolling, will cement together, and to a large extent remain upon the surface, and, under the influence of the roller, soon become hard and smooth, leaving what appears to be well-built macadam, while in reality it is nothing more than a layer of broken stone, lying perfectly loose, unbonded and uncemented, covered with a layer of screenings which has been left upon the surface to sustain the action of wagon traffic. In the course of time this layer of screenings is cut and ground up by wagon traffic, and gradually settles down into the interstices of the rock, filling all the voids, and ultimately the macadam, under this influence, becomes hard, compact and homogeneous, and may be said to have reached a state of final repose.

“Several weeks, and in some instances several months or even two or three years' use of the street, is necessary to bring the macadam to that thoroughly hard and compact condition in which it is supposed to be left by the contractor. The method of construction, as stated, accounts mainly for the tendency of macadam to go to pieces during warm, dry weather. It is simply a case of the fragments of rock not being bonded or cemented together as they should be.

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“The most improved methods of building macadam differ very materially from this. The rock is spread in layers of the required thickness, and in some instances without the addition of any screenings, a roller specially built for the purpose, of not less than ten tons' weight, is passed over the rock, the effect of which is to break off the edges and corners of the stones sufficiently to fill the interstices.

“After considerable rolling, the macadam is sprinkled with water, and while the rolling proceeds the quantity of water is increased until the entire mass is wet, and the rolling is continued until the macadam becomes a perfectly solid, compact, homogeneous mass, thoroughly cemented together.

“In other cases screenings are used with equally good results, the extent of the voids in the broken rock first being determined by actual measurement at the quarry and only sufficient screenings to fill the given amount of voids are allowed upon the ground, special care being taken to insure equal distribution, and the whole mass thoroughly watered and rolled as before.

“Rollers of all descriptions are built for various purposes, and experience has proven that beveled wheels of large diameter (not less than six feet) and weighing not less than 600 pounds per lineal inch, are absolutely necessary to insure the desired effect upon macadam. Upon the rolling depends almost entirely the thorough bonding together of the material. In a six-inch layer of loosely-spread broken stone ($2\frac{1}{2}$ -inch size) about 45 per cent. of the vertical depth or thickness is space (voids) which can be taken up only by persistent rolling with a heavy roller, and when thoroughly compacted the layer of stone will be but four inches in thickness.”

BEST METHODS OF ROAD-BUILDING.

During the first three years' building under the State Aid Law, the citizens of Mercer, Burlington, Camden and Gloucester counties would have nothing but telford roads, believing a foundation of large stones was necessary to sustain the traffic; consequently, their roads cost from six to nine thousand dollars per mile. But after many years of satisfactory experiences in Morris, Passaic, Union and Middlesex counties with four, six and eight-inch macadam, and the insistence on the part of your Commissioner that an eight-inch macadam, well constructed of cubical stones one and one-half inches in diameter, is all sufficient for the heaviest traffic, and will stand more wear before re-surfacing becomes necessary than ten or twelve inches of telford, has resulted in a great saving to the public.

Burlington, Middlesex, Morris and Passaic have been this year the happy recipients of many roads that have cost only from three to four thousand dollars per mile. The smallest depth and width, consistent with strength and proper passage of traffic, has been adopted, thus spreading the benefits of the State Aid Law among a greater number of our citizens. In support of the above position, we are glad to be able to print a communication from Mr. A. J. Cassatt, director of Pennsylvania Railroad, who is one of the most successful road-builders :

NO. 26 SOUTH FIFTEENTH STREET,

PHILADELPHIA, March 10th, 1897.

MY DEAR SIR—Since acknowledging the receipt of your third annual report, a copy of which you were so good as to send me, I have read it with much interest, and am particularly pleased to find that you are so emphatically in favor of the macadam system.

After an experience of some fifteen years as Road Supervisor of Lower Merion township, Montgomery county, Pa., during which time I constructed over forty miles of stone roads, using both systems, commencing with the telford, I am strongly of the same opinion, and would not use any other system than the macadam under any circumstances or for any character of sub-grade. In this climate long-continued periods of dry weather, which we are apt to have during the summer, are the worst enemies of stoned roads; the mass disintegrates under the effect of the heat and drought, and the surface of the road soon becomes covered with loose stones. This is especially the case where there is a telford foundation, and this is one of my objections to that system. Another objection is that the surface of finer stones wears off much more rapidly, the large stones at the bottom acting as an anvil and the wheels as hammers to crush and wear out the surface-stones, whereas the macadam always wears smoothly and uniformly, excepting, perhaps, where the bond is broken in the early spring when the frost is coming out of the ground, and the road is liable then to cut into ruts if there is heavy hauling over it; but these ruts are easily filled and the surface restored to smoothness. On the other hand, when the surface of a telford rock becomes worn down to the big stones, there is nothing to do but to re-surface completely. Excepting in the spring, when the frost is coming out of the ground, I have never known a properly drained macadam road to be injured by wet weather.

You are quite correct in stating that the harder the stone the smaller they may be broken to advantage. As we are able to procure trap-rock, which is both tough and hard, delivered at reasonable prices at the most convenient railway sidings, we use only what we call one-inch stone, that is to say, stone of about an inch cube, and that will pass through a one and one-half inch ring. This I put on to a depth never exceeding six inches, and in some cases I have used a depth of four inches successfully,

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water and roll and then put on a binder of screenings of the same stone procured from the crushers. We put enough of this on and no more than is required to bind the whole mass, watering and rolling until it is perfectly compact.

Experience also teaches me that it is useless to make the roads too wide. For any ordinary country road we find it sufficient to spread the stone to a width of twelve feet ; this will be increased to thirteen feet, or perhaps a little more, by the action of the roller. Thirteen feet is sufficient to allow two vehicles to pass without going off the stone, and in our neighborhood, which is a suburban one, and where there is considerable travel on all the roads, I think this is not too wide. In some country districts a lesser width would no doubt do, but it would seem to me that eight feet ought to be the minimum width, and that as between this and twelve feet there would be no necessity for increasing the width, for, unless you went to the latter width, vehicles would have to turn on to the sides of the road to pass each other. On a road narrower than eight feet all the travel would be right in the center of the road, and the wheels would follow each other so that the road would be likely to wear into ruts. This, however, is theoretical on my part, as I have never built any roads less than twelve feet wide.

We use a seven-ton steam-roller by preference, but when the work is pressing we sometimes have to fall back on a heavy horse-roller, weighing about three tons, on a wheel-base of four feet wide, but the steam-roller is more economical and does better work. I am

Yours very truly,

A. J. CASSATT.

Mr. Henry I. Budd, Commissioner of Public Roads.

TRAP-ROCKS FOR ROAD BUILDING PURPOSES.

New Jersey is one of the most favored States in the Union in the possession of immense quantities and great varieties of trap-rock. The trap ridges, commencing at the Palisades, on the Hudson, extend in a southwesterly direction about seventy miles across the State ; they vary in width from twelve to twenty miles. These trap ridges do not uniformly come to the surface over this whole distance, but are in sufficient localities so nicely interspersed that all the railroads passing in any direction through the State north of Trenton intersect and give cheap distribution for the product of the quarries over all portions of the State. The quality of these traps vary very much, therefore it would be wise for the Legislature to make an appropriation, the same as has been done in Massachusetts, to have the different traps analyzed and their wearing qualities tested by machines constructed for the purpose.

In order that we might be able to select those traps which have the most enduring wearing qualities, and as their specific gravity is a large factor in their durability as road materials, we have had, during the past season, the different supervisors weigh, as they came to them, the traps from different localities, in order to determine the specific gravity of each.

A specimen of trap from the Bergen Quarries, used on the Rancocas and Charlestown road, weighed $2,848\frac{1}{2}$ pounds to the cubic yard; a specimen of trap used on the Little Falls road, Essex county, and taken from quarries along the line of the road, weighed 2,700 pounds to the cubic yard; a specimen of surface-trap used in the construction of the Hanover road in Essex county, weighed 2,565 pounds to the cubic yard. The weight of three specimens of trap-rock from Birdsborough, Pa., used in the construction of Market street extension, Camden county, weighed as follows: Bottom stone, 3,229 pounds per cubic yard; $1\frac{1}{2}$ -inch stone, 3,145 pounds to the cubic yard:

Specimens of trap used on the Newfoundland road in Passaic county, and brought from the neighborhood of Paterson, weighed 3,200 pounds to the cubic yard; a specimen of the stone from Chimney Rock near Bound Brook, used in the construction of the Somerville and Bound Brook road, weighed 2,735 pounds to the cubic yard; a specimen of stone from quarries near Chatham, used on the Chatham and Passaic River road, weighed 2,491 pounds to the cubic yard; a specimen of Bergen stone from Shanley's Bergen cut crushers, used in the construction of a road near Rahway, weighed 3,000 pounds to the cubic yard; a specimen of stone from Little Falls, Passaic county, weighed 2,885 pounds to the cubic yard.

Specimens of stone from Lambertville Quarries, used on the Columbus and Bordentown road, weighed 3,100 pounds to the cubic yard; the average of three loads of Lambertville stone, used on the Market street extension, Camden county, was $2,639\frac{1}{3}$ pounds to the cubic yard.

These weights were ascertained by the supervisors of the different roads upon which the stone was used, and, although they may not be absolutely correct, they indicate very nearly the weight of a ton of crushed stone.

We wish we had more accurate data, but have taken the best we can obtain, and hope this will be a movement towards determining the true specific gravity of all stones used in road construction.



Diorite, Showing Interlocked Structure.

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ESSENTIAL QUALITIES OF ROAD-STONES.

Some of our counties have been using their native rocks, boulders, granites, conglomerates, gneiss, etc., for road-stones, the strength of which has been much reduced by long exposure to the elements; consequently, have rapidly disintegrated under traffic into sand and clay, which is rapidly wasting with wind and rain; therefore, we thought for instruction it would be profitable to our roadmakers to present to them a portion of a most valuable essay contributed by C. L. Whittle and published as "Circular No. 29, Road Inquiry, United States Agricultural Department":

Geological study of the rocks and all sources of supply of road-building materials in the United States shows that, although the range in variety is very great, the distribution of stones of the highest grade is not general. First in importance among our road-stones is the class of rocks commonly called traps or dike-stones, and technically known as diabases and diorites. These rocks are not uniformly desirable, but nearly all of them are better than the best of other rocks. An understanding of their qualities may, perhaps, better be had by comparing them with granite, a rock of intermediate value as a road-stone, and with marble, which, by general agreement, is regarded as the poorest.

Rocks of the trap class have a record crushing strength of 29,000 pounds to the square inch, while good granite does not, as a rule, possess a crushing strength of over 20,000 pounds. To this property of the traps, due to their structure, we must add the uniform hardness of the individual minerals—pyroxene, hornblende and feldspar—which go to form so large a part of these rocks. Their hardness is about the same, five to six; the resistance to abrasion depends upon the elements of hardness and toughness, and the latter quality is found to predominate in the dike rocks. In granite, the place of pyroxene and hornblende is occupied by quartz, one of the hardest as well as the most brittle of minerals. When a granite is free from mica, it offers great resistance to wear, but its brittleness and its granular character operate to increase the rate of abrasion. The gradual destruction of the roadbed by the ordinary processes of friction and impact is always to be expected, and the rate of wear would seem to depend directly upon the hardness of road-stone used in its construction, and yet so many factors have to be taken into consideration in choosing a road metal that it is found that the question of hardness, important as it may be when combined with other qualities, singly, is not of greatest consequence. Quartz, the hardest of our common minerals, used alone does not make desirable road-stone, as its dust is lacking in cementing power; it has a low specific gravity and is very brittle, qualities we should seek to avoid in selecting a road material. On the other hand, rocks as soft as limestones and slates are quickly ground to powder and are rapidly carried away by water and wind action. Hardness is of

importance in tending to resist the abrasive effect of wheels and the feet of animals, but brittleness promotes crumbling under the impact of blows thereby delivered.

In diabases and diorites, the feldspars are essentially aluminosilicates of calcium and sodium, and they form one of the unstable compounds, under the influence of their environment on which depends so largely the rapid disintegration of these rocks. When these rocks (which are commonly called "traps" or "dike-stones") are used in road construction, *and are fresh*, little loss from this cause is to be apprehended during the life of a road, but where the *weathered portion of the rock, the sap*, is used, the loss sustained by chemical and mechanical means is considerable. The alteration of feldspar to clay, quartz and calcite so weakens the coherency of the rocks that they readily crumble to powder under pressure, and are converted into fine sand. Wind quickly transports the fine quartz and clay thus liberated from the surface of the road, and rain-water, charged with organic acids derived from decaying vegetation, rapidly dissolves the calcite and carries it away. The organic acids occurring in all water, act as a slow solvent on all the common minerals occurring in road-stones.

The essential mineral pyroxene and the occasional minerals pyrite and black mica in diabases are also prone to decomposition—a change which is aided by the presence of these acids. Diorites contain hornblende, of which the same thing may be said. Although there is considerable loss and injury sustained by road metal from chemical changes, they are relatively much less important than the part played by solution when a rock, composed wholly or in part of calcite, is used. A limestone or marble, which is practically all made up of calcite, suffers a very considerable loss, because it is so readily soluble in rain water when impregnated with acids, making it, with its other objections, the poorest of road metals.

ESSENTIAL QUALITIES OF ROAD-STONES.

A road-stone that will well subserve the needs of a farming community in the South, where the element of frost does not need to be taken into consideration, would quickly go to pieces if subjected to the rigors of our northern winters. Granite, considered a very satisfactory stone in southern localities, would be discarded in other districts. The weight of testimony places this rock among our less desirable stones, but it does not give reasons sufficient to discard it altogether. By comparing traps with other rocks, granite and marble or limestone, used in road-building, we show on what qualities their superiority depends. In practice, the qualities which are commonly regarded as essential in a road stone are resistance to abrasion (which is largely determined by hardness and toughness), cementing and recementing value, freedom from attack of organic or inorganic acids.

The dust resulting from abrasion should be of a nature best to resist the power of the wind, and this dust should be free from mica and be of as



Diabase, Showing Interlocked Structure.

high a specific gravity as is possible, in order that the effect of running water and wind may be reduced to a minimum. Trap-rock possesses nearly all of these qualities. Normally a diabase is made up essentially of feldspar and pyroxene, with or without black mica, and diorite may be considered as the same rock, with the mineral hornblende replacing the pyroxene. A true granite is composed of quartz, orthoclase, feldspar and two micas, biotite and muscovite. The micas are not always present, their place being wholly or in part taken by hornblende or pyroxene. A striking difference between granite, diabase and diorite lies in the fact that the two last do not possess quartz. By reference to the accompanying illustrations the reader will see that there is another difference in the form and arrangement of their constituent minerals. The minerals composing diorites and diabases are interlocked with each other in such a perfect manner as to produce rocks whose toughness and crushing strength is very great. To the effect of this structure must be added the great toughness of the mineral hornblende in diorite and the less toughness of pyroxene in diabase. In the granites the structure is granular, with little tendency toward an interlocking arrangement. In granite, quartz takes the place of pyroxene and hornblende, and is one of the hardest as well as the most brittle of minerals. When granite is free from mica it offers great resistance to wear. No granite can be found whose feldspar is free from some secondary alteration to clay. When this change has gone on to a degree sufficiently great to affect the strength of the stone *it should be discarded as unfit* for road material. Granites in this condition quickly crumble to sand and clay, and the winds sweep away the fine material in dry weather, while in rainy times the road is in a muddy state. If mica be one of the constituents, it is swiftly transported by the winds, owing to its tabular character, or carried off by running water. The rock syenite, which is a granite without quartz, is preferable when it is in reasonably fresh condition, but if badly weathered it is even more objectionable than granite. From the point of view of abrasion, marbles are to be classed among the poorest of all stones used in road construction.

CEMENTATION.

The property of cementation of road-stones is not well understood, because it has not been recognized as one of the qualities of a road-metal. These are: (1) Adhesion between the dust particles produced by capillarity; (2) the binding property of fine material possessing a small quantity of clay, and (3) the induration resulting from the deposition of calcite or other substances when the road's surface becomes dry, which were held in solution in that zone of the road that serves as a roof to the sub-structure. Traps in decomposing yield, among other substances, a certain amount of calcite, clay, quartz and iron oxide. The dust which results from abrasion of these rocks, owing to the character of the minerals present, is possessed of flat surfaces, which would increase the effect of capil-

larity and the binding power of the clay. As the dust dries, the broken stone is more or less indurated by the amount of calcite and iron oxide present in solution. The comparative absence of these substances in granite destroys its cementing qualities. The injurious effects of organic and inorganic acids on road-stones are confined for the most part to rocks containing calcite or dolomite, minerals which they readily dissolve and carry away. Not a little of the loss of substance sustained by a road is caused by wind and water action, and rocks whose minerals are of a high specific gravity and are free from mica are best adapted to resist these processes of destruction. Quartz, being one of the lightest of common minerals, is, therefore, undesirable. Traps are relatively of a high specific gravity, and therefore are less liable to suffer from these forces. Granites or traps which contain mica in any abundance are to be looked upon with suspicion as road materials, as the mica is quickly transported by wind and water action, notwithstanding the fact that it is heavier than the feldspar or quartz. The calcite of marbles is of greater density than quartz, but the readiness with which it becomes pulverized to an extremely fine condition makes it very susceptible to these forces.

RELATION OF DECOMPOSITION TO CEMENTATION.

The calcite derived from the alteration of the feldspar, when deposited from solution during dry periods, acts, to a limited extent, as a binding material, tending to strengthen the rock-dust and increase its attachment to the broken stone. This is true of several other substances.

As furnishing corroboration of the part played by the clay resulting from the decomposition of feldspar in cementing together the fragments of broken stone, laboratory experiments on road-building stones giving the cemented value of powdered rock of various kinds, shows that the maximum cementing value has been obtained from an olivine diabase which was much weathered.

Although granite and syenite contain a great amount of feldspar, the cementing value of these rocks is much less than that possessed by diabases and diorites. The essential differences between these rocks are the presence of quartz in the two former, the shape of the individual minerals composing them, and differences in mineral arrangement and chemical composition. Quartz in granite and syenite occurs in rounded and angular grains. The minerals, pyroxene, hornblende and feldspar in diorites and diabases, on the contrary, occur in prismatic and tabular forms. Here are striking differences in the habit of the minerals constituting these rocks, and the action of cement upon the powder produced from them is very different also. In the case of granite and syenite the shape of the grains after crushing is irregular, the quartz having curved surfaces. Cementation and capillarity will not be so strongly exercised upon grains of this nature as upon those of crushed trap. The cleavage of the feldspar, hornblende and pyroxene, their tabular character, furnishing as they do planes of weakness in the minerals composing our dike



Marble, Showing Granular Structure.

rocks, cause their powder to have flat faces. By the interlocking arrangement of these grains and the increased effect of capillarity, due to their tabular form, we should expect that the cementation value of these rocks would be the highest, and experiment only emphasizes the correctness of this view.

THE EFFECT OF MOISTURE ON A ROADWAY.

The part played by water on crushed stone while undergoing rolling is several fold. In practice, broken stone, completely wet down, is thoroughly rolled with a roller weighing ten or more tons. The wet surface of the angular rock-fragments permits a more thorough compacting, as the water acts as a lubricant, allowing the stones to slip by one another with greater freedom than would be the case were the fragments dry. At the same time the water retains the powdered rock resulting from abrasion of the particles and holds it between the fragments. This process is reactionary and cumulative, for the presence of the powder of attrition acts through capillarity to take up and retain still greater quantities of water until the spaces between the pieces of broken stone composing the upper part of the road become completely filled with powdered rock. Not a little of the cementing or bonding of a road during rolling is, in reality, the effect of capillarity existing between the grains of powdered rock and the adjoining walls. This principle may be observed on our seashores and sand roads. While wet the beach or road may be firm and unyielding, allowing heavily-loaded teams to pass over them, but when dry such places are impassable for heavy teams and difficult of passage for all kinds of vehicles. In this case cementing, as ordinarily understood, plays no part in producing adhesion between the grains. Upon drying, the grains are entirely free to move over one another, having lost the water which served to bind them together. When a macadam road is thoroughly compacted a careful inspection will show that the fragments of broken stone are closely packed together and the spaces between are filled with a fine, powdered rock, which, if derived from a suitable road material, carries a small percentage of clay. Any of our commonly-used road-stones contain an appreciable quantity of clay disseminated in little particles in the feldspar whence it has been derived by the weathering of the rock prior to its removal from the quarry.

As already stated, the microscope shows that the feldspar of our traps and granites and other road-stones is never entirely free from a considerable amount of kaolinization, or alteration to clay. This change has taken place in the crust of the earth to a great depth, and no road material can contain feldspars free from more or less of this

mineral, depending upon the character of the rock and the amount of weathering to which it has been subjected. By the gradual wearing of the feldspar, by the abrasive action of the roller, the wheels of carriages and the feet of animals, a small but important quantity of clay is liberated, and this, in combination with any clayey material that may have been added to the road, serves to furnish the necessary quantity of cement to knit the broken stone firmly together. It is not to be understood that an appreciable quantity of clay acts otherwise than objectionably when used in road-building. As a rule, nothing is more undesirable than the clay element in highway construction, yet a little mixed with some of our Southern limestones serves to increase their cementing and enduring qualities. Upon drying, the powdered rock sets much after the manner of a sandy clay, and serves not only to bind the pieces of rock together, thus giving rigidity to the way, but to retard the wear due to any differential motion of the fragments over one another while the load is passing along the road. A wetting of the superficial portion of a roadway during rains tends, by the expansion of the cement, to knit the surface together and make it impermeable to the passage of water.

From a theoretical standpoint it would seem probable that a certain condition of moisture, instead of being objectionable to a roadway undergoing constant use, is rather desirable than otherwise. A condition of moistness serves to prevent loss of material worn fine by the abrasive action of the wind, and the presence of a thin film of wet dust acts as a cushion to protect the fragments of rock from the rude touch and impact of passing traffic, thus lessening the wear and tear of the surface. In the same manner the moist cement operates to distribute the bearing surfaces of the broken stone and to reduce the local intensity of the friction between one rock and another, although cement in this condition will tend to allow a greater freedom of movement among the broken stones, and hence in this way make the surface more yielding. Assuming that the loss through increased abrasion of material resulting from moist cement between the rock fragments is equal to the saving due to the cushioning effect of a small quantity of moisture on the surface, there still remains a saving to the road by the protection afforded by preventing excessive loss through the action of the wind.

EXCERPTS ON ROAD-BUILDING IN NEW JERSEY.

The system of building roads under the State Aid Act is becoming exceedingly popular among all classes in New Jersey. The farmers.

feared the expense would be greater than they could bear, but the injection of one stone road, be it ever so short, into any community, was an object-lesson which was so easy and pleasant to study it stimulated the residents of other neighborhoods to desire the same kind of an improvement in each of their own sections. The popularity of the work is further intensified because it is undertaken only upon the petition of those to be directly benefited. Those living along the line of such improvements having but a small share—one-tenth—of the cost directly to pay is a still further incentive to petitioners. One-third of the expenses being assured by the State, and the State receiving nearly all its income from corporations, miscellaneous and otherwise, it imposes no tax upon its citizens for the donation, and leaves only fifty-seven per cent. of the cost to be shared by city and country property-holders, thus making the tax very light for the comparatively poor country districts. County taxes being assessed in the cities as well as in the country according to the value of property owned, include the wealthy merchants, manufacturers and insurance companies. Most of the wealth of the State being found in the cities, our system successfully provides for the construction of improved roads without laying much of a burden upon the farmers, not requiring them to contribute more than an equitable share of the expense, according to the wealth of each individual taxpayer. We have demonstrated by building numerous stone highways under the State Aid Law that we can have good roads without overloading with taxes this class of smallest income. The farmers' returns are comparatively small compared with those in other pursuits; therefore, at first they hesitated to subscribe for the building of these improved highways; but they are rapidly learning that by the use of these they can very much add to their net returns by the lessened cost in serving the cities with their products. The cost of so doing has been so much lessened, they are placing on the credit side a very comfortable balance saved over the former mode of transportation. Not only they, but all classes, are benefited. These roads are bringing city people into the country as permanent settlers. The merchant can more easily and readily be brought in connection with the farmer, who is his most profitable customer, and people from long distances can share with him the pleasure in passing over good roads.

The extreme popularity of this movement has been instrumental not only in building over two hundred and forty miles of good roads, but also in causing many hundred more to be petitioned for, which, under the present appropriation, will require many years to build. The question of keeping the present generation on the farm by giv-

ing them better social advantages, through free and easy communication, will probably be solved by this new movement. With stone roads the embargo of mud and sand is rapidly being removed from the country highways of New Jersey, and farmers are finding it as easy to go from the country home to the school-house, market, lecture-room and church as it is for citizens to pass from their homes to the same places. Thus farm life is receiving not only all the delights of rural existence, but the advantages offered by the town; the daily mail, social intercourse with neighbors, etc., brought near. The farms are being transformed into most attractive homes, giving to agriculture a better place among the professions and occupations of life.

There are peculiar reasons why New Jersey should push the work of road-building. The State has two of the largest cities of the country to draw upon for its population. For the better class of the population good roads and convenient transit furnish the best attractions. The great benefits which Essex county has derived from improved roads vastly exceeds the cost of the improvement, and they have made this the richest and most favored county in the State. To the same extent other counties have been and will be benefited by good roads.

Within the present century Switzerland has covered her country with the finest highways in the world. The lesson taught by the roads of Switzerland is that the best of public highways may be built without overloading the country with debt and without burdening the citizens with excessive taxes. In no country in the world is the construction of roadways carried out with more thoroughness. They are models in every respect. If so poor and mountainous a country as Switzerland be able to build good roads, New Jersey should be rich enough to cover all her highways with stone. The French idea that the State should bear a considerable share of the cost of constructing its roads has added wonderfully to French rural prosperity, transforming whole regions into veritable paradises of farming. The rural inhabitant of New Jersey now bears so small a portion of the expense under the State Aid law that his disposition towards the movement is assuming an enthusiastic attitude.

It costs $9\frac{1}{2}$ cents per bushel to ship wheat from Chicago to New York, a distance of 900 miles; it costs 3 cents a bushel to haul wheat on a level road a distance of five miles, and on a sandy road it would cost at least 9 cents per mile to haul it. The saving on a bushel of wheat with good roads for a distance of five miles would be about equivalent to that of 600 miles of transportation by steamer or

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canal-boat, or of 375 miles by railroad. One mile of good roads would make a saving equal to 75 miles of railroad transportation. Thus every mile of good roads places the producer 75 miles by rail nearer to the markets. It is estimated that the cost of hauling five hundred million tons of farm produce to market is two dollars per ton, or just about one billion dollars; it is also estimated that about 60 per cent. of this last amount, or six hundred millions, would be saved each year if farmers were able to do this hauling over good roads.

These statements are startling, but true. They show the importance of good roads. The real cost of transportation that burdens our agricultural classes is the part of it between the farm and the town or railway station rather than between the railway station and the market. The loss due to bad roads is one of the *greatest wastes of energy* connected with farming, as it is carried on in this country. Road and street improvement throughout the United States is becoming a subject of universal interest. Its national importance is such that to-day it absorbs a large share of public attention in every advancing city and State in the Union. It is not a *popular fad* or a *momentary outcry* of the *people*. It is a *deep-seated* movement appealing to the best elements of our civilization. It is a *factor* in public affairs of *increasing* power.

Good roads enlist the attention of business men, bankers, statesmen, farmers, manufacturers, engineers, philosophers and every intelligent citizen, however humble his station in life.

INSTRUCTIONS TO SUPERVISORS AND OTHERS INTERESTED IN
BUILDING AND REPAIRING ROADS.

Points necessary to properly build, bond and preserve good roads :
Select the hardest and toughest stone or rock procurable. Trap-rock excels all others.

All stone should be as nearly cubical as possible, and none should be over one and one-half inches in diameter for the bottom and one inch for the surface.

All stone when applied should be clean and free from tailings, as they bunch, and keep the stones apart, making weak spots where the roller has no effect, and the road will ravel. Use only stone screenings or a strong silicious sand for binder.

Thoroughly drain and compact the earthen base, and give it the same curvature as the finished roadbed. Dry, firm earth is even a

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better base than a telford or large stone foundation, and six and eight-inch roads should be put down in two courses.

Spread the metal at an even depth over the whole surface. Thoroughly water before the roller, which wetting causes the pieces to glide more readily together. Remedy any depressions caused by rolling by adding sufficient stone to bring the surface to the proper level.

For economy and durability of construction the different States and most all of the modern road-builders are using and advocating the use of steam-rollers, and those of not less than ten tons in weight. For gravel or earth roads a horse-roller of six tons is sufficient. If each course of metal is well rolled and compacted, the surface will be so impervious to water it will keep the underlying earth so dry there will be no moisture to freeze, uplift and disintegrate the stone bed.

In the spring, after the frost is well out and the ground is moist, the whole surface should be rolled with a heavy roller. There is nothing which gives better return for the money invested than free application of the roller to the surface.

During the dry season frequently water the roads or cover with a slight coat of sand or loamy gravel. Avoid clay, as it, when wet, uplifts the stone under heavy traffic.

Never allow a rut, hollow or puddle to remain on the road, but fill at once with inch stone. Ruts or depressions which hold water soften the surface and aid rapid grinding, the action of the wheels soon wearing through the metal.

In repairing, coat the middle or horse-track first, and when this is worn in, coat each of the sides in turn; remove all large and projecting stones before applying a new coating.

Never put a stone upon the road for repairing purposes that will not freely pass in every direction through a two-inch ring, and remember that smaller stones should be used for patching and all slight repairs.

Use stone screenings or loamy gravel for binding the newly-laid stones together; road-sweepings, sods, grass and other rubbish will ruin the best road ever constructed.

Rake all loose stones from the bed.

Keep the middle of the road a little higher than the sides, so that rain may run into the side gutters.

Keep the water-table, gutter and ditches clean the whole year through.

Place signs about six hundred feet apart, which should read: "Protect the road; don't all drive in the same track; drive over all

parts of the road to prevent ruts, which are great destroyers of roads." This advice, followed with wide tires, would not only preserve and continually roll the stone roads, but would make good roads out of the poor dirt highways.

In short, a perfectly good road must have a firm and unyielding foundation, good drainage, hard and compact surface, free from all ruts, hollows or depressions, the surface neither too flat to allow water to stand, nor too convex to be inconvenient to the traffic, and free from loose stones.

Fine roads are the result of constant repair, where every defect is promptly corrected before it has time to cause serious damage to the highway.

All bridges and trunks should be replaced with iron, terra cotta or stone. Those of small span, with stone arches or iron pipe. Those of large span, with stone abutments and iron superstructure. Iron beams are cheaper than wood.

All trunks from one to four feet in diameter should be iron pipe. Glazed terra cotta comes next, but it is not as durable on account of frost, which in time decomposes it.

In many parts of our State resort is still had to wood construction, with the result that in from five to ten years they have to be rebuilt. In short, stone, iron and condemned iron pipe are now so cheap there is little excuse, on the score of economy, for using perishable materials.

For further instructions, read specifications.

CITATIONS ON ROAD-BUILDING.

The object of all legislation should be the greatest good to the greatest number ; therefore legislation should be liberal towards good roads, as they are more generally useful than any form of public improvement.

Good roads in the end will not cost as much money outlay as poor ones. No tax is as great as one of bad roads. A bad road is a heavy tax on those who use it, and the worse the road the heavier the tax.

Improved roads bring better prices for farms and farm products. Double loads cheapen transportation.

Can market over good roads when commodities are scarce ; can always ship despite the weather.

Rural homes are more sought after along good roads.

Cannot sell lands advantageously along poor roads. Good roads make brisker demand for farms.

Bad roads cause a decay of agriculture ; they impose the greatest of all burdens on the farmer.

Bad roads cause people to gather into cities.

Wagon-highways are the greatest arteries of commerce.

Civilization to be judged by the roads.

The splendid condition of the roads of Switzerland and France due to perpetual attention.

Experience over a series of years demonstrates a stone road is cheaper than a gravel, although the first cost of gravel is much less.

The trained roadbuilder is just as necessary as the trained doctor, manufacturer or educator.

Result of improved roads :

Tremendous increase in value of farm property.

Facilitates business.

Greater happiness for farmer, wife, sons and daughters.

Good roads shorten distance to be traveled. He who shortens his distance to market gains a great advantage.

Poor roads wear out the horses very rapidly, thus detracting very largely from the profits of the farm.

State aid and organizations absolutely necessary for general improvement of roads.

STEEL RAILS.

S. N. Stewart, C. E., of Cleveland, Ohio, has invented a guide to wagons using steel rails, which destroys the necessity of flanges, heretofore needed on all steel roads to help the vehicles or cars on the tracks. This invention enables the use of a narrow rail, not more than two inches in width and one-half of an inch or less in thickness. With steel at one cent per pound, it adds not more than \$700 to the cost of a mile of macadam road.

Great simplicity is claimed for the invention. The advantages he claims for it are as follows :

It leaves a wide path for the horses' feet, not having to travel on the rail, as they would with one of an eight or sixteen-inch width.

It avoids the friction caused by zig-zagging, as with the horse's rolling gait, and of moving off a flanged rail ; thus saves much wear to team and wagon.

It allows of the use of a comparatively light rail, thus reducing the number of tons needed per mile.

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It makes available a very narrow stone roadway, as wagons cannot vary one-fourth of an inch from a straight line ; thus materially lessens cost.

It would permit the cost of double tracks to be less than the average mile of macadam, while single tracks could be utilized with gravel and sand ballast by having at regular intervals macadam to turn out on.

Reduces the cost of haulage over stone and dirt from 100 to 10—in some cases to 2—the cost of the guides but \$3.00, the weight 25 pounds, and it is claimed that a substantial single-track wagonway with a 2-inch flat rail can be built at \$900 to \$1,000 per mile, and can macadamize $4\frac{1}{2}$ feet between stringers and still keep the total cost of the road below an eight-foot macadam costing \$2,200 per mile, and the wear of the horses' feet on the macadam would be light on account of the one-fifth lessened draft.

Several wagons can be drafted with one guide ; on macadam road five farmers drive to town each with one team and one wagon ; on the steel road one farmer (each in turn) can take the five loads with one team, leaving the four other farmers and teams to remain to plow or do other work.

MOTOR CARS FOR STONE ROADS.

There is an immense interest being manifested in road motors. It is stated that fifteen large motor-car factories are already busily occupied in England, employing 1,000 men. It is predicted that in a short time thousands of electric cabs, landaus and parcel vans will have superseded horse vehicles in London streets. Thus three inventions are coming in to contest the situation with horses—the trolley car, bicycle and the horseless carriage. Only a few years ago, street cars were operated by horses ; now nearly all are operated by electricity. The trolley is not the only enemy the horse has to meet. The bicycle is as great, if not greater adversary than the trolley. All ages are learning to ride and the bicycle has become a prominent part of millions of persons' lives. Although the horse has been displaced by the motor cars and the bicycle, he has maintained his place for the carriage, but if the horseless carriage or motorcycle becomes a success, the horse will be almost driven from his realm ; but what the country loses in the horse it will gain in the lessened wear to the expensive roads that are now being built to make traveling easy for all kinds of vehicles.

LEAGUE OF AMERICAN WHEELMEN AND GOOD ROADS.

The bicycle riders of New Jersey are well organized, their association being known as the New Jersey Division of the League of American Wheelmen. They now number 7,000 in this State and are active in all matters which pertain to the welfare of wheel riders.

One of the chief objects of this league is the improvement of roads. It is preparing and circulating a great deal of literature on this subject. Its official organ is the "L. A. W. Bulletin and Good Roads," which is sent to each member each week.

The League of American Wheelmen tries to keep in touch with State, county and municipal officers who have charge of streets and roads, and is ever ready to do what it can to help in the work of good roads, either in the matter of educating the people or of promoting the plans of this department. The wheelmen so outnumber the drivers of horses in many sections of the State that it is but fair that the demands of this class should be considered.

So great has become the number of wheelmen in all the States of the Union that their influence will, as in the past, be more strongly felt in the Legislatures of their respective States. As has been shown in European states, in each case the quality and condition of the public roads is raised or lowered in about the same measure as the general government bestows or withholds its pecuniary support and official direction; therefore, the intelligence of the American wheelmen has been developed in the direction of securing State aid for their improvement. The more progressive States of the Union are responding to their call, and soon, if their ends are accomplished, they can ride over improved highways from the Atlantic to the Pacific and through and from the Dominion of Canada to the Gulf of Mexico.

Statements by Engineers and Supervisors.

Honorable Henry I. Budd, State Commissioner of Public Roads :

I herewith submit a detailed statement of the cost of the Atlantic county gravel road, completed this year :

Preliminary survey,	\$159 23
Right of way to straighten road,	100 00
Preparation of roadbed,	10,696 36
Bridges extended and strengthened,	227 86
Grubbing sidewalks,	663 54
Stripping gravel-beds,	2,029 44
Digging and carting gravel,	8,907 71
Carting in excess of one-half mile,	4,724 88
Cost of gravel purchased (not donated),	1,059 45
Open ditches,	1,046 21
Engineering expenses,	892 79
Committee expenses,	121 77
Supervisors,	732 25
Advertising,	28 80
Monuments and tools,	11 00
Extra gravel,	48 94
Total cost,	\$31,750 23

J. J. ALBERTSON, *Engineer.*
R. STEELMEN, *Supervisor.*

Magnolia, N. J., November 1, 1897.

Hon. Henry I. Budd, State Commissioner of Public Roads :

We, the subscribers, the engineer and supervisor regularly appointed to direct and superintend the construction and building of the macadam stone road in the township of Willingboro, county of Burlington, leading from the southerly end of the macadam stone road previously constructed at a point in the village of Charleston in the center of the old Salem road, at the distance northwardly from the northerly wall of the new iron bridge over Olive's Mill Creek of one hundred and thirty-five feet and six inches, and extends southwardly the several courses thereof along the middle of the said old Salem road, and ends near the toll-gate at a point six feet northwardly from the middle of the old Beverly and Mount Holly Turnpike road, do hereby certify the contract was awarded to John F.

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Shanley and that the work has been done by them according to the specifications, and the following is a correct statement of the total cost, as per contract :

5,673.34 sq. yds. of macadam at 57 cts. per sq. yd.	\$3,233 80
167 cu. yds. of shouldering at 57 cts. per cu. yd.,	95 19
1,095 lin. ft. of underdrains at 15 cts.,	164 25
	\$3,493 24

Total cost \$3,493 24

CHARLES STOKES, *Engineer.*
B. FRANK BISHOP, *Supervisor.*

Beverly, July 31, 1897.

Hon. Henry I. Budd, State Commissioner of Public Roads :

I herewith submit you an estimate of the cost of building a stone road (telford, macadam and rubble) on the Main street of Moorestown, from the Mount Laurel road to the junction of the Haddonfield road with the Moorestown and Camden turnpike, about one mile :

Telford, macadam and rubble pavement, \$9,000 00

HOWARD PARRY, *Engineer.*
JOSIAH D. PANCOAST, *Supervisor.*

Riverton, N. J., November 13, 1897.

Hon. Henry I. Budd, State Commissioner of Public Roads :

We hereby submit a statement of the cost of building the macadam stone road from Columbus to Bordentown, ten feet wide and eight inches deep.

The grading was done by the townships through which the road passes :

28,554 $\frac{1}{2}$ sq. yds. macadam at 52 cts. per sq. yd.,	\$14,848 31 $\frac{1}{2}$
2,052 feet of underdrains, 9 cts.,	184 68
Supervisor's salary,	480 00
Engineer's salary,	309 65
	\$15,822 64 $\frac{1}{2}$

Total cost, \$15,822 64 $\frac{1}{2}$

PETER E. HARVEY, *Engineer.*
DAVID SHARP, *Supervisor.*

Columbus, N. J., November 13, 1897.

Honorable Henry I. Budd, State Commissioner of Public Roads :

I herewith submit to you the itemized cost of the construction of the macadamized road from the two bridges over the Pensauken creek (being

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the line of Camden county) to West Palmyra Station, in the township of Palmyra and county of Burlington :

4,829 sq. yds. macadam at 50 cts. per sq. yd.,	\$2,414 50
275 cu. yds. of gravel for shoulders at 40 cts. per cu. yd., . . .	110 00
2,906 cu. yds. of cutting at 15 cts.,	435 90
Engineer's salary,	59 21
Supervisor's salary,	180 00
Total cost,	<u>\$3,199 61</u>

HOWARD PARRY, *Engineer.*
 JOEL HORNER, *Supervisor.*

Riverton, N. J., November 13, 1897.

To the Honorable Henry I. Budd, State Commissioner of Public Roads :

I herewith present an itemized statement of the cost of the Florence stone road extending from P. R. R. to the township line :

12,926 $\frac{2}{3}$ sq. yds. macadam at 49 cts.,	\$6,334 07
520 sq. yds. telford at 49 cts.,	254 80
3,225 $\frac{1}{2}$ sq. yds. slag ballast at 44 cts.,	1,419 14
520 sq. yds. extra depth at 7 cts.,	36 40
Intersection at Broad st., 243 1-9 yds., at 49 cts.,	119 12
Draining on Heights, 1,022 ft. at 12 cts.,	122 64
	<u>\$8,286 17</u>
Engineer expenses,	165 75
Supervisor salary,	231 00
Total cost of road,	<u>\$8,682 92</u>

CHARLES T. HARRISON, *Engineer.*
 EDWIN WAINWRIGHT, *Supervisor.*

Florence, August 20, 1897.

Hon. H. I. Budd, State Commissioner of Public Roads :

We herewith submit a statement of the cost of Browning road :

Telford center, 8 ft. wide, 10 in. deep, 13,553 $\frac{1}{3}$ sq. yds. at 70 cts.,	\$9,487 33
Macadam, 2 ft. wide each side, 6 in. deep, 6,776 $\frac{2}{3}$ sq. yds. at 51 cts.,	3,456 10
Macadam approaches 6 in. deep, 179 1-9 sq. yds. at 51 cts., . .	91 35
Gravel shouldering, 430 cu. yds. at 60 cts.,	258 00
Grading, 995 cu. yds. at 30 cts.,	298 50

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Tile drain, 7,716 ft. at 18 cts.,	\$1,388 88
Open ditches,	211 27
Engineering expenses,	455 74
Pipes for culverts (estimated),	377 36
Supervisor's salary,	300 00
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Total cost,	\$16,324 53

J. J. ALBERTSON, *Camden County Engineer.*
G. FRANK DAVIS, *Supervisor.*

Magnolia, N. J., November 1, 1897.

Hon. Henry I. Budd, State Commissioner of Public Roads :

I beg to herewith submit an itemized statement of the cost of Market street extension, Camden county :

8,150.57 sq. yds. of telford at 72 cts.,	\$5,868 41
Engineering expenses,	176 05
Supervisor's salary	180 00
	<hr/>
Total cost,	\$6,224 46

J. J. ALBERTSON, *County Engineer.*
WILLIAM C. WOOD, *Supervisor.*

Magnolia, N. J., November 1, 1897.

Hon. Henry I. Budd, State Commissioner of Public Roads :

I herewith furnish you a statement of the cost of the White Horse road extension, Camden county :

Preparation of roadbed,	\$284 50
1,905 sq. yds. of telford, at 74 cts.,	1,409 70
Engineering expenses,	50 83
Supervisor's salary,	165 00
	<hr/>
Total cost,	\$1,910 03

J. J. ALBERTSON, *County Engineer.*
WILLIAM C. WOOD, *Supervisor.*

Magnolia, N. J., November 1, 1897.

Hon. Henry I. Budd, State Commissioner of Public Roads :

The following is the cost of grading and paving with telford pavement the Little Falls road, in the town of Montclair, Essex county, New Jersey

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Grading—4,513 cu. yds., at 22 cts.,	\$992 86
Pavement—8,453.2 sq. yds., at 44½ cts.,	3,761 67
Total,	<u>\$4,754 53</u>

JAMES OWEN, *County Engineer.*
HENRY SPEER, *Supervisor.*

Newark, N. J., October 28, 1897.

Hon. Henry I. Budd, State Commissioner of Public Roads :

The following is the cost of grading and paving with telford pavement, Mt. Pleasant avenue, from the end of the present pavement to the Hanover bridge, in the Township of Livingston, County of Essex, State of New Jersey :

Grading—12,020 cu. yds., at .25,	\$3,005 00
Paving—13,216 sq. yds., at .46,	6,079 36
	<u>\$9,c84 36</u>

JAMES OWEN, *County Engineer.*
S. B. WINANS, *Supervisor.*

Newark, N. J., Oct. 28, 1897.

Hon. H. I. Budd, State Commissioner of Public Roads :

I herewith forward you a detailed statement of the cost of the second section of the Westville and Glassboro stone road, in Gloucester county :

Total length, 29,665 feet.
Deducted for bridges, 89.2 feet.
Net length of stone work, 29,575.8 feet, by 10 feet wide.

32,862 sq. yds. macadam, at 79 cts.,	\$25,960 96
111 1-9 sq. yds. 4 in. ex. deep, at 7 cts. per inch,	31 11
500 feet tile drain, at 12 cts.,	60 00
Preparation of roadbed,	142 22
532 cu. yds. gravel for shouldering, at 60 cts.,	319 20
Engineering expenses,	561 48
Supervisor's salary,	543 00
Legal expenses,	11 50
Advertising,	14 80
Committee expenses,	32 03
Strengthening bridges, replacing wooden trunk with iron pipe,	<u>959 26</u>
Total cost,	<u>\$28,635 58</u>

J. J. ALBERTSON, *Engineer.*
THOMAS B. KIER, *Supervisor.*

Magnolia, N. J., November 1, 1897.

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Hon. H. I. Budd, State Commissioner of Public Roads :

Herewith we submit a statement of the cost of grading and construction of the Lawrenceville and Princeton road in Mercer county, New Jersey, under the State Aid Law :

To 30,947 $\frac{7}{8}$ yds. telford, at 79 cts.,	\$24,448 74
To 6,107 $\frac{3}{8}$ yds. macadam, at 47 cts.,	2,870 34
To 17 $\frac{3}{8}$ yds. telford wings, at 79 cts.,	135 00
To 231 $\frac{1}{8}$ yds. macadam wings, at 47 cts.,	108 62
To 11,594 yds. earth excavation, at 25 cts.,	2,898 50
To 9,120 yds. rock excavation, at \$1.50,	13,680 00
To 2,078 yds. binder, at 75 cts.,	1,558 50
To 6,326 yds. shoulder, at 75 cts.,	4,744 50
To 1,573 yds. extra haul, at 25 cts.,	393 25
To 6,360 ft. sole tile drain, at 16 cts.,	1,017 60
To 730 ft. of 10 and 15-in. pipe, laying, placing, etc., at 40 cts.,	292 00
To 340 ft. of 8-in. pipe, laying, placing, etc., at 15 cts.,	51 00
To sundry extra work, men, teams, etc.,	589 60
	<hr/>
	\$52,787 65
To Supervisor,	713 00
To engineering expenses,	1,337 51
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Total cost,	\$54,838 16

W. E. H. ROUSE, *Supervisor.*
JOSEPH L. WATSON, *Engineer.*

Trenton, October 20, 1897.

Hon. Henry I. Budd, State Commissioner of Public Roads :

The following is the final estimate of the cost of the Metuchen and Perth Amboy road :

33,978 $\frac{3}{8}$ sq. yds. macadam, at 59 cts.,	\$20,047 41
12,794 cu. yds. extra excavation, at 25 cts.,	3,198 50
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Total cost,	\$23,245 91

F. L. BUCKELEW, JR., *Engineer.*
GEORGE T. COMMINGS, *Supervisor.*

Jamesburg, N. J., November 24, 1897.

Hon. Henry I. Budd, State Commissioner of Public Roads :

Below please find statement of cost of stone and gravel road from Long Branch to Asbury Park, in the county of Monmouth, New Jersey :

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27,862 sq. yds. 8 in. macadam at 79 cts.,	\$22,010 98
12,961 sq. yds. 10 in. telford at 94 cts.,	12,183 34
11,360 lin. ft. 4 in. underdrains at 7 cts.,	795 20
7,478 cu. yds. gravel at 89 cts.,	6,655 42
2,354 cu. yds. excess excavation at 15 cts.,	353 10
850 sq. yds. stone gutters at 85 cts.,	722 50
Iron pipe, culverts and catch-basins,	693 29
Resetting curbing,	60 83
Repairing washouts,	177 97
782 cu. yds. of gravel to finish portion of road now in litigation at 89 cts.,	695 98
Supervisor's services,	625 50
Engineering expenses,	1,330 00
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Total,	\$46,304 11

W. H. DENYSE, *County Engineer.*
 JOHN A. EATON, *Supervisor.*

Long Branch, N. J., October 1, 1897.

Hon. Henry I. Budd, State Commissioner of Public Roads :

We hereby certify that J. B. Salmon has completed the grading and paving on the three sections of roads, in the township of Roxbury, county of Morris, and the following is an itemized statement of the work :

Section 1.

1,896 cu. yds. earth excavation at 25 cts.,	\$474 00
15 cu. yds. rock excavation at \$1.00,	15 00
Overhaulage 749 cu. yds. 950 feet at .095	71 16
230 feet stone drain at 16 cts.,	36 80
6,806.66 sq. yds. 6 in. macadam pavement at 34 cts., . .	2,314 26
<hr/>	
	\$2,911 22

Section 2.

3,258 cu. yds. earth excavation at 25 cts.,	\$814 50
8,724.44 sq. yds. 6 in. macadam pavement at 33 cts., . .	2,879 06
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	\$3,693 56

Section 3.

430 cu. yds. earth excavation at 26 cts.,	\$111 80
2,787 sq. yds. 6 in. macadam pavement at 34 cts., . .	947 58
32 feet 12 in. tile drain at 45 cts.,	14 40
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	\$1,073 78.

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Engineering expense,	\$431 86
Supervisors,	237 00
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Total,	\$8,347 42

R. C. SHAN,
Supervisor Section 1.
M. H. FANCHER,
Supervisor Sections 2, 3.
WILLIAM E. KING,
County Engineer.

Morristown, N. J., October 23, 1897.

Hon. H. I. Budd, State Commissioner of Public Roads :

We hereby certify that Daniels & Stanley have completed the grading and paving on Budd's lane, or Passaic avenue, in the township of Chatham, county of Morris, and the following is an itemized statement of the work :

3,058 cu. yds. of earth excavation, at 25 cts.,	\$764 50
26 cu. yds. of rock excavation, at \$1.25,	32 50
400 cu. yds. overhauling—500 feet at 5 cts.,	\$20 00
200 " " 400 " 4 cts.,	8 00
450 " " 2,000 " 20 cts.,	90 00
	<hr/>
	118 00
8,952 sq. yds. 6 in. macadam, at 45 cts.,	4,028 40
2,572 sq. yds. 4 in. macadam, at 45 cts.,	1,157 40
2,625 sq. yds. 6 in. telford, at 22 cts.,	577 50
50 lin. ft. stone drain, at 12 cts.,	\$6 00
30 lin. ft. 4 in. drain pipe, at 10 cts.,	3 00
60 lin. ft. 3 in. drain pipe, at 10 cts.,	6 00
	<hr/>
	15 00
Supervisor,	252 00
Engineering expense,	242 95
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Total,	\$7,188 25

WILLIAM E. KING, *County Engineer.*
WILLIAM E. BUDD, *Supervisor.*

Morristown, N. J., October 16, 1897.

Hon. Henry I. Budd, State Commissioner of Public Roads :

We hereby certify that F. N. Taft has completed the grading and paving on the Long Hill road, in the township of Passaic, county of Morris, and the following is an itemized statement of the work :

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4,081 cu. yds. earth excavation, at 25 cts.,	\$1,020 25
420 cu. yds. rock excavation, at \$1.50,	630 00
11,905.6 sq. yds. 4 in. macadam pavement at 30 cts.,	3,571 68
3,111.1 sq. yds. 6 in. macadam pavement at 40 cts.,	1,244 44
500 sq. yds. 6 in. telford pavement, at 20 cts.,	100 00
110 feet 12 in. tile drain pipe, at 40 cts.,	44 00
100 feet 3 in. tile drain pipe, at 10 cts.,	10 00
112 feet 12 in. iron drain pipe, at \$1.25,	140 00
1,492 feet 18 in. stone drains, at 12 cts.,	179 04
Supervisor,	234 00
Engineering expenses,	341 40
	\$7,514 81

WILLIAM E. KING, *County Engineer.*
 JOSEPH P. LEONARD, *Supervisor.*

Morristown, N. J., October 16, 1897.

Hon. Henry I. Budd, State Commissioner of Public Roads :

The grading and macadamizing of Rea avenue, from Fourth avenue to Cherry lane, is finished, and the following is a true statement of the work done and the cost thereof :

7,657.5 sq. yds. of 4 in. macadam at 25 cts. per sq. yd.,	\$1,914 26
5,584.66 cu. yds. earth excavation at 24c per cu. yd.,	1,340 32
108 lin. ft. of 30 in. cast-iron pipe at 3.25 per lin. ft.,	351 00
37 lin. ft. of 18 in. vitrified pipe at 75 cts. per lin. ft.,	27 75
91½ sq. yds. paved gutters at 60 cts. per sq. yd.,	54 90
	Total, \$3,688 23

JAMES WALL, *Supervisor.*
 WILLIAM L. WHITMORE, *County Engineer.*

Paterson, N. J., Sept. 7, 1897.

Hon. Henry I. Budd, State Commissioner of Public Roads :

The grading and macadamizing of the Echo Lake road, from the Paterson and Hamburg turnpike to the Echo Lake Post Office, is finished, and the following is a true statement of the work done and the cost thereof :

20,594.00 sq. yds. 4 in. macadam at 27 cts. per sq. yd.,	\$5,560 38
7,791.56 cu. yds. earth excavation at 20 cts. per cu. yd.,	1,558 31
3,117.98 cu. yds. solid rock at \$1.00 per cu. yd.,	3,117 98
9,089.83 cu. yds. loose rock at 30 cts. per cu. yd.,	2,726 95
90 lin. ft. of 8 in. vitrified pipe at 60 cts. per lin. ft.,	54 00
20 lin. ft. of 10 in. vitrified pipe at 67½ cts. per lin. ft.,	13 50

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20 lin. ft. of 12 in. vitrified pipe at 75 cts. per lin. ft.,	\$15 00
511 lin. ft. of 15 in. vitrified pipe at 90 cts. per lin. ft.,	459 90
168.83 cu. yds. of dry wall at \$1.50 per cu. yd.,	253 24
111.18 cu. yds. of rubble masonry at \$4 00 per cu. yd.,	444 72
Extra filling,	130 00
241 sq. yds. of paved gutters at 47 cts. per sq. yd.,	113 27
900 sq. yds. of bottom stone at 25 cts. per sq. yd.,	225 00
362 sq. yds. of filled gutters at 75 cts. per sq. yd.,	271 50
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Total,	\$14,943 75

HORACE MABIE, *Supervisor.*

WILLIAM L. WHITMORE, *County Engineer.*

Paterson, N. J., September 7, 1897.

Hon. Henry I. Budd, State Commissioner of Public Roads :

The following is a statement of the work done on the Little Falls road, Passaic county :

14,463 sq. yds. of macadam at 20 cts. per sq. yd.,	\$2,892 60
12,917 cu. yds. earth excavation at 20 cts. cu. yd.,	2,583 40
4,908 cu. yds. solid rock at 84½ cts. cu. yd.,	4,147 26
261 lin. ft. of 15-inch pipe at 53 cts. lin. ft.,	138 33
115 sq. yds. cobble-stone paving at 60 cts. sq. yd.,	69 00
36 cu. yds. rubble masonry at \$3.00 cu. yd.,	108 00
200 sq. ft. bluestone flag at 26 cts. sq. ft.,	52 00
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Total cost,	\$9,990 59

WILLIAM L. WHITMORE, *County Engineer.*

NATHANIEL BROOKS, *Supervisor.*

Paterson, N. J., November 1, 1897.

Hon. Henry I. Budd, State Commissioner of Public Roads :

We herewith submit to you the cost of the construction of Union avenue, leading from Gaston avenue, in the town of Somerville, to Green Brook in the borough of Bound Brook : Total length, 21,235 feet.

35,952 sq. yds. of 8-in. macadam at 43 cts.,	\$15,459 36
533.3 sq. yds. of 12-in. macadam at 63 cts.,	335 98
1,244 sq. yds. of 12-in. rock at 60 cts.,	746 40
1,916 cu. yds. of extra excavation at 23 cts.,	440 68
496 cu. yds. of excess cartage at 45 cts.,	223 20
800 lineal feet tile drain at 22 cts.,	176 00
Retaining walls,	676 00

COMMISSIONER OF PUBLIC ROADS.

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Repair of damage by washout,	\$129 50
Engineering expenses,	817 25
Supervisor's salary,	492 00
	<hr/>
Total cost,	\$19,496 37

JOSHUA DOUGHTY, JR., *Engineer.*
ELON S. ROGERS, *Supervisor.*

Somerville, N. J., November 6, 1897.

Hon. Henry I. Budd, State Commissioner of Public Roads :

We herewith submit to you the cost of the construction of Mountain avenue, leading from Somerset street, in Borough of North Plainfield, to Green brook, the county line :

Total length, 11,548 feet.	
20,529.8 sq. yds. of 10-in. rock, at 43 cts.,	\$8,827 81
1,622.2 cu. yds. of extra excavation, at 20 cts.,	324 44
487.5 cu. yds. excess carting of binder, at 15 cts.,	73 12
Engineering expenses,	467 45
Supervisor's salary,	426 00
	<hr/>
Total,	\$10,118 82

JOSHUA DOUGHTY, JR., *Engineer.*
S. B. WHEELER, *Supervisor.*

Somerville, N. J., November 6, 1897.

Observations by Correspondents.

November 30, 1897.

Hon. James A. Gary, Postmaster-General :

My DEAR SIR—You are credited by the press with being strongly in favor of a system of *postal saving depositories*, but some of the writers raise difficulties about the investment of the deposits. I venture, therefore, to make the suggestion that no better possible investment could be had than in *county bonds issued for road-building*. Such bonds are the very safest of investments, since their avails, properly applied to road-improvement, will vastly increase the value of property in the county and the bonds thus multiply their own security.

It seems to me that the two schemes—postal savings and road-building—naturally go together and support each other.

One great advantage of this arrangement would be, that the money deposited in country districts would come back into circulation there, forming an "endless chain" of benefits.

A further advantage, from the road-building point of view, would be that the poor and sparsely-settled counties would get their road-money at as low a rate of interest as those which are rich and populous.

The Government could be further secured by the State's guaranty of the bonds, by its own supervision of the road-building, and, if necessary, by the State conferring upon it the right to collect tolls on the roads in case of default in payment of interest or principal.

I shall be glad to go more into details in this matter, if it proves to possess any interest for you.

Very respectfully yours,

(Signed) ROY STONE,

Acting President, National League for Good Roads.

LOANING THE ACCUMULATIONS OF POSTAL SAVINGS BANKS TO COUNTIES
FOR BUILDING STONE ROADS.

UNITED STATES DEPARTMENT OF AGRICULTURE, }
OFFICE OF ROAD INQUIRY, }
WASHINGTON, D. C., December 2, 1897. }

Hon. Henry I. Budd, State Commissioner of Public Roads :

DEAR SIR—I send you herewith a copy of the annual report of the Hon. James A. Gary, Postmaster-General of the United States, and beg leave to

ask your especial attention to his exposition of the advantages and feasibility of establishing the postal savings system in this country. I send you also copy of my letter to him on behalf of the National League for Good Roads, written before his report came into my hands.

Upon further consideration of the subject, I am convinced that this project, carried out in the direction indicated in my letter, opens the way we have so long sought for the improvement of the highways on a National scale, and a way independent of direct National aid, which, however wise and proper, could only be secured after a bitter contest ; a way, moreover, requiring no increase of local taxation.

The only obstacle to the postal-savings plan is the difficulty of finding proper investments for the funds deposited ; the Government having taken the people's money and agreed to pay interest on it, must lend it somewhere in order to make that interest. It would be especially unfortunate if, having taken the money of country districts, where it is scarce at best, the Government should carry it to the money centers to invest.

The ideal operation would be one which, while drawing the money out of its hiding-place or idleness in the rural districts, and making it earn interest for its owners, should put it actively at work in the same districts earning money to reimburse the Government, and at the same time adding wealth to the region through public improvements. The proposed investment in county bonds issued solely for road improvement, and with the proceeds under sufficient Government supervision, would meet these conditions in the highest degree.

In view of the perfect security offered and of the great public benefits to accrue, the government could well afford to incur the small additional expense of handling these funds, and loan the money at the same rate of interest that it pays to the owner. Suppose the rate to be $2\frac{1}{2}$ per cent., the interest on the bonds could easily be taken from the ordinary road funds of the county, and, as the county roads would need no repairs during the construction years, the road tax could either be lessened for the time or applied to the improvement of local roads. Some counties, of course, would be too conservative to accept this plan, but there would be enough ready and willing to take advantage of it to show its benefits and ultimately lead the others to its adoption.

For this purpose long-term bonds would be more desirable than short ones, and payment would not be required in less than a hundred years, if then ; so that no present provisions need be made in reference to the principal, except that the county should have the privilege of payment after thirty or fifty years.

This matter is of such importance as to deserve the careful study of the friends of good roads, and I shall be greatly pleased to have your views and suggestions regarding it, and, if you consider it favorably, to have your recommendations as to the best methods of advancing the whole project.

Very truly yours,

ROY STONE,

Acting President, National League for Good Roads.

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UNITED STATES DEPARTMENT OF AGRICULTURE,
 OFFICE OF ROAD INQUIRY.
 WASHINGTON, D. C., December 21, 1897.

Hon. H. I. Budd, State Commissioner of Roads, Trenton, N. J. :

DEAR SIR—I have been led by a suggestion of Mr. George William Hill, of this department, to consider the possibility of combining the rural free delivery of mails with the daily care of the roads. In view of the fact that experiments have recently been made in rural free delivery in many of the States, but not in New Jersey, where the condition of the roads is the most favorable, I would recommend, for your consideration, the plan of making a combined experiment of this sort in some of the good road regions of your State; that is, to have the postman, who now gives the Government about one half of his time for \$300 a year, devote the remainder of it to the care of the roads, as he returns from his tour of delivery, and be compensated for this by the county.

In Circular 24, of this office, Mr. J. O. Sanford, of the Board of Agriculture of Vermont, gives the "practical results" of the daily care of common roads.

He says: "Ordinary country roads do not wear out; they wash out and freeze out. Water is the great road-destroying element." "The chief work done by country people on the public highways is in repairing the damage consequent upon neglect." "After the road is put in good condition one man can easily keep in good condition and care for a long stretch." "The general results are that much better roads are secured at less expense, and the tax rate for highways has been reduced each year as the roads grew better and we learned to maintain them free from damage at less cost."

It has not been, heretofore, considered practicable elsewhere in this country, on account of the expense, to keep a man constantly on the road; but this proposition furnishes a chance to divide that expense, and so help on both the free delivery of the mails and the care of the roads. The carrier could be equipped with a few light tools, which he could carry on his bicycle if the road was in good condition, or, when it is bad, in his spring wagon; and he could have a light one-horse roller and scraper with which he could make an occasional trip at times when the roads were drying or freezing. He could also have some convenient arrangement for carrying a small amount of material, broken stone or gravel (which could be left ready for him beside the road) to fill a small depression before it became a mud-hole. He would, of course, take pains during every rain-storm to open the drains and turn off the water which might be filling and following the wagon-tracks, and, in this way, his work would count a hundred times over in saving the great work of road repairs. He would also throw loose stones out of the road, and with a light hammer break off the points of those which are fast. After wind-storms he could carry an axe to cut out fallen timber, and he would at all times give notice to the road supervisors of any larger work requiring

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attention, and report to higher authorities whether this attention was promptly given.

The Post Office Department is very favorably inclined toward this suggestion, and if you are disposed to take it up, as I hope, I shall be glad to assist in arranging the details.

Truly yours,

ROY STONE,

Director.

Report on Florence Road.

This road, running from Florence Station, P. R. R., Amboy division, to Burlington township line, south of R. D. Wood & Co.'s iron furnace, is one of the Burlington county, New Jersey, State-aid roads, one and three-fourths miles long. By the advice and request of the Road Inquiry of the United States Department of Agriculture, a portion of this road was constructed with a slag base or foundation. At the request of the Director of Road Inquiry, I visited the road several times during its construction. The work was under the direction of Charles T. Harrison, Engineer for the County of Burlington. The work on the road began April 1 and was finished about July 1, 1897. The slag used was from the iron works of R. D. Wood & Co. at Florence, manufacturers of cast-iron water-pipes. The slag was taken from the base of iron pots. It cools rapidly when brought to the air, and is of the nature of glass. The large lumps, being brittle, are readily broken. The foundation, six inches in depth, was laid of this slag on one-half mile of this road. The earth foundation was mostly of sand, dry and loose. Some of the slag was put down as telford foundation, laid by hand, sharp, protruding points broken off, voids filled with small pieces and earth spread over as a filler; on this the surface of four inches of one and a half inch trap-rock was laid, covered with coarse sand and ground stone for filling and binding, and rolled to a smooth, hard surface. Only a small portion was laid as telford, on account of the sharp edges of the slag cutting the hands of the workmen. The greater part of the half mile of slag foundation was broken up with hammers to two-inch size and put on six inches in depth, well covered with sand and earth, and well rolled and compacted before the surface of trap-rock was put on. The balance of the road, one and one-quarter miles, was all of trap-rock of macadam construction. My last visit was to examine the wear of this road. I examined it September 18 last and found it as good as when finished the last of June. The part of the road constructed with slag foundation was as smooth and hard as where all was stone. The slag foundation was located nearest to the iron furnace where all the heavy teaming is being done, and was constantly traveled every working day by heavy, two-wheeled carts carrying from one to two tons, and four-wheeled wagons with iron pipes, weighing several tons. Thus far there is every reason to believe the slag foundation, which is indestructible by the elements, will remain firm and hard, as no wheels will come in contact with it.

The cost of the road, with slag foundation, was 44 cents per square yard, and that of stone 54 cents per square yard.

E. G. HARRISON,

*Agt. Road Inquiry, Department of Agriculture,
Washington, D. C.*

**Report on Bog Iron Ore Road, Englishtown, Monmouth County,
New Jersey.**

I visited this place for the purpose of examining the above road November 9th.

The road runs from the village of Manalapan to the railroad station at Englishtown, and is 3.81 miles long. The bed or foundation is of bog iron ore, found in that vicinity. The width was twelve feet, depth of foundation six inches. It was put down in two courses of sufficient depth to make three inches after rolling. The roller used was a horse-roller of 6,000 pounds. Water was applied in sufficient quantities to secure a firm set. Upon this foundation there was placed about two inches of Jamesburg gravel, which was also rolled. About one mile was made of all gravel, as the haul of iron ore was found too far to be profitable.

The contract price of this road was 21 $\frac{3}{4}$ cents per square yard, making the total cost \$7,599.99.

Bog iron ore does not make a good surface for a road, as it crushes easily under wheels and goes into dust, but it makes an excellent foundation for either gravel or stone.

I saw a number of the citizens of this section, and they all expressed themselves as pleased with the road.

E. G. HARRISON,
Agt. Road Inquiry, Department of Agriculture,
Washington, D. C.

Hon. Henry I. Budd, State Road Commissioner, Trenton, New Jersey:

DEAR SIR—The season of stone-road building for 1897 is nearing its end. Burlington county has added ten miles of stone road to its system of road improvement. While this is much better than no addition at all, it is much out of proportion with the wishes and sentiment of the people.

The stone-road movement has been popular in Burlington county from the time of the introduction of the Stone Road Act, and the sentiment has outgrown the expectations of its projectors. In formulating the bill it was their purpose to stone the leading and long thoroughfares connecting the principal cities and towns of the State. The refusal of the Boards of Chosen Freeholders to act necessitated the formation of another bill mandatory in character and which did not distinguish between roads to be built. In Burlington county, immediately after the institution of the act, petitions for by-roads and all kinds of public roads have been pouring in to the Board of Chosen Freeholders to receive their formal official recognition and disposal, to be consigned, probably, to oblivion in awaiting their

turn when the State Road Commissioner would give his endorsement and say that State aid was available.

When the original Stone Road Bill was enacted, the annual stone-road appropriation was fixed at \$75,000, which sum was considered sufficient for the purpose intended—the improvement of the leading thoroughfares only; but to satisfy the demands of the public under the present law, which includes and makes liable any and every public road in the State, the present annual appropriation of \$100,000 is inadequate, and double the appropriation should be made. All public-spirited citizens and more than twenty thousand wheelmen of Burlington county expect you, the State Road Commissioner, to recommend to the Governor and the Legislature an increased appropriation, and they further expect these chosen representatives in the Legislature to support the measure.

The wheelmen of Burlington county are instituting strong local organizations in every town and city. They are a political organization as far as stone road improvement is concerned; they are intelligent and determined; they express disapproval of the experimental methods of keeping in repair the surface of the newly constructed stone roads; they object to clay, dirt or anything being used which makes a muddy surface in damp and wet weather; they would like to have trap-rock screenings and nothing else if practicable.

Such permanent roads as the wheelmen and modern vehicles want are desirable, and can be made practicable by a tax of one dollar per annum for the County Road Fund being consented to and imposed upon each bicycle and pneumatic vehicle.

In reply to your question as to whether the lands fronting on the new stone roads in Burlington county have increased in value, would say that, while the answer is positively in the affirmative, it will not be admitted by all, from the fact that some properties fronting on the new stone roads can now be bought, in the winter of 1897, for less money than they could have been in 1890, before the stone roads were built. Such a comparison of prices cannot be intelligently applied to the question at a time when all values are falling and depreciating in proportion to the appreciating and increasing value of money. The only true method of judging is to compare the values of two properties of the same size, character and improvements, one fronting on an improved stone road and the other fronting on the old-fashioned dirt road. In Burlington county the one fronting on the stone road can find a purchaser in the dead, depressed real estate market at a price twenty-five per cent. higher than the dirt-road property.

Concerning the State Specifications for stone-road construction issued the early part of this year, I think they merit the approval of stone-road students, excepting some think the bottom course of macadam construction should be of coarser stone, not less than one and one-half inches and not more than two and one-half inches in diameter. There are some who acquiesce in the opposition of the contractors to the mention of limestone binder in Article 5. I am of the opinion that limestone binder is the

proper material to bond a stone road, and I will be of the same opinion until I see it tested and proved to the contrary. Contractors say it will increase the cost of road building from five to ten cents per square yard. There is no reason why it should. The natural deposits are as near; the supply is inexhaustible; it is a softer stone; it will cost less to crush; therefore, everything considered, it should cost less than trap-rock.

Limestone binder should bond the whole road construction to within one inch of the top. Trap-rock binder and screenings should penetrate the road one inch and make the smooth finishing surface. This construction, thoroughly consolidated by the use of water and roller, will make the model and durable stone road.

Congratulating you upon the courteous, impartial and able administration of your office,

I am yours respectfully,

CHARLES STOKES, *Engineer.*

Beverly, N. J., December 7, 1897.

MAGNOLIA, N. J., November 15, 1897.

Honorable H. I. Budd, State Commissioner of Public Roads, Trenton, New Jersey:

DEAR SIR—It is with great pleasure that Atlantic county announces that it has completed its share of the great State Road from Philadelphia to America's greatest seaside resort, Atlantic City.

In 1894 the State and county officers conceived the idea that a thoroughfare across the State would be desirable although very expensive, particularly so when the locality through which a straight line would pass is largely unimproved. There were large tracts of woodland owned by non-residents who would not take any interest in road improvement. To meet just such emergencies our Legislature in 1895 passed an act enabling the Boards of Freeholders of the various counties to declare their intention, by a resolution, to improve a road by State and county aid without the usual petition signed by two-thirds of the abutting property owners, who pay ten per cent. of the total cost.

Atlantic county availed itself of this provision in the law and last year commenced the great road, which was completed this spring, extending from Hammonton to Atlantic City meadows at Absecon, at a total cost of \$31,750.23 for 22.1 miles.

There is an old incorporated toll-road across the meadows to Atlantic City. This, I think, will soon be bought from its stockholders by State and county aid, in pursuance of an act passed at the last session of our Legislature to meet such cases.

The Atlantic county road is built in accordance with my specifications published in your last report, of local gravel, which is mostly of excellent quality. It is graded to width of 30 feet. The gravel bed is 14 feet wide,

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which is too narrow to accommodate the summer carriages and bicycle travel. On special days there were more than 5,000 bicycles passing over this road to the sea. The earnings of this turnpike road have been increased many times by the tolls derived from cyclists. It will necessitate a much greater expenditure to acquire this toll-road now than would have been necessary one year ago, before the county road was built.

Atlantic county has decided to build another gravel road from Egg Harbor City to its county seat at May's Landing, a distance of seven miles.

Good gravel on a sand foundation seems to meet all the requirements where the winter and early spring travel is light.

Very truly yours,

J. J. ALBERTSON,

Engineer in charge of Atlantic County Roads.

MAGNOLIA, N. J., November 19, 1897.

Honorable H. I. Budd, State Commissioner of Public Roads, Trenton, New Jersey :

DEAR SIR—We have just completed the second section of the Westville and Glassboro stone road, a total length of eleven and one-half miles.

This road opens a splendid agricultural district, thereby enabling farmers to compete with market gardeners located near our great market, Philadelphia, and at the same time giving the city consumer the advantage of fresh vegetables direct from the producer. This saves to both their mutual share of usual charges imposed by transportation companies, also allows the vegetables to be delivered in much better order.

The section built this year, five and one-half miles in length, is of macadam construction, ten feet wide and ten inches deep, at a total cost of \$28,635.58.

Gloucester county is one of the few that thought the county and State Road law burdensome. They contested the matter vigorously in the courts. Their objections were overruled. Now the mandatory clause from our road law has been repealed. There was no longer any necessity for it. The sentiment for road improvement is so firmly established that some check will soon be required. This Board of Freeholders, composed largely of the same members that contested the first Stone Road law in the courts, at its last meeting, held yesterday, in response to public demands, decided to build five and one-half miles of county road, to Cumberland county line. This shows the wonderful change that has come over this community. The worst feature of the road improvement in Gloucester county is the fact that the county is issuing bonds to pay its share of the cost. These are to run ten years, one tenth of which, with all interest, is made payable each year.

This county has a supervisor of completed stone roads, whose salary has just been increased. His supervision will now extend over about twice the

length of the road that it did last year. This is an important office, as very large amounts of money will be required to maintain these excessively-used free roads. This expense could be greatly reduced by the general adoption of broad tires on all freight wagons, as we have so often advocated.

Sincerely yours,
 J. J. ALBERTSON,
Engineer in Charge Gloucester County Work.

MAGNOLIA, N. J., November 15, 1897.

Hon. H. I. Budd, State Commissioner of Public Roads, Trenton, New Jersey:

DEAR SIR—The interest in road improvement grows in Camden county with each succeeding year.

We have built two valuable connecting links, one known as "White Horse Road Extension," within Camden City limits. The telford construction is 14 feet wide and 12 inches deep, at a total cost of \$1,910.03. This connects the White Horse stone road with the stone pavement on Haddon avenue.

We are just finishing what is known as the "Market Street Extension" in Gloucester City, which is also 14 feet wide and 12 inches deep, at a total cost of \$6,224.46. Each of the above pieces was built without the aid of the abutting property-owners, who would not petition for their improvement and agree to pay the usual ten per cent. In these particular cases the county pays 66 $\frac{2}{3}$ per cent. of the total cost and the State the balance, or 33 $\frac{1}{3}$ per cent.

We are about finishing a road from Collingswood through Knights Park to Merchantville. This is built on the combination plan, which, I think, was first introduced by me in Gloucester county in 1894. We make a 10-inch telford center, 8 feet wide, and build 6-inch deep macadam wings 2 feet wide on each side of the telford center, making a total width of 12 feet. This is economical and meets all requirements for its location.

We are also building a gravel road from Berlin via Waterford to the Atlantic county line near Hammonton, a distance of eleven miles, on the same general plan and under the same specifications that we used so satisfactorily in Atlantic county last year. The gravel beds are not so favorably located, thereby necessitating its being carted a greater distance, which materially adds to the cost.

In this county the desire for more good roads is in excess of our share of the State aid. We have decided to build what is known as the Blue Anchor Road, of gravel, without the State aid, and under a different act, in which case the township in which the road is located bears the 33 $\frac{1}{3}$ per cent. usually paid by the State.

The question of toll-roads, which are brought into sharp competition with the free State and county roads, seems to be in a fair way to be solved. We have pointed out the injustice of this competition for several years.

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The property-owners along the line of the Camden and Marlton Turnpike are dissatisfied with paying toll on their thoroughfare to the city, and tax, that others more favorably located may go free.

By virtue of the Act of 1897 they have petitioned for the road to be bought by the county and State, the expense of which is to be met in the same proportion as though a new stone road were being built.

The commission appointed by our Governor has made its report, but final action upon it has not been taken by our Board of Freeholders.

Applications have been presented to our Board for the improvement of several more roads, the specifications for which have been prepared. The first cost of a stone road is not the only one. Our supervisor of completed stone roads is kept busy constantly looking after the damage and worn places, sometimes re-surfacing with stone, and, at other seasons, with gravel, which is a very good substitute for water.

Nature has been kind in sending periodical showers nearly all summer. Our completed roads have been disintegrated less this past season than ever before, which is partly due to the frequent rains and partly due to their close supervision by our experienced and efficient supervisor.

Very truly yours,

J. J. ALBERTSON,

County Engineer.

A History of Road Improvement in South Jersey.

BY CLAYTON CONROW, CINNAMINSON, N. J.

Having been invited to give some account of road improvement in this section of New Jersey, I would ask the reader to go back with me for a moment to take a bird's-eye view of the conditions of the roads fifty years ago. Then the roads were little more than beds of sand, similar to those which may still be seen in the pine barrens of the State; in fact, some remnants of the old-time roads may be found in our very midst. In 1847 a few enterprising citizens, despairing of State or county assistance, organized a movement to have some of the leading roads, notably those which led to the city of Philadelphia, improved by voluntary labor. To that end, in the fall of the year, after the rush of the season's work was over, a large force of teams and laborers were collected on the road leading from Burlington to Camden, the object being to cut down some of the steeper hills and to cover the sandier portions with gravel, clay or loam, according to the inclination or judgment of those who did the work. The masses of the people were entirely ignorant of road-making; very few, if any, had ever seen a good gravel road. The great Pennsylvania Railroad was organized the year previous, and was scarcely launched upon its career of usefulness. The Camden and Amboy railroad had been built a dozen years, and was running an occasional freight or passenger train at a slow rate of speed. The citizens of Pennsylvania had inaugurated a movement to build stone roads fifty years before, but the people did not travel then as now, and, as there were no stone-quarries in this section of the State, the citizens of New Jersey could not follow the example of a sister State and construct roads of stone; hence, their only recourse was to use the best materials at hand, and when the volunteer forces had collected at what is now called East Camden, some of the teams and men having traveled a distance of eight miles to reach that point, a great contention arose as to the best material to be used in the construction of the road, some contending for clay and others for a stone-quarry loam found in a hill belonging to the Cooper estate, now East Camden. The contention became so sharp that there was a division of the forces, a part using clay from a pit near the Ellisburg and Marlton junction and the others the aforesaid loam. I may add in this connection, that in the light of the present age neither material would be considered of any value for road purposes, but with their inexperience they did the best they knew. It may be observed that every-

thing connected with the movement was gratuitous. If a team-driver refused to work in the line mapped out by the volunteer supervisor, there was no remedy; his discharge would mean the loss of his labor in the cause. If the owner of the abutting property should object to having his front cut down, or, as he would say, disfigured, there the matter rested; there was no legal redress, the steep hill must remain and all travelers must suffer for his obstinacy.

This method of road improvement went on for two or three years, but, owing to the absence of all legal authority, it was very ineffectual and unsatisfactory. A cross-grained landowner could hinder the progress of the work.

To give the reader an idea of the condition of the road at that time, I would state that twenty-three baskets constituted a full two-horse load, the baskets then holding three pecks each; one ton of hay made a good load for four horses. Now, if we value a team and driver at \$3 per day and add the cost of crossing the river, which was then 60 cents for the round trip, then divide the amount by 23, we find it would cost 15 15-23 cents per basket to deliver their produce in Philadelphia markets. These farmers had to come in competition with those who lived on the borders of navigable streams and could land their produce in the same markets by boats at a cost of 2½ cents per basket; this was an unequal contest, in which the inland farmer was placed at a great disadvantage. How long could he endure this competition, when his produce was sometimes sold for less than the cost of transportation, to say nothing of the cost of growing it? What was to be done? Scores of farmers moved from the State; some went west, some went south even as far as Norfolk, Va., and settled along tide-water streams. This was the beginning of that extensive trade in southern produce and which still confronts the farmers of New Jersey with the sharpest competition. I am persuaded that if the roads had remained in the same condition to this time, West Jersey would have been nearly depopulated.

It was at this period, 1849, that a few enterprising citizens, seeing the unequal contest and hoping to end their days in the land of their nativity, and seeing also the hopelessness of the State coming to their rescue in aiding the counties and townships in building improved public roads, petitioned the Legislature for a charter giving them the right to build turnpikes. After much opposition and wirepulling the charter was granted. It may be asked, Why was there so much opposition to the measure? I would reply that those who lived contiguous to the city, and those who delivered their produce by boat and who had almost a monopoly of the Philadelphia market for perishable produce, contended that they did not want roads improved so that wagons as large as their boats would be hauling the products of their farms over them to come in competition with their own.

Not only the road of which I have spoken was turnpiked, but during that and the ensuing ten years scores of turnpike companies were incor-

porated ; in fact more charters were granted in that time than in all the other years of the State's history.

The effect was most wonderful. It gave to agriculture, and, consequently, to all other avocations dependent thereon, the greatest stimulus it had ever received up to that time. Some writers have designated that period as the "golden decade" of the century. The State was saved from innocuous desuetude. The work of depopulation had ceased ; emigration was checked ; immigration began. The citizens were more prosperous than ever before. The taxable value of the land was doubled, aye, in many cases, trebled. The teams which formerly carted twenty-three baskets now took sixty ; instead of requiring a day to make the journey, they would frequently make two trips in the same time ; instead of costing $15\frac{5}{8}$ cents per basket, it was now reduced to less than 4 cents.

These roads were all made of gravel because stone was not accessible at that time. The capital stock of these companies was not taken by a rich syndicate of Wall street brokers on which to extort large dividends, but by some of the humblest citizens of the State, and in many cases paid for by working it out by manual labor, or by teams in the construction of the road.

This condition of affairs continued for about forty years, during which time a great many of the companies went out of existence, partly from lack of suitable material with which to keep the roads in order.

In 1885 a law was enacted giving turnpike companies the right to issue bonds and build stone roads on the old gravel foundation.

Under this law the first stone road, constructed in a rural district south of Trenton, was built. Many others soon followed. They were so satisfactory that the public clamored for more ; but now they wanted free roads, and the Legislature rose to the occasion and, recognizing the duty of the State to its citizens, enacted the present State Aid Law, under which a perfect network of stone roads is being constructed, by which the resources of the counties are developed and the State placed in the front rank of advancement.

Now, what shall we say of their value? Who can estimate the benefits conferred upon the citizens of New Jersey by these stone roads?

Can their value be measured by dollars and cents? We may say that again the farmer's market-wagon has been enlarged ; that instead of hauling an average of sixty baskets per load, as on the gravel roads, he now hauls an average of one hundred baskets, thereby enabling him to reduce the cost of his produce so that he may successfully compete with his brother farmers of the sunny South and the fertile West. But is this money value all? Is there not a moral side to be considered? Has there not been an uplifting of humanity, a civilizing agency at work which cannot be measured by human language?

WESTFIELD, N., J, October 11, 1897.

Hon. Henry I. Budd, State Commissioner of Public Roads, Trenton, New Jersey :

DEAR SIR—In reply to your question, would say our county still believes in hard, smooth, well-graded roads. It has ceased to be a question whether they pay or not ; we know from experience that they do. It is an admitted fact, even by the heavy taxpayer. All our main country roads and many of our town and city streets are paved with crushed stone, after either the macadam or telford system. As we have a mountain of trap-rock, we find this the cheapest and best material to use. We are assured that it has helped wonderfully in the value of real estate and the increase of population. People who ten or fifteen years ago moved from New York were apt to only rent and return after a year or two, especially the desirable class who kept horses. Now they buy, and become permanent citizens. Ten or fifteen years ago half the farms were in the market, for sale at a low figure, and many in the sheriff's hands. Now they are held as an investment by their owners, because they see a steady growth in population and a steady advance in value. The skeptic who formerly talked down Jersey because of its mud roads has been silenced.

The common method of making our roads has been so often described that it need not be told again. In riding over our roads, however, we see and realize that they can be made poorly, and realize the necessity of keeping the work in the hands of skillful men, and under honest, intelligent supervision, and that contractors and workmen be required to faithfully perform the work they are paid to do. We realize, also, the importance of first grading the street or roads before putting on the stone. Thousands of dollars have been wasted in our county by not having an engineer give the proper level, and the road graded to it before stoning.

Within the last five years most of our villages and towns—Summit, Roselle, Cranford, Westfield and Plainfield—have seen the necessity of having a sewerage system and have gone to great expense laying pipes through the center of all of their streets, also lateral drains to the houses. This has played havoc with good roads in those streets. The contractors were not as particular about putting the dirt back again in the trenches as they should have been, and, consequently, these streets have been and many are still in bad condition. While it has and will require a large amount of stone to put the streets in their former condition, the sewer is a good job, done for years to come. If the road overseers would use their modern adjustable road-scrapers for planing off the elevation and filling up the sunken places it would help to put these streets in good shape. Four strong, steady horses, a good driver and an intelligent operator to handle the scraper are necessary. Do not fear that the macadam will break the scraper. It may wear the shoe some, but that can be replaced. There are opportune times when this work should be done—after rains, while the surface is still wet and loose, in the winter and spring when the frost is coming out. For giving a road a good grade and crown nothing equals

an adjustable scraper. It is not used one-quarter enough even on macadam roads. During the summer we have had several very heavy rains and showers, doing much damage to property, especially our roads and streets, washing off the macadam and making deep gullies in the sides of the roads. We see the importance of keeping the roads a little rounding and the side ditches cleaned out so that the water will not run down the center of the road, also having frequent side-openings to lead the water from the roads to the fields and not allow it to accumulate and gain strength to wash out the road. Another point we notice is the necessity of using a good binding-material to hold the separate stones together, something that will not readily absorb moisture and wash away. The washings from roads and rich loamy soil or sand is not good. Trap-rock stone-dust from the crusher is good; there is considerable of the cement nature in it. Subsoil clay is also good when too much of it is not used. Some red shale soils have iron in them and are good.

In repairing the county roads our officials allow the contractor to spread a thin coat of clay over the road before putting on the stone, so as to make a union of the old road and the new covering; after this clay is evenly spread, one and a half inch stone, two inches deep, is spread, and on this a coat of clay is spread, then is well watered with a sprinkling cart and rolled with a heavy steam roller. A final coat of stone screenings one inch thick is spread, and watered and rolled. In hauling stone our carters carry from three to four tons. They use a wagon-body made of planks, the side plank on each, one and a half inches thick, one foot wide and ten feet long; two are used on each side, making the body two feet deep; the bottom planks are six inches wide and rounded on the ends; cleats hold the two end-boards in place. The carter when unloading removes the binding chain, lifts the plank from one side and lets the stone drop to the ground, then one by one lifts the bottom plank, more stone falling as each plank is lifted. An expert carter will unload in five minutes. The stone should not, as is often done, be raked or pushed off level, leaving the dust in one place and coarse stone in another, the dust wearing out first and washing away, making little hollows in the road. It should rather all be reshoveled, fine and coarse together, and spread evenly.

It is the observing and doing these little things that make a good road.

Very truly yours,

DENNIS C. CRANE.

METUCHEN, N. J., January 23d, 1897.

Hon. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Accept thanks for your Annual Report of Public Roads. We have some experience with stone roads, and feel that all main roads leading to towns or cities should be of stone or similar materials. The writer was supervisor on the road from New Brunswick to Metuchen,

which passes his door ; would not willingly do without it for any consideration. Your predecessor rode over it with me before commencing the work and talked over the kind and quantity of dirt to be applied between the layers of stone ; but from my observation and experience I should be unwilling to allow any dirt binder, although in that instance the specifications called for it. I had frequent tilts with the contractor's superintendent about putting in too much dirt binder. He referred me to the Union county road which he had constructed in that manner, and contended they could not be properly constructed without. I took four gentlemen over those roads from Plainfield to Westfield and found them in such good condition that I yielded somewhat to his entreaties ; but am firmly convinced now that they should be made without dirt. They would wear longer and not heave with the frost. I would roll constantly while constructing, and after finishing, with as heavy roller as possible. Of course a telford bottom would last a long while with occasional top dressing with stone screenings and stone dust, say every two years, well rolled down to keep it smooth and water-tight. An ordinary macadam, six inches deep, treated thus, would always keep dry underneath, and would not freeze or break up.

Some four years ago I made about one mile of stone road for our township, placing first about four inches of stone the size of stove-coal, without digging out for shoulders, merely placing a little dirt along the edges to keep stone from spreading ; then a top course of stone about the size of chestnut coal, about two inches deep, making six inches in all, covered with one inch of dirt and no stone dust, rolled down with an ordinary field-roller, which of course was too light. One-eighth of the mile was up a hill grade of about thirty feet and only about four and a half to five inches deep, and is still in good condition. The great thickness of stone is not necessary, with occasional top-dressing to keep the road dry under the stone ; neither are large stones necessary.

Mr. E. D. Rightmire, of Burlington county, makes a good suggestion, namely, to wet and roll in dry weather, say in the months of June, July and August, or other dry seasons.

Stone roads up and down hills should be crowned more than on the level, say about one and one-quarter inch to the foot from the outside to the center, to throw the rain-water to the outside, so as not to follow the indenture of the wheels and wash the road away.

I also approve the suggestion of allowing rebate in taxes for wide tires on team-wagons to be drawn with wide or long whiffle-trees for horses to walk on the wheel tracks.

Very respectfully,

MANNING FREEMAN.

FELLOWSHIP, N. J., Oct. 14, 1897.

Henry I. Budd, Esq., Trenton, New Jersey :

DEAR SIR—The road leading from Merchantville to Vincentown is probably one of the longest stone roads in the State. The changed con-

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dition of this road is one of the marked improvements in our neighborhood. The amount of travel over this great highway is surprising, and farmers at least thirty miles from Philadelphia can now raise and market crops that never paid them before. You can see their teams hauling immense loads of perishable produce to the city, and very often returning with manure for the farm or brewers' grains for the cattle, while the well-kept, fine-looking horses tell in very plain language how much easier it is to draw a heavy load on a good road than a light load on a bad road.

Macadamizing a main road has a tendency to bring about the improvement of the by-roads leading to it, thus benefiting the country far beyond its immediate vicinity, even as a good act extends its influence beyond the knowledge of the actor. Very little property has changed hands of late years, but it is evident the condition of farms along the stone road is improving; the fences along the roadside are kept in repair or entirely removed; the land is generally well tilled, and increased production of crops seems to be the order of the day. Should the present price of farm products be maintained for any great length of time, a great change will be wrought in farmers' financial condition, and they will be united in their demand for an increased appropriation for stone roads.

The great public concern at present should be to have the roads already constructed properly maintained, and toward this end I am sure your best efforts will be directed, and no citizen who has enjoyed the advantages of good stone roads would be willing to give them up unless assured of something better in their place.

Very truly yours,

WILLIAM R. LIPPINCOTT.

APPENDIX.

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Appendix A.

Amended Form of Specifications Used for Macadam and Telford Construction Under the State Aid Law.

Specifications for a Stone Road in County, New Jersey, known as road, beginning at in the township of, extending in direction to, a distance of miles.

GRADING.

1. The cuts and fills are to be made by the Contractor, as per profile and specifications of the Engineer appointed by the Board of Freeholders. The Contractor will be required to grade the approaches of all connecting roadways. The profile must, as near as possible, be drawn so that all the fills and excavations on the line of the road will balance each other, so as to destroy the necessity of obtaining earth outside of the roadway. Said profile and specifications to be first approved by the Board of Freeholders and State Commissioner of Public Roads.

EXCAVATION FOR ROADBED.

2. The bed to be the width of feet ; to be excavated or built to a curvature to conform to the final surface of the road when finished ; the grade from center to sides being not less than one inch fall to one foot. The roadbed is then to be rolled until approved by the Engineer. If any depressions form under such rolling, owing to improper material or vegetable matter, the same shall be removed and good earth substituted and the whole re-rolled until thoroughly solid and to above-mentioned grade. The earth taken from any cut or ditch to be deposited where Engineer may direct, within one-half mile, either within or without the lines of the road. No earth shall be removed from line of road without the order of the Engineer.

The material in excavation will be classified as earth and solid rock. All questions of classification of material will be decided by the Engineer in charge, whose decision shall be final.

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OBSTRUCTIONS.

3. In case there shall be at the time stipulated for the commencement of the work any trees, stumps, roots, rubbish or other encumbrances on the line of the work objectionable to the Engineer, the same shall be removed at the expense of the Contractor.

TELFORD FOUNDATIONS.

4. The stone construction if of telford, to be made of a bottom course of stone, of average depth not more than five (5) inches, to be set by hand as a close, firm pavement, the stones to be placed on their broadest edges lengthwise across the road and so 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 hammer and projecting points broken off. No stone to be used of a greater length than ten (10) inches or width of four (4) inches 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 stone with a flat, smooth surface to be broken. The whole surface of this pavement to be subjected to a thorough settling or ramming with heavy sledge hammers and thoroughly rolled with a five or seven-ton roller. No stones larger than one and one-half inches to be left loose on top of telford.

BROKEN STONE.

5. inches of broken stone are to be put on the telford foundation to a depth to make the road when finished (including binding and surface finish) inches; to be composed of one-and-one-quarter-inch stone, or stone which will pass through a ring of one and one-half ($1\frac{1}{2}$) inches in diameter. Said stones to be as nearly cubical as possible; to be evenly and thoroughly compacted by rolling. Any inequalities during the rolling are to be carefully filled with additional material, so as to produce an even surface on this and the following macadam construction.

MACADAM.

6. If of macadam, after the roadbed has been formed and rolled as above specified, and has passed the inspection of the Engineer and Supervisor, the first layer of broken stone, consisting of inch-and-a-half stone, or stone that will pass through a ring two inches in diameter, shall be deposited in a uniform layer having a depth of inches, after rolling, and rolled repeatedly until compacted to the satisfaction of the Engineer. The second course of broken stone shall consist of inch-and-a-quarter stone—that is, every piece of stone shall be broken so it can be passed through a ring one and one-half inches in diameter, and no stone shall be more than two inches, or less than one inch, long. All stone must be as

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nearly cubical as possible, broken with the most approved modern stone-crushing machinery, free from screenings, earth and other objectionable substances, and in uniform sizes. This course is to be spread in a uniform layer to a depth of at least . . . inches, and after rolled until thoroughly settled into place to the satisfaction of the Supervisor, under the instruction of the Engineer.

BINDING AND FINISHING.

7. The surface of each course to be thoroughly and repeatedly rolled and sprinkled until it becomes firm, compact and smooth. When the two courses are rolled to the satisfaction of the Engineer, a coat of three-quarter-inch stone and screenings is to be spread of sufficient thickness to make a smooth and uniform surface to the road, then again thoroughly rolled until the road becomes thoroughly consolidated, hard and smooth, and a small stone placed on the surface will be broken before being driven into the bed. Rolling to be done by Contractor, with a ten-ton steam roller approved by the Engineer. If the conditions are such that a roller of less weight would be more efficient, the Engineer and Supervisor may require the use of same. Any depressions formed during the rolling or from any other cause are to be filled with three-quarter-inch stone and screenings, and the roadway brought to a proper grade and curvature as determined by the Engineer. Water must be applied in such quantities and in such manner as to completely fill all the voids between the broken stone with the binding material saturated so as to secure a set.

MANNER OF ROLLING.

8. In the rolling the roller must start from the side lines of the stone bed and work towards the center, unless otherwise directed. The rolling shall at all times be subject to the direction of the Engineer and Supervisor, who may, from time to time, direct such methods of procedure as in their opinion the necessities of the case may require.

MATERIAL.

9. The stone for the construction of this road is to be of the same kind and quality, or equally as good, in every particular, as that shown in the Engineer's office. The stone used for telford foundation course must be of hard, durable nature, not liable to disintegrate by frost or weather; for macadam foundation, course must be of best trap-rock. The inch-and-a-quarter stone, three-quarter-inch and screenings for the final finish must be of the best Jersey trap rock.

SHOULDERING.

10. Excavate or fill roadbed as per stakes furnished by Engineer; a shoulder of firm earth or gravel is to be left or made on each side, extend-

ing at same grade and curvature of road to side ditches or gutters. This shoulder to be thoroughly rolled on each side for a width of at least seven feet from the stone bed, and before the last rolling, covered with a suitable sowing of grass seed; when necessary, the ditches are to be excavated as per stakes furnished by Engineer, to give an easy flow of water, so that no water shall be left standing on the road or in the ditches, for all of which no extra payment will be made.

UNDER DRAINS.

11. Under-drains, if found necessary, shall be constructed by the Contractor (at prices named in the bids) of good four-inch sole tile, laid upon a board of not less than one inch in thickness and six inches in width, whenever and wherever the Engineer shall decide; top of tile to be at least thirty (30) inches deep, unless otherwise directed by the Engineer, the joints of the tile to be covered with salt hay and trench filled with pervious earth.

LIMITS AND EXTRAS.

12. The Contractor, in the preparation of the roadbed, shall be required, if necessary, to excavate, without pay, to a depth of twelve (12) inches on the average throughout the length and breadth of the road, in addition to the trench especially prepared to receive the stone bed. If the excavated materials from the roadway are found insufficient or of poor quality, the Contractor must provide enough extra shouldering or filling from a pit, at his own expense, the Engineer furnishing an approximate estimate of quantities needed, before bids are made.

NO EXTRA PRICE.

13. No allowance in measure of depth of pavement will be made on account of any material which may be driven into the roadbed by rolling. The pavement when completed must conform to the grade and cross-section and be satisfactory to the Engineer, whose decision shall be final. No extra work will be paid for unless the price has been agreed upon between the contracting parties, including the State Commissioner of Public Roads, and indorsed upon the agreement, witnessed by the Engineer.

Where extra depth of pavement is required it must be obtained by making the pavement thinner on the more solid portions of the road. Changes in depth to be made only upon written order of Engineer and State Commissioner, and as located by them.

All clay or gravel for shouldering and all extra hauling to be at the Contractor's expense.

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BIDS.

14. Bids will be received under these specifications as follows :

Price per square yard for telford, road complete.

Price per square yard for macadam, road complete.

Price per cubic yard for earth excavations in excess of twelve (12) inches, average throughout the length and width of the road.

Price per cubic yard for solid rock excavations in excess of twelve (12) inches, shale to be classed with earth.

For under-draining, furnishing all labor and material, per lineal foot.

Price (lump) for the whole road complete according to the specifications and quantities given by the Engineer.

ESTIMATE OF QUANTITIES.

15. Telford,	square yards
Macadam,	“ “
Under-drains,	lineal feet
Solid rock,	cubic yards
Earth excavations in excess twelve (12) inches,	cubic yards
Total estimated cost,	

Bids shall be accompanied by cash, certified check or approved bond, to insure the execution of the agreement, to the amount of least one thousand (1,000) dollars.

LIABILITIES OF CONTRACTORS.

16. (1.) He shall keep up sufficient guards by day and night to prevent accidents from travel, and will be liable for any damage which may arise by his neglect to do so, or from any omission on his part.

(2.) He shall keep the road sprinkled until the final certificate of completion by the Engineer is given.

(3.) He is to commence and prosecute the work upon the road at such points as may be directed by the Engineer and Supervisor within days from and after the signing of the contract, and shall continue work thereon until completion, except as herein provided.

(4.) He further agrees to complete the same on or before the day of , A.D. Twenty dollars for each day that the work shall remain uncompleted after the time allowed by contract may be deducted from any moneys due the Contractor, as liquidated damages. A bonus or premium of \$1.00 per month will be paid the Contractor for each month the road is completed before the time specified in the contract, except only to the provisions herein contained, unless otherwise agreed upon by the Board of Chosen Freeholders, on certificate of the Engineer recommending the extension of the time limit of completion.

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(5.) The Contractor shall keep the finished roadway and earth work in repair for the space of one year from the date of its completion and acceptance, and shall be liable for wear and tear caused by ordinary travel and as much longer as for any period or periods during said year it shall be out of proper condition; and if during that time the roadway or any part of the work shall, in the judgment of the Engineer and Road Committee, require repairing, and they shall duly notify the Contractor to make repairs as required, and if the Contractor shall refuse or neglect to do so, to the satisfaction of the said Engineer and Road Committee, within five days from the date of service of notice, then said Engineer and Road Committee shall have the right to have the work done properly by other parties and pay the expense for the same out of the five per cent. retained.

(6.) The Contractor will be required to preserve all stakes and bench marks made and established on the line of the work until duly authorized by the Engineer to remove the same.

(7.) The Contractor shall not disturb the position of title stones (the corners to properties adjacent the road); where they appear he will either lift or lower them so that their tops may conform with the finished surface of the stone construction under the personal supervision of the Engineer.

(8.) The Contractor must also preserve the roadway on which he is working from needless obstruction, and, where necessary, will construct safe and commodious crossings, to be maintained in good order, and to afford all proper and reasonable means for the accommodation of the public.

ENGINEER.

17. Engineer is to be selected or appointed by the Freeholders and paid by them. He is to furnish all surveys, profiles, plans, specifications and quantities of all kinds before specifications are signed, and in such a clear manner that lump bids can be made upon the work. He is to place stakes at small intervals on opposite sides of the road, marked for the finished grade, so that by a line and rule the depth of pavement can be easily and correctly determined. He is also to furnish estimates of quantities of work done before partial payments are made, the quantity of road laid to be determined by surface measurement, and should any difference arise between the contracting parties as to their meanings, his decisions on these matters are to be final and conclusive. The work is to be done according to his direction, and if any material is brought upon the road not approved by him, it is to be removed at the expense of the Contractor.

RIGHT TO BUILD BRIDGES, CULVERTS, ETC., AND SUSPENSION OF WORK.

18. The right of the county to build bridges, culverts, or lay pipes or other appurtenances in connection therewith, in said street, road or avenue, during the progress of the work, is expressly reserved, as well as suspending the work, or any part thereof, during the construction of the same for

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the purpose above stated, without further compensation to the Contractor for such suspension than an extension of time for completing the work, as much as it may have been delayed by such suspension.

STOPPING WORK ON ACCOUNT OF WEATHER.

19. The Supervisor, in his discretion, may stop any portion of the work if, in his 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 for.

ABANDONMENT OF CONTRACT.

20. If at any time the work under contract should be abandoned, or if at any time the Supervisor or Engineer should judge and so certify in writing that the said work or any part thereof is unnecessarily delayed, or that the Contractor is wilfully violating any of the conditions or covenants of this contract, or is executing the same in bad faith, the board shall thereupon notify the said Contractor to discontinue all work under this contract, and may employ other parties to complete the work in such manner as they may decide, and use such material as they may find upon the line of said work, and to procure other material for its completion, and charge the expense of the said labor and material to the Contractor, to be deducted from any moneys due him under contract, and in case such 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 Board of Freeholders, on notice from the Engineer.

SUPERVISOR.

21. Nothing in these specifications relating to the duties of the Engineer shall be taken or construed to, in any manner, conflict with the duties of the Supervisor in the performance of his duties, as specifically set forth in the act entitled "An act to provide for the more permanent improvement of the public roads of this State," approved March 22d, 1895, and the supplements thereto, but they shall co operate as far as practicable. The Contractor shall employ competent men to do the work, and whenever the Supervisor shall inform him 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, he shall thereupon be discharged.

INSPECTION.

22. All directions and determinations necessary to give due and full effect to any of the provisions of these specifications shall be given by the Engineer and Supervisor.

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All material and workmanship of any kind shall be subject at all times to the inspection of the Engineer and Supervisor. Whenever unfaithful and imperfect work is discovered it shall be repaired or replaced by the Contractor, after due notification from the Engineer and Supervisor.

PAYMENTS.

23. Monthly payments will be made by the Board of Freeholders to the contractor, if desired, for all completed work, upon presentation by him of the proper certificates of the Engineer and Supervisor, to the extent of eighty per cent. of the amount then due. Fifteen per cent. will be paid at the completion of the work. The balance (five per cent.) will be retained by the said Board of Freeholders to keep the roadway completed by the contractor in good repair, in case said contractor fails to do so, during the period of one year, after the expiration of which time and the final release of the contractor the said balance of five per cent., or such portion of it as has not been expended as aforesaid, will be paid over to the contractor. It being expressly understood that the measurement shall be taken after the entire completion of each class of work, and the aforesaid prices cover the furnishing of all the different materials, excavation and labor, and the performing of all work necessary under these specifications.

BOND OF CONTRACTOR.

24. The bond to be given by the Contractor for the faithful performance of the work mentioned and set forth in these specifications, and the agreement accompanying the same, shall be such sum as the Board of Chosen Freeholders shall decide, and not less than fifty per cent. of the cost of the road when completed.

CONTRACTOR TO INSURE PAYMENT FOR LABOR, MATERIAL, ETC., ON FINAL ESTIMATE.

25. The Contractor must also furnish said Engineer and Supervisor with satisfactory evidence that all persons who did work or furnished materials 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 fully paid and secured, and shall also give notice to said Engineer and Supervisor, within ten (10) days after the completion of the work, that any balance for such work or materials, or compensation for such damage still due, has been fully paid or released.

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PERSONAL ATTENTION.

26. The contractor must give his personal attention to the work, and not assign or sublet the same, but keep the same under his control.

.....
County Engineer.

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.....
Road Committee.

Approved this, A. D. . . . , by resolution of the Board of Chosen Freeholders.

.....
Director Board of Chosen Freeholders.
.....
Clerk of Board of Chosen Freeholders.

OFFICE STATE COMMISSIONER OF PUBLIC ROADS,
TRENTON, N. J.

I have this day carefully read and examined the foregoing specifications, and the same are hereby approved.

Any departure from these specifications which increases the cost of the road must have the written consent of the State Commissioner of Public Roads.

Given under my hand this, A. D. . . .

.....
State Commissioner of Public Roads.

Form of Specifications Used for Gravel Roads Under the State Aid Law.

PREPARATION OF ROADBED.

The Contractor is to remove from the roadbed to the width of 30 feet, or from curb-line to curb-line, all material objectionable to the Engineer, such as trees, stumps, roots, brush, etc., at least 25 feet from center line of road, then the road is to be excavated or built, as the case may be, and prepared to receive a gravel bed . . . feet wide, the sub-grade of which is to slope 5 inches from center to shoulder.

The Contractor is to grade the road, where the Engineer so directs, to conform to the profile furnished by the Engineer, and approved by the Board of Chosen Freeholders and the State Commissioner of Public Roads, to the width of . . .

The curvature or slope from center or crown of road to sides or curb lines being 1 in. fall to each foot.

The shoulders or sides to the width of . . . feet, composed of the local earth, are to be plowed and sloped to conform to the final surface and curvature of road when finished.

In the preparation of the road-bed the Contractor will not be required to excavate to a greater depth than 12 in. on an average in a continuous cut, the whole width of the road, without extra pay, at prices per cubic yard named in accepted bid; no payment allowed when the gravel taken from cut is used in surfacing road and then measured.

Any excavation of a less depth than that just named must be done by the Contractor without extra pay, and to be included in his price named for the "preparation of roadbed."

All the above items are to be included under one head, styled "Preparation of Roadbed," and to be bid upon as one item and paid for in one sum as such, by the lineal foot, at price named in accepted bid.

TILE DRAINING.

When, in the judgment of the Engineer and Supervisor, any under-draining is required, the Contractor is to furnish material and construct a 4 in. sole tile drain, in a good workmanlike manner, on a yellow pine board 1 in. in thickness and at least 6 in. wide. The top of the tile is to be at least 2 feet 6 inches below surface of finished road. The joints of the tile to be covered with meadow hay. The ditch is then to be covered with pervious earth. The completed drain is to be paid for by the lineal foot at prices named in accepted bid.

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MATERIAL.

The Contractor is to dig, cart and place upon the road, in accordance with the specifications, the gravel selected by the Engineer and Board of Freeholders, and to use no other gravel.

Should any objectionable material be used, he is to remove the same at his own expense.

The gravel is to be placed upon the road in two layers, these to be thoroughly harrowed, mixed and rolled with roller approved by Engineer until thoroughly consolidated and firm, the whole to be of sufficient thickness that when it is thoroughly rolled and solidified that the solid gravel will be 8 in. deep in the center and slope at a regular grade to 6 in. in depth at a distance of 6 feet on each side of the center line of road. Should any inequalities appear during the rolling, these to be carefully filled with gravel, so that the finished road will conform to the approved profile; no extra pay will be allowed for material required to fill up these depressions, the gravel to shrink 33 per cent. in rolling.

The Contractor is to be paid by the cubic yard for the compacted gravel that he puts on the road, and to be measured on the road after it is thoroughly rolled, at the price named in the accepted bid, which is to include the loading, carting, spreading, mixing, harrowing and finishing the road and shaping the local earth shoulder.

SIDEWALK.

The Contractor will also be required, when the Engineer so directs, to grub and remove from sidewalk or strip of land, . . . feet wide on outside of curb-lines, all material objectionable to the Engineer, such as trees, stumps, roots, brush, etc., thereby completing the opening of the entire road to the width of . . . feet, which will be . . . feet on each side of the center line.

The grubbing and removing of such objectionable material to be done and measured only where the Engineer and Supervisor shall order. The same to be paid for by the acre for the land actually grubbed at prices named in the accepted bid.

CARTING GRAVEL.

The Contractor will not be required to cart any gravel a greater distance than one-half mile without extra pay; for each extra half mile of carting, or fraction thereof, at a price per cubic yard named in his accepted bid.

All gravel used for surfacing found within one-half mile of the place where it is to be used, whether on the line of the road or not, must be carted without extra pay.

On certain sections of the road, when the gravel is found just where it is wanted and does not require (in the judgment of the Engineer) to be loaded and carted, no allowance will be made for the same, other than the price per lineal foot accepted for "The Preparation of the Roadbed," and no other pay for the graveling, rolling or placing the same will be allowed.

If there are sections of this road which do not, in the judgment of the Engineer, require any "Preparation of the Roadbed," but do require a coat of gravel, which shall be applied when ordered by the Engineer in the manner already specified, and to a depth by him to be named, and measured when compact and paid for at same price per cubic yard as other gravel furnished under these specifications.

STRIPPING GRAVEL-BEDS.

If the gravel beds are covered with objectionable surface material this must be first removed by the Contractor, and deposited where the Engineer so directs, and to be paid for by the county at a price per cubic yard named in accepted bid for removing or stripping such objectionable material from top surface of gravel-bed. No allowance will be made for removing stumps, trees, brush or roots from gravel-pit.

OPEN DITCHES.

The Contractor is to grade the shoulders and open all necessary side ditches (as per stakes furnished by the Engineer) so that there will be no water allowed to stand by the side of the road or on it. The open ditches are to be paid for by the cubic yard as excavations, at the prices named in accepted bid.

EXTRA DEEP.

Should the committee so order, the Contractor is to build, in all other respects as already specified, the gravel-bed to a greater depth or thickness than that already named. The Contractor is to do the same at a price named per square yard for each extra inch in depth.

EXTRA WORK.

No extra work will be paid for unless the price has been agreed upon between the contracting parties, and endorsed upon the agreement, witnessed by the Engineer.

Bids shall be accompanied by cash, certified check or approved bond, to insure the execution of the agreement, to the amount of at least \$1,000.

Bids will be received under these specifications as follows :

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1. Price per lineal foot for the preparation of the roadbed.
2. Price per acre for grubbing and removing objectionable matter from sidewalks.
3. Price per lineal foot for completed tile drain.
4. Price per cubic yard for excavating open ditches by side of road.
5. Price per cubic yard for excavations on an average in excess of 12 inches in one continuous cut in preparation of roadbed.
6. Price per cubic yard for compacted gravel . . . feet wide, as specified.
7. Price per square yard for each ordered inch in depth in excess of thickness named.
8. Price per cubic yard for carting gravel more than one-half mile and each additional half mile or fraction thereof.
9. Price per cubic yard for stripping or removing earth from top of gravel-bed.

The person bidding the lowest on the aggregate of the above nine propositions will be considered the successful bidder (all other things being equal), and no bid will be considered unless it names a separate price on each one of the nine foregoing propositions, and also states to which of the four sections of the road it is intended to apply.

LIABILITIES OF CONTRACTOR.

1. He shall keep up sufficient guards by day and night to prevent accidents from travel, and will be liable for any damage which may arise by his neglect to do so.
2. He is to make good any defects which may appear in said road for one year after its completion and final acceptance by the Board, and shall be liable for wear and tear caused by ordinary travel upon the road within one year after its acceptance.
3. He is to commence upon the road at such points as may be directed by the Engineer and Supervisor within thirty days from and after signing the contract, and shall continue work thereupon until completion, except as herein provided.
4. He further agrees to complete the same on or before, under a penalty of twenty dollars per day, except only to the provisions herein contained, unless otherwise agreed upon by the Board of Chosen Freeholders, on certificate of the Engineer recommending the same, and shall receive a bonus or premium of one dollar per month for each month the work is completed before the specified time expires.
5. At least twenty per cent. of the entire cost of the road shall remain in the hands of the Board of Chosen Freeholders until the expiration of the terms of the contract, and until the road shall have been finally accepted by the Engineer and the Board of Chosen Freeholders, and five per centum of the entire cost of the road shall be retained by said Board until one year after the final acceptance of the road, part or all of which may be used by said Board to make any repairs that the Engineer, in

conjunction with the Road Committee, may deem necessary, should the Contractor neglect or refuse to attend to the same within ten days after due notice, and the amount expended to be deducted from balance due the Contractor.

ENGINEER.

Engineer is to be selected or appointed by the Freeholders and paid by them. He is to furnish all surveys, profiles and specifications, and should any difference arise between the contracting parties as to their meanings, his decisions on these matters are to be final and conclusive. The work is to be done according to his direction, and if any material is brought upon the road not approved by him, it is to be removed at the expense of the Contractor. No work or material is to be paid for without a certificate from the Engineer and Supervisor that it is done, and is fully up to the requirements of these specifications.

RIGHTS TO BUILD BRIDGES, CULVERTS, ETC., AND SUSPENSION OF WORK.

The right of the county to build bridges, culverts, or lay pipes or other appurtenances in connection therewith, in said road or avenue during the progress of the work, is expressly reserved, as well as suspending the work, or any part thereof, during the construction of the same for the purpose above stated, without further compensation to the Contractor for such suspension than an extension of time for completing the work as much as it may have been delayed by such suspension.

STOPPING WORK ON ACCOUNT OF WEATHER.

The Supervisor, in his discretion, may stop any portion of the work, if in his 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 completion of the work, as herein provided for.

ABANDONMENT OF CONTRACT.

If at any time the work under contract should be abandoned, or if at any time the Supervisor should judge and so certify in writing that the said work or any part thereof is unnecessarily delayed, or that the Contractor is wilfully violating any of the conditions or covenants of this contract, or is executing the same in bad faith, the Board shall thereupon notify the said Contractor to discontinue all work under this contract, and may employ parties to complete the work in such manner as they may decide and use such material as they may find upon the line of said work

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and to procure other material for its completion ; and charge the expense of the said labor and material to the Contractor, to be deducted from any moneys due him under contract, and in case such expenses shall exceed the sum which would have been payable under contract, if the same had been completed by said Contractor, he shall pay the amount of the excess to the Board of Freeholders, on notice of the excess so due from the Engineer.

SUPERVISOR.

Nothing in these specifications relating to the duties of the Engineer shall be taken or construed to in any manner conflict with the duties of the Supervisor in the performance of his duties, as specifically set forth in the act entitled, "An act to provide for the permanent improvement of the public roads in this State," approved March 22d, 1895, and the supplement thereto, but they shall co-operate as far as practicable.

ESTIMATES.

The estimate for the work to be done on the roads above named under these specifications, is as follows :

. . . . miles of completed gravel road, at \$. . . per mile.

BOND OF CONTRACTOR.

The bond to be given by the Contractor for the faithful performance of the work mentioned and set forth in these specifications, and the agreement accompanying the same, shall be such sum as the Board of Freeholders shall decide, and not less than 50 per cent. of the cost of the road when completed.

CONTRACTOR TO INSURE PAYMENT FOR LABOR, MATERIAL, ETC., ON FINAL ESTIMATE.

The Contractor must also furnish said Engineer and Supervisor with satisfactory evidence that all persons who did work or furnished materials 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 fully paid and secured ; and shall also give notice to said Engineer and Supervisor within ten (10) days after the completion of the work that any balance for such work or materials, or compensation for such damage still due, has been fully paid or released.

Approved,, C. E.

., Director.

Attest :
., Clerk.

FOURTH ANNUAL REPORT

OFFICE STATE COMMISSIONER OF PUBLIC ROADS, }
TRENTON, N. J. }

I have this day carefully read and examined the foregoing specifications, and the same are hereby approved.

Any departure from these specifications which increases the cost of the road must have the written consent of the State Commissioner of Public Roads.

Given under my hand this, A. D. . .

.
State Commissioner of Public Roads.

Appendix B.

Following is the text of the State Aid Road Law, with its amendments :

CHAPTER CCXXIII.

An Act to provide for the permanent improvement of public roads of this state.

I. BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*, That whenever the board of chosen freeholders of any county in this state shall, by resolution, have declared their intention to cause any particular road, or section thereof, within such county to be improved under the provisions of this act, such board shall cause all necessary surveys to be made and specifications to be prepared ; the specifications shall require the construction of a macadamized road, or a telford or other stone road, or a road constructed of gravel, oyster shells or other good materials, in such manner that the same, of whatever materials constructed, will, with reasonable repairs thereto, at all seasons of the year, be firm, smooth and convenient for travel ; shall be so prepared as to call for bids from which an approximate estimate of the cost can be ascertained, and shall state the amount of security that will be required of the bidder ; after said specifications shall have been prepared they shall be submitted to the board of chosen freeholders for their approval or rejection ; and if such board shall approve them, they shall then be submitted to the state commissioner of public roads for his approval or rejection ; it shall be the duty of the commissioner of public roads, before approving the specifications for any road so submitted to him, to ascertain, by personal examination or otherwise, the natural character of the soil upon which such road is proposed to be constructed, and all other facts that he may deem important, and if, after examination of the specifications and facts so ascertained, he shall be of the opinion that the specifications provide for the construction of a road that will, with reasonable repairs thereto, be firm,

Board of freeholders may cause road to be improved.

What specifications require.

How prepared.

Freeholders to reject or approve.

Commissioner to examine road and approve specifications.

Cost of all roads not to exceed $33\frac{1}{3}$ per cent.

May withhold this approval.

Distribute among the counties.

When approved, freeholders must advertise for bids.

Committee to receive bids.

Bidders must give bond.

Bids, how received.

smooth and convenient for travel at all seasons of the year, and if he shall also be of the opinion that one third of the cost of constructing the road or section of road to which such specifications relate, together with one-third of the cost of constructing all other roads and sections of roads in this state under specifications previously approved by him, will not in any one year exceed the sum of one hundred thousand dollars, then he shall approve the specifications, but otherwise he shall reject them ; *provided, however*, that he shall, in his discretion, have the power to withhold his approval of any specifications, to the end that the estimated aggregate amount of contracts made in any one year shall not exceed the sum of three hundred thousand dollars, and also to the end that the amounts paid out of the state treasury under the provisions of this act shall in each year be distributed amongst the several counties of the state in such manner as to the said state commissioner of public roads shall seem fair and equitable, and any specifications, the approval of which is withheld as aforesaid, may, if otherwise satisfactory to the said state commissioner of public roads, be approved by him in any year subsequent to the one in which the same may be presented for approval as aforesaid ; if the board of chosen freeholders and the state commissioner of public roads shall both approve such specifications, it shall then be the duty of the director of the board of chosen freeholders to advertise in at least two daily newspapers, printed and circulating in the county, for the period of two weeks, or in at least two weekly newspapers, printed and circulating therein, for at least four weeks, for bids to do the work according to the specifications prepared ; such advertisements shall state where bidders may find the specifications, and shall name a time and place where the board of chosen freeholders, or a committee of five members thereof, of whom the director shall be one, will meet to receive bids ; every such bid shall be accompanied with the bidder's bond in the sum of one thousand dollars, with security satisfactory to the board, conditioned that if the contract shall be awarded to him he will, when required by the board, execute an agreement in writing to perform the work according to the specifications ; no bids shall be received by the board or any member thereof, or by said committee or any member thereof, except at a meeting of said board or a committee, of which notice shall be given as aforesaid, and all bids then received shall be immediately publicly read ; if the bids shall be received by a committee of the board they shall be reported to the board at the next meeting thereof, with the recommendations of the committee ; the board may reject all bids if, in their opinion, good cause exist therefor, but otherwise they shall award the contract to the lowest bidder who

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shall give satisfactory evidence of his ability to perform the contract ; *provided, however,* that the estimated amount of contracts awarded in any one year by any board of chosen freeholders, together with the estimated cost of repairs of roads already constructed, shall not exceed one-fourth of one per centum of the ratables of the county as reported to the state comptroller for the last preceding year ; *and provided further,* that in every contract made as aforesaid it shall be specified that at least five per centum of the contract price shall not be paid to the contractor within the period of one year after the work specified to be done by such contract shall have been fully performed and accepted ; the bidder to whom the contract may be awarded shall, in addition to executing the agreement to perform the work according to the specifications, also execute to the board of chosen freeholders a bond conditioned for the faithful performance of the contract, in the sum specified in the advertisement for bids, and with such sureties as the board may approve ; the contract shall, on behalf of the board of chosen freeholders, be executed by the director thereof, and, when executed by the bidder and said director, a copy of the contract and specifications, with the estimated cost of the work, shall be forthwith filed with the state commissioner of public roads:

Limit of county expenditures.

Five per centum to be retained by county.

Contractors must give bond

Copy of contract and specifications filed with state commissioner.

Commissioner must appoint supervisor.

Property owners nominate supervisor.

Commissioner may remove supervisor.

Supervisor must give his full time to the work.

2. *And be it enacted,* That after a copy of the contracts and specifications shall have been filed with the state commissioner of public roads as aforesaid, the said state commissioner of public roads shall, as soon as practicable, appoint a supervisor of the construction of the work under such contract, who shall receive for his services under this act three dollars per day, to be paid out of the county treasury ; if the work for which such contract shall be made shall have been petitioned for, pursuant to the provisions of the eighth section of this act, then, if the petitioners therefor, or any of them, shall in writing nominate to the said state commissioner of public roads one or more persons for the position of such supervisor, it shall be the duty of said state commissioner of public roads, if only one nomination be made, to appoint as such supervisor the person so nominated, and, if more than one nomination be made, to appoint as such supervisor one of the persons so nominated, and if no such nomination be made, the said state commissioner of public roads shall then appoint as such supervisor any person whom he may consider competent for such position ; the said state commissioner may, however, at any time summarily discharge any supervisor who, in the judgment of the state commissioner, is incompetent or who neglects his duty, and, in such case, shall appoint a new supervisor to take the place of the one so discharged ; the supervisor shall supervise all work done under

Supervisor
must certify
payments.

Freeholders
may borrow
money tempo-
rarily.

Supervisor to
prepare final
certificate.

State to pay
one-third cost.

Total state
appropriation.

Allotment to
be made before
December 31st.

Comptroller to
draw warrants.

the contract shall give his whole time thereto, shall require the provisions of the contract to be strictly adhered to by the contractor, and, in any case where the contract provides for partial payments during the progress of the work, he shall also, as each payment becomes due and before payment shall be made, present to the board his certificate, and also the certificate of the surveyor or engineer, if any there be, stating as near as may be the total amount of work done, and that such work has been done in all respects as required by the contract; and the board shall thereupon direct payment to be made by the county collector; *provided*, that no partial payment made during the progress of the work shall exceed eighty per centum of the estimated value of the work done; the board shall have power to borrow on temporary loans on the credit of the county such sums of money for the purpose of carrying on such work as may from time to time become necessary; and when the work shall have been fully completed, and the terms and conditions of the contract shall have been fully complied with, and such facts shall have been certified to the board to their satisfaction by the supervisor and the surveyor or engineer, if any there be, payment in full shall be made, less the amount required to be withheld for the period of at least one year, as in the next preceding section specified.

3. *And be it enacted*, That when the work under any contract shall have been fully completed, it shall be the duty of the supervisor to prepare a detailed and itemized statement in duplicate of the cost of the improvement, one copy whereof shall be filed with the board of chosen freeholders and one with the state commissioner of public roads.

4. *And be it enacted*, That one-third of the cost of all roads constructed in this state under this act shall be paid for out of the state treasury; *provided*, that the amount so paid shall not in any one year exceed the sum of one hundred thousand dollars; if one-third of such cost shall appear by the statements filed in any one year with the state commissioner of public roads to exceed the said sum of one hundred thousand dollars, then, and in such event, the said sum of one hundred thousand dollars shall be apportioned by the governor and the state commissioner of public roads amongst the counties of the state in proportion to the cost of roads constructed therein for such year, as shown by the statements of costs filed in the office of the state commissioner of public roads; the governor and said state commissioner of public roads shall, between December fifteenth and thirty-first in each year, certify to the state comptroller the amount to be paid to each county for such year, and the state comptroller shall thereupon draw his warrants in favor of the respective county collectors for the sums certified

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as aforesaid upon the state treasurer, who shall pay the same out of any moneys in the state treasury not otherwise appropriated.

5. *And be it enacted*, That on or before September first in each and every year it shall be the duty of the board of chosen freeholders to certify to the county board of assessors, either in the annual tax budget or separately, two-thirds of the estimated cost of all work for which contracts shall have been awarded under this act during such year; and the county board of assessors shall include the sum so certified in the county taxes assessed for such year, and the same shall be assessed, collected and paid over to the county in the same manner and within the same time that other county taxes are assessed, collected and paid over; if a deficiency shall exist in consequence of the cost exceeding the estimate, or in consequence of the receipt of less than one-third of the cost from the state treasury, the board of chosen freeholders shall have authority to borrow on temporary loans to the amount of such deficiency until the next annual taxes shall be assessed, collected and paid over to the county; and if there be a surplus, in consequence of the cost being less than the estimate, such surplus shall be retained and used in the construction of other roads under this act, or in repairs to roads constructed under this act.

Board of freeholders to certify costs to assessors.

Deficiency, how met.

6. *And be it enacted*, That instead of certifying to the county board of assessors two-thirds of the estimated cost of all work for which contracts shall have been awarded under this act in any one year as required by the fifth section of this act, or two-thirds of said estimated cost less one-tenth of said estimated cost as required by the eighth section of this act, the said board of chosen freeholders may, if a resolution to such effect shall be adopted by a vote of at least two-thirds of all its members, borrow such sum or sums of money as may be necessary for the payment of such proportion of said estimated cost by the sale of the bonds of such county, issued in the name of the board of chosen freeholders thereof, and in such sums as the said board may deem proper; said bonds shall bear interest at a rate not exceeding five per centum per annum, shall be sold at not less than their par value, shall not exceed in the aggregate the proportion of the estimated cost of such road as hereinabove mentioned, shall be so divided that one-tenth of the amount of the proportion of said estimated cost shall fall due in one year from their date, and one-tenth of the proportion of said estimated cost in each successive year thereafter for the period of ten years after their date, and shall be either coupon or registered bonds, as the board of chosen freeholders may determine; the principal and interest thereof shall be made payable at the office of the county collector of such county; said bonds shall

Two-thirds less one tenth.

Bonds, how sold.

When to mature.

be signed by the director of said board and the county collector, and shall be sealed with the seal of the county, and the county collector shall keep a record thereof ; it shall be the duty of the board of chosen freeholders each year to place in the tax levy for such county in each year, so long as said bonds shall run, a sufficient sum to pay the interest accruing thereon for said year and the principal of the bonds that shall mature in said year.

7. *And be it enacted*, That any road constructed under the provisions of this act, except within the limits of any city, shall forever thereafter be a county road, and the duty of keeping the same in repair, except within the limits of any city, shall devolve upon the board of chosen freeholders and the county supervisor hereinafter mentioned, and all other powers and duties respecting such roads, except within the limits of any city, shall be imposed upon and vested in the said board of chosen freeholders to the exclusion of all township, borough or other municipal officers excepting city officers ; after the first road shall have been constructed under this act in any county, it shall be the duty of the board of chosen freeholders thereof to appoint a county supervisor of roads who shall hold his office for three years and until his successor is appointed, shall give bond to the board of chosen freeholders in the sum of one thousand dollars conditioned for the faithful performance of the duties of his office with such sureties as the board may approve, and shall receive such salary or allowance as the board may fix ; the board of chosen freeholders shall provide all moneys necessary to keep in a proper state of repair the roads constructed under this act, except within the limits of any city, and may, if there be no moneys on hand that can be lawfully used for such repairs, borrow therefor on temporary loans until the next annual taxes shall have been assessed, collected and paid over to the county; it shall be the duty of the supervisor to report to the board of chosen freeholders, or to the road committee thereof, all repairs he may think necessary or proper to be made to such county roads, and, under the direction and control of said board of chosen freeholders or its road committee, to expend the moneys raised for such repairs in such manner and upon such portions of the roads as will tend to keep them in the best possible state of repair ; no part of said moneys shall be paid into the hands of the supervisor, but all expenses of repairs shall be paid by the county collector on the orders of the board of chosen freeholders, granted only on the presentation of bills verified by affidavit, as now required by law in the case of other claims against the county ; if the board of chosen freeholders shall neglect or refuse to make appropriations sufficient to keep any such road as aforesaid in good repair, any citizen of the county

Record to be kept.

County road, township rights acquired.

County supervisor, when appointed.

Compensation to be fixed.
Duties of.

County to borrow by temporary loans.

Money, how expended.

County collector to make all payments.

Neglect to repair.

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may apply to the supreme court for a writ of mandamus to compel said board to make an appropriation as aforesaid ; and when any such application is made, the court, upon a rule to show cause or otherwise, in such manner as the court shall prescribe, shall ascertain and determine whether such road as aforesaid is in a proper state of repair, and may also, in its discretion, allow to the attorney of the applicant a reasonable counsel fee to be paid by the county; in case the board of chosen freeholders shall not have on hand sufficient moneys out of which to make the appropriation commanded to be made by any writ of mandamus granted as aforesaid, they shall borrow such sum or sums as may be necessary therefor on temporary loans on the credit of the county, and shall require the amount so borrowed to be raised by taxation with the next assessment of county taxes ; it shall be the duty of the authorities of any city within which any portion of road may be constructed under the provisions of this act to keep the portion thereof within such city in repair forever after such construction, and such city shall have the same power, authority and jurisdiction over such portion of such road, and shall have imposed upon it the same duties as were imposed upon and vested in it with respect to such portion of such road before its improvement under the provisions of this act.

Freeholders to be mandamus.

Portion of road within city limits to be kept in repair by the city.

8. *And be it enacted*, That whenever there shall be presented to the board of chosen freeholders of any county a petition signed by the owners of at least two-thirds, either in lineal feet or in area, of the lands and real estate fronting or bordering on any public road or section of road in such county, taking in said estimate of area all the lands of every such owner which are assessed for taxes in said county and which lie together in any farm, tract or lot of which a part has a frontage on said road or section of road, praying the board to cause such road or section to be improved under this act, and setting forth that they are willing that the peculiar benefits conferred on the lands fronting or bordering on said road or section shall be assessed thereon in proportion to the benefits conferred to an amount not exceeding ten per centum of the entire cost of the improvement, it shall be the duty of the board to cause such improvement to be made ; *provided*, that the road or section desired to be so improved shall be at least one mile in length, or, if it be less than one mile in length, shall be an extension of or connection with some other permanently improved or paved road or street ; *and provided, further*, that the estimated cost of all improvements made under this act, together with the estimated cost of repairs of roads already constructed in any county in any one year shall not exceed one-fourth of one per centum of the ratables of such county for the last preced-

Petition, how signed.

Lineal feet or area.

Length of road.

If less than one mile.

Estimated cost not to exceed one-fourth of one per centum of ratables.

Board of freeholders to select road under certain circumstances.

Must cause surveys to be made and specifications prepared.

Stone or other good material to be used.

When specifications are not approved or bids rejected.

Other specifications to be made.

No re-advertisement necessary.

After contract awarded, board to certify two-thirds estimated cost, less one-tenth, to assessors.

Commissioners to estimate benefits, how appointed.

To give notice of appointment of.

ing year; and *provided, further*, that where more roads are applied for than can be constructed under this act in any one year, the said boards of chosen freeholders shall have the power and authority to select from the roads petitioned for the ones first to be constructed, having regard to the most important roads and the distribution of the benefits of this act to all parts of their counties; it shall not be necessary for the board in any such case to declare by resolution their intention to cause such improvement to be made, but they shall forthwith cause all necessary surveys of such road or section to be made, and specifications to be prepared for a macadamized road, or a telford or other stone road, or a road constructed of gravel, oyster shells or other good material, in such manner that the same, of whatever materials constructed, will, with reasonable repairs thereto, at all seasons of the year, be firm, smooth and convenient for travel; the proceedings shall thereafter be the same as is hereinbefore required in cases where such intention has been declared; if the specifications shall not be approved by the board or by the state commissioner of public roads, or if all the bids for the work shall be rejected, it shall be the duty of the board to cause other specifications to be prepared, or re-advertisements for bids to be made, as often as may be necessary and until a contract shall be awarded, to the end that the improvement prayed for may be completed with reasonable speed; *provided, however*, that no re-advertisement need be made where the lowest bid submitted shows that the improvement prayed for cannot be made within the limit of expenditure in this section above mentioned; in every case where a contract shall be awarded after the presentation of such petition as aforesaid, the board of chosen freeholders, instead of certifying to the county board of assessors two-thirds of the estimated cost of the work as prescribed by the fifth section of this act, shall, unless they determine to issue bonds in the manner prescribed by the sixth section of this act, which they are hereby authorized to do, certify two-thirds of said estimated cost less one-tenth of said estimated cost, which sum the county board of assessors shall include in their assessments of county taxes.

9. *And be it enacted*, That when the improvement prayed for as aforesaid shall have been completed and the statement of the cost thereof filed with the board of chosen freeholders, as prescribed by the third section of this act, said board shall apply to the circuit court of the county for the appointment of commissioners to estimate and assess the peculiar benefits conferred by such improvement upon the lands and real estate fronting or bordering on the road or section thereof improved, of the time and place of which application notice shall be given by

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ten days' publication in two daily newspapers printed and circulating in the county, or by two weeks' publication in two weekly newspapers printed and circulating therein, at which time and place or at such other time and place as the court shall designate, said court shall, without unnecessary delay, appoint three commissioners who shall be disinterested freeholders and residents of the county in which the application is made, to estimate and assess the benefits aforesaid; the said court shall have power to remove any commissioner and appoint another in his place and also to fill any vacancy that may occur in the office of any commissioner from any cause; said commissioners shall each receive three dollars per day, to be paid by the county collector.

Court to appoint and remove commissioners.

Compensation of.

10. *And be it enacted*, That said commissioners, before entering upon the duties required of them by this act, shall take and prescribe before some person duly authorized to administer the same an oath or affirmation that they will make all assessments and estimates required of them fairly, legally and equitably according to the best of their skill and understanding, which oath or affirmation shall be attached to the report that they are hereinafter required to make.

Oath of commissioners.

11. *And be it enacted*, That the said commissioners, having thus qualified, shall give such notice as the court may direct of the time and place when and where they will hear any persons in interest who may present themselves to be heard, and at such time and place and at such other times and places to which they may adjourn for that purpose the said commissioners shall attend, and shall give a public hearing to those persons in interest who may desire to be heard; the said commissioners shall have power to examine witnesses under oath or affirmation, to be administered by any one of them, and to enter upon and view the lands and real estate fronting or bordering on the road or section thereof improved, and to adjourn from time to time in their discretion, or as directed by said court; they shall use diligent efforts to ascertain the names of the owners of the lands fronting or bordering on the road or section thereof improved, and shall state the same in the report hereinafter mentioned; but the failure to ascertain the name of any owner, or to state the same correctly, or the omission of any such name from the report, shall not invalidate said assessment nor be a bar to the collection of the same.

Commissioners to give public hearing of time of meeting.

12. *And be it enacted*, That after having given opportunity as aforesaid for a public hearing of the persons in interest, and having viewed the lands fronting or bordering on the road or section thereof improved as aforesaid, the said commissioners shall make a report in writing of their estimates and assessments to the said court, accompanied by a map prepared by the

Commissioners to report in writing.

Map made by engineer in charge of the road.

engineer in charge of the construction of the road, showing the several tracts or parcels of lands and real estate fronting or bordering on said road or section thereof; the said report shall state the cost of the whole work, which shall be furnished to the commissioners by the board of chosen freeholders from the report of the supervisor of construction filed with said board under the requirements of the third section of this act, and shall give the names, so far as ascertained, of the owners of the tracts or parcels of lands and real estate fronting or bordering on said road or section thereof, the city, township, borough or other municipality in which each tract or parcel of land is situate, and the amount of the assessment upon the owner or owners of each of said tracts or parcels of land and real estate for the said benefits; which several assessments shall be in proportion, as near as may be, to the peculiar benefits deemed to have been conferred by said improvement upon the respective tracts of land and real estate aforesaid; if any tract of land shall be located in more than one city, township, borough or other municipality, it shall be stated in said report as being in the city, township, borough or other municipality in which there is the greatest frontage by lineal feet on the road or section thereof improved; in no case shall any tract or parcel of land and real estate, or any owner thereof, be assessed beyond the amount of benefit actually derived from said improvement, nor shall the aggregate amount of assessments imposed upon the tracts or parcels of land fronting or bordering on such road or section thereof exceed ten per centum of the total cost of the improvement.

13. *And be it enacted*, That upon the coming in of any such report signed by the said commissioners, or any two of them, said court shall cause such notice to be given as it shall deem proper of the time and place of hearing any objections that may be made to such assessment, and after hearing any matter that may be alleged against the same the said court, either by rule or order, shall confirm the said report, or shall refer the same to the same commissioners for revision and correction, or to new commissioners to be appointed by the said court forthwith to reconsider the subject-matter thereof, and the said commissioners to whom such report shall be so referred by the court shall return the same corrected and revised, or a new report to be made by them in the premises, to the said court without unnecessary delay, and the same, being so returned, shall be confirmed, or again referred by the said court in the manner aforesaid, as right and justice shall require, and so, from time to time, until a report shall be made or returned in the premises which said court shall confirm; such report, when so confirmed, shall be final and conclusive, as well upon the said boards of

Names of
property owners
required.

Location of
tracts of land.

Court to give
notice of
hearing.

Court may
order new
report.

When report is
confirmed shall
be final and
conclusive.

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chosen freeholders and the cities, townships, boroughs or other municipalities in which said lands may be situate, as upon the owners of any lands and real estate affected thereby, and the court shall require the same to be forthwith filed with the county clerk, and certified copies thereof and of the accompanying map, and of the rule or order confirming the report, to be promptly delivered to the county collector, one for said county collector and for each city, township, borough or other municipality in which the assessed lands may lie; the county collector shall retain one of the said copies for his own use, and shall forthwith give one to the collector or receiver of taxes in each of the cities, townships, boroughs, and other municipalities in which the assessed lands may lie; each city, township, borough or other municipality whose collector or receiver of taxes shall receive such certified copy shall, by its proper disbursing officer, within six months after the date of the said order of confirmation, pay the amount of assessments appearing by said report to have been assessed upon the lands situate in such city, township, borough or other municipality, who shall receive for his services three per centum of the money so collected, to be paid by the county.

File with
county clerk.

Copies to county
collector and
townships, &c.

Township to
collect in six
months.

14. *And be it enacted*, That no certiorari shall be allowed by any court to review any of the proceedings in relation to such improvement, nor in any way to affect any assessment made by such commissioners, after the lapse of thirty days from the making of the order of the court confirming such assessment; the court shall designate what notice, if any, shall be given by publication or otherwise of the confirmation of the report of said commissioners.

No certiorari
allowed.

15. *And be it enacted*, That the assessments made by said commissioners shall be and remain a lien upon the lands assessed, from the date of the confirmation of the report of assessments in the same manner and to the same extent that taxes are liens upon lots or tracts of lands situate in the city, township, borough or other municipality in which the assessed lands may be.

Assessments to
remain a lien on
the property.

16. *And be it enacted*, That the receiver or collector of said city, township, borough or other municipality shall, as soon as the said report is delivered to him, give to the owners of lots and tracts of lands appearing by said report to be assessed, such notice of the assessments and of the time within which the same are required to be paid as the court in its order of confirmation, hereinabove mentioned, shall prescribe; all such assessments shall become due and payable to such receiver or collector within six months from the date of the order of confirmation hereinabove mentioned.

Collector to
notify owners
of lands.

Township, &c.,
to bring suits for
collection of
assessments.

17. *And be it enacted*, That if any assessment upon any lot or tract of land made under the provisions of this act shall not be paid within the time appointed in said notice, the township committee, common council or other governing body in the city, township, borough or other municipality within which such lot or tract of land shall be situate, or a majority of them may, as they shall deem proper, either bring an action on contract in any court of competent jurisdiction, in the corporate name of such city, township, borough or other municipality, against the owner or owners of such lot or tract of land for so much money laid out and expended by them for the use of such owner or owners and declare generally, and give the special matter in evidence, and either party from any judgment rendered therein may have the same remedy by appeal or otherwise as if said parties were private individuals, or they may proceed to collect the said assessment by sale of the lot or tract of land whereon such assessment has been imposed, or may be a lien, in the same manner and to the same extent as lands are now sold for unpaid taxes in such city, township, borough or other municipality, and the purchaser or purchasers at any such sale or sales, and his legal representatives, shall hold and enjoy such lot or tract of land, with the rents, issues and profits thereof, in the same manner and by the same title and tenure as purchasers at the sales of lots or tracts of land for unpaid taxes can now hold and enjoy the same in such city, township, borough or other municipality.

Either party
may appeal.

Assessments to
be a lien upon
the lands and
sold as lands
are now sold
for taxes.

Property owners
may improve at
their own ex-
pense.

18. *And be it enacted*, That if any property owners or owner along any road in any county of this state which has not been improved, or is not undergoing improvement, under the previous sections of this act, shall desire any section of any road in such county to be improved, and are or is willing to contribute the whole expense of such improvement, the supervisor of roads of such county shall, upon the written request of such owners or owner, make a plan of such section of road so to be improved, in which shall be given the levels and distances, and also specifications, which shall state the materials that may be used, and the manner of using them ; and a copy of such plan, specifications and of any bids to do such work shall then be submitted by such owners or owner to the board of chosen freeholders, and if such board shall approve them, it shall then be lawful for such owners or owner to accept any bid or bids so approved from among the bidders, and proceed to build such section of road according to such plan and specifications, and such owners or owner shall have control of the expenditure of the moneys used to make such improvement, subject to the approval and supervision of the supervisor of such county ; and

Bids and speci-
fications received

Owners to dis-
burse the money

upon the completion of the improvement to the satisfaction of the said supervisor and said board of chosen freeholders, and upon the submission to said board of receipts, showing full payment for materials furnished and work done under the plan and specifications, such section of road so improved shall thereafter be a county road; and the said supervisor shall be paid by the aforesaid owners or owner the sum of ten dollars for making the plan, the sum of five dollars for drawing the specifications, and the sum of five dollars for the supervision of the work, and, in case such supervisor is not a civil engineer and an actual survey is necessary, then such owners or owner, at their or his expense, shall procure a survey which shall be subject to the approval of such supervisor, which survey shall take the place of the plan before mentioned.

Shall be a
county road.

Fees allowed.

19. *And be it enacted*, That the act entitled "An act to provide for the more permanent improvement of the public roads of this state," approved the fourteenth day of April, one thousand eight hundred and ninety-two, and all acts supplementary thereto and amendatory thereof, be and the same are hereby repealed; *provided, however*, that this section shall not cause any proceedings for the improvement of any public road or section thereof under the provisions of the act hereby repealed to abate, but such proceedings may be continued under the provisions of this act in the same manner as if they had been commenced hereunder.

General
repealer.

Proviso.

20. *And be it enacted*, That this is act shall take effect immediately.

Approved March 22, 1895.

Destroying Power to Mandamus.

CHAPTER 168.

A Supplement to an act entitled "An act to provide for the permanent improvement of public roads in this state," approved March twenty-second, one thousand eight hundred and ninety-five.

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

1. Whenever there shall be presented to the board of chosen freeholders of any county in this state any petition by the owners of lands praying the said board to cause any road or section thereof to be improved under the provisions of the act to which this is a supplement, it shall be the duty of such board of chosen freeholders, if they are satisfied that all the

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provisions and conditions of said act have been met and complied with in and by such petitions, to consider and to determine by a vote of a majority of all the members constituting said board, whether the road or section mentioned in said petition is of sufficient general importance to warrant the expenditure of the county and state money for the improvement thereof; and said board of chosen freeholders is hereby authorized, by a vote of a majority of all the members constituting the said board, to grant the prayer of the said petition or to refuse the same if said board shall be of the opinion that the improvement is not of sufficient public importance or that the expense thereof will be an unnecessary public burden; *provided*, that this act shall in no way affect any proceeding heretofore taken to procure a mandamus in case of petition filed under said act.

2. All acts and parts of acts inconsistent with the provisions of this act be and the same are hereby repealed, and this act shall take effect immediately.

Approved April 14, 1896.

Changing Location or Improving.

CHAPTER 75.

An Act to amend an act entitled "An act to provide for the permanent improvement of public roads in this state," approved March twenty-second, one thousand eight hundred and ninety-five.

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

1. The eighteenth section of the said act shall be amended so as to read as follows:

18. That if any property-owners or owner along any road in any county of this state which has not been improved or is not undergoing improvement under the previous sections of this act shall desire any section of any road in such county to be improved or to be changed in location and improved, and are or is willing to contribute the whole expense of such improvement, and provided every owner of land upon that part of the road proposed to be vacated under this act shall consent in writing to such vacation, the supervisor of roads of such county shall, upon the written request of such owners or owner, make a plan of such sections of roads so to be improved or changed in location and improved, in which will be given the levels and distances, and also specifications stating the materials that may be used and the manner of using them; and a copy of such plan, location, change of location, specifications and of any bids to do

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such work shall then be submitted by such owners or owner to the board of chosen freeholders, and if such board shall approve them and any change of location which may be proposed, it shall then be lawful for such owners or owner to accept any bid or bids so approved from among the bidders, or at their own expense to proceed to build such section of road according to such plan, location and specifications, and such owners or owner shall have control of the expenditure of the moneys used to make such improvements, subject to the approval and supervision of the supervisor of such county ; and upon the completion of the improvement to the satisfaction of the said supervisor and said board of chosen freeholders, and upon the submission to said board of receipts showing full payment for materials furnished and work done under the plan and specifications, such section of road so improved shall, if the board of chosen freeholders shall so declare, thereafter be a county road, but otherwise shall remain an ordinary public highway, and any and all portions of any road now existing which may have been rendered unnecessary or be superseded by the new road so constructed shall be vacated and abandoned as a public road without other action or proceedings than the approval of the board of chosen freeholders as hereinbefore provided ; and the said supervisor shall be paid by the aforesaid owners or owner the sum of ten dollars for making the plan, the sum of five dollars for drawing the specifications, and the sum of five dollars for the supervision of the work, and in case such supervisor is not a civil engineer and actual survey is necessary, then such owners or owner at their or his expense shall procure a survey which shall be subject to the approval of such supervisor, which survey shall take the place of the plan before mentioned, and shall include all the new roads proposed to be constructed and all the old roads proposed to be abandoned.

Approved March 23, 1896.

Increased Power to Borrow.

An Amendment to an act entitled "A supplement to an act entitled 'An act to enable boards of chosen freeholders to acquire, improve and maintain public roads,' approved March nineteenth, one thousand eight hundred and eighty-nine, which supplement was approved April ninth, one thousand eight hundred and ninety-two.

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

1. The first section of an act entitled "A supplement to an act entitled 'An act to enable boards of chosen freeholders to acquire,

Section to be amended.

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improve and maintain public roads,''' approved March nineteenth, one thousand eight hundred and eighty-nine, which supplement was approved April ninth, one thousand eight hundred and ninety-two, be amended so as to read as follows :

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

Amount authorized to raise and bonds issued.

1. In counties of the second class it shall be lawful to raise a sum not to exceed four hundred thousand dollars, for which bonds may be issued by the board of chosen freeholders of any such county, under the act to which this is a supplement or any supplement or amendment thereof; *provided, however,* that if work under said act and supplements or amendments has already been done to an amount exceeding said sum, bonds under said act and supplements may be issued to an amount sufficient to raise and pay for such work; *and provided also,* that no county road bonds shall be issued to such an amount as, in addition to existing debt, shall raise the debt of the county for all purposes above three per centum of the assessed value of the real estate therein; and in case any such bonds shall be issued in excess of the limit aforesaid, all such bonds so issued in excess shall be void in the hands of any person or party notwithstanding any recitals therein or any representations that may be made concerning the same; in case application has already been made to the circuit court and a certificate shall have been recorded and filed, as required by said act, such application need not be repeated in case of any subsequent issue of such bonds where the original certificate on file shows that the new issue of bonds will not exceed three per centum of the assessed value of the real estate in said county as limited by this act.

Proviso.

Proviso.

2. The second section of said act be amended so as to read as follows :

Board not to use money raised except to grade, &c.

2. In any county of the second class wherein the board of chosen freeholders thereof shall heretofore or may hereafter issue bonds under said act and supplements, that such board of such county shall not use any of the money so raised for any other purpose except to grade, macadamize or improve any road in any such county, under the provisions of the act to which this is a supplement and the several supplements and amendments thereof; *provided,* nothing herein shall prohibit the doing of the necessary repair of any road heretofore graded, macadamized or improved by any such board or that may be hereafter graded, macadamized or improved under said act and supplements.

Proviso.

3. All acts and parts of acts inconsistent herewith be and the same are, so far only as they conflict herewith, repealed, and that this act shall take effect immediately.

Approved March 24, 1897.

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Broad Tires.

CHAPTER 76.

An Act to amend an act entitled "An act to enable township committees to encourage the use of broad tires on wagons and carts by a rebatement of taxes."

I. BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*, That section one of an act entitled "An act to enable township committees to encourage the use of broad tires on wagons and carts by a rebatement of taxes," approved March sixteenth, one thousand eight hundred and ninety-three, which reads as follows :

"I. BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*, That township committees be and they are hereby authorized, when in their judgment it is for the public good, to pass an ordinance allowing a rebate of taxes for township or road purposes to all owners or possessors of wagons and carts used in said township for transportation of goods, wares, merchandise, produce, passengers, and for general farm, freight and express purposes, having tires of not less than four inches in width ; *provided*, the said rebate shall not exceed fifty cents for each wheel in use in any one year," be and the same is hereby amended so as to read as follows :

I. BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*, That township committees be and they are hereby authorized, when in their judgment it is for the public good, to pass an ordinance allowing a rebate of taxes for township or road purposes to all owners or possessors of wagons and carts used in said township for transportation of goods, wares, merchandise, produce, passengers, and for general farm, freight and express purposes, having tires of not less than four inches in width ; *provided*, the said rebate shall not exceed one dollar for each wheel in use in any one year.

2. That this act shall take effect immediately.

Passed March 24, 1896.

Appendix C.

NEW JERSEY.

1. All road taxes are to be paid in money.
2. The office of overseer of highway is abolished.
3. The roads of a township are placed under the management of the township committee, and money may be raised by township bonds for grading, macadamizing and improving the same ; bonds to be authorized by vote at the annual town meeting.
4. Under the County act, the Board of Chosen Freeholders of any county may designate certain roads as county roads, and improve the same by the issue of county bonds ; townships to pay one-third of the cost.
5. Under the State Aid law, whenever the owners of two-thirds of the lands fronting on any public road will undertake to pay one-tenth of the cost of improving such road, the Board of Chosen Freeholders may cause such improvements to be made, the State paying one-third of the cost up to, at present, the limit of \$100,000 per year.
6. Under the act for the acquirement of turnpike roads for free public use, whenever the owners of two-thirds of the land fronting on any turnpike toll-road pray that said road may be acquired for free public use, and that they are willing to pay ten per cent. of the entire cost of such road, the Governor appoints five commissioners to estimate and determine the fair and just value of said road ; after having arrived at such value, if the State Road Commissioner ratifies the same, the board may purchase, the State paying one-third of the cost and the county paying the balance, fifty-seven per cent.

Appendix D.

TABLES.

As many persons interested in the construction of stone roads are asking questions about their cost, we enclose a table to show at a glance the number of square yards at different widths in a mile of road ; also the cost at different widths and various prices per square yard. Any variations from these prices can be quickly ascertained, by adding subtracting, multiplying and dividing, for a less or greater width. For example, a road eight feet wide has $4,693\frac{1}{3}$ square yards in one mile. Nine feet wide would be obtained by adding one-eighth of that number of square yards ; for seven feet wide you would subtract one-eighth of that number of square yards. For twice that number of feet you would multiply by two.

SQUARE YARDS IN ONE MILE OF

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

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

8 feet wide, or	4,693 $\frac{1}{3}$ sq. yds.,	at 30c. per yd.,	. . . . .	\$1,408 00
10	“ 5,866 $\frac{2}{3}$	“ “	1,760 00
12	“ 7,040	“ “	2,112 00
14	“ 8,213 $\frac{1}{3}$	“ “	2,464 00
16	“ 9,386 $\frac{2}{3}$	“ “	2,816 00
18	“ 10,560	“ “	3,168 00

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

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

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

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

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

	8 feet wide, or	4,693 $\frac{1}{3}$ sq. yds.,	at 60c. per yd.,	. . . . .	\$2,816 00
10	"	5,866 $\frac{2}{3}$	"	"	3,520 00
12	"	7,040	"	"	4,224 00
14	"	8,213 $\frac{1}{3}$	"	"	4,928 00
16	"	9,386 $\frac{2}{3}$	"	"	5,632 00
18	"	10,560	"	"	6,336 00

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8 feet wide, or	4,693 $\frac{1}{3}$ sq. yds.,	at 65c. per yd.,	\$3,050	66 $\frac{2}{3}$
10	"	5,866 $\frac{2}{3}$	"	"	3,813 33 $\frac{1}{3}$
12	"	7,040	"	"	4,576 00
14	"	8,213 $\frac{1}{3}$	"	"	5,338 66 $\frac{2}{3}$
16	"	9,386 $\frac{2}{3}$	"	"	6,101 33 $\frac{1}{3}$
18	"	10,560	"	"	6,864 00

8 feet wide, or	4,693 $\frac{1}{3}$ sq. yds.,	at 70c. per yd.,	.....	\$3,285	33 $\frac{1}{3}$
10	"	5,866 $\frac{2}{3}$	"	"	4,106 66 $\frac{2}{3}$
12	"	7,040	"	"	4,928 00
14	"	8,213 $\frac{1}{4}$	"	"	5,749 33 $\frac{1}{3}$
16	"	9,386 $\frac{2}{3}$	"	"	6,570 66 $\frac{2}{3}$
18	"	10,560	"	"	7,392 00

8 feet wide, or	4,693 $\frac{1}{3}$ sq. yds.,	at 75c. per yd.,	.....	\$3,520	00
10	"	5,866 $\frac{2}{3}$	"	"	4,400 00
12	"	7,040	"	"	5,280 00
14	"	8,213 $\frac{1}{3}$	"	"	6,160 00
16	"	9,386 $\frac{2}{3}$	"	"	7,040 00
18	"	10,560	"	"	7,920 00

8 feet wide, or	4,693 $\frac{1}{3}$ sq. yds.,	at 80c. per yd.,	.....	\$3,754	66 $\frac{2}{3}$
10	"	5,866 $\frac{2}{3}$	"	"	4,693 33 $\frac{1}{3}$
12	"	7,040	"	"	5,632 00
14	"	8,213 $\frac{1}{3}$	"	"	6,570 66 $\frac{2}{3}$
16	"	9,386 $\frac{2}{3}$	"	"	7,509 33 $\frac{1}{3}$
18	"	10,560	"	"	8,448 00

8 feet wide, or	4,693 $\frac{1}{3}$ sq. yds.,	at 85c. per yd.,	.....	\$3,989	33 $\frac{1}{3}$
10	"	5,866 $\frac{2}{3}$	"	"	4,986 66 $\frac{2}{3}$
12	"	7,040	"	"	5,984 00
14	"	8,213 $\frac{1}{3}$	"	"	6,981 33 $\frac{1}{3}$
16	"	9,386 $\frac{2}{3}$	"	"	7,978 66 $\frac{2}{3}$
18	"	10,560	"	"	8,976 00

8 feet wide, or	4,693 $\frac{1}{3}$ sq. yds.,	at 90c. per yd.,	.....	\$4,224	00
10	"	5,866 $\frac{2}{3}$	"	"	5,280 00
12	"	7,040	"	"	6,336 00
14	"	8,213 $\frac{1}{3}$	"	"	7,392 00
16	"	9,386 $\frac{2}{3}$	"	"	8,448 00
18	"	10,560	"	"	9,504 00

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	8 feet wide, or	4,693 $\frac{1}{3}$	sq. yds., at	95c. per yd.,	\$4,458	66 $\frac{2}{3}$
10	"	5,866 $\frac{2}{3}$	"	"	5,573	33 $\frac{1}{3}$
12	"	7,040	"	"	6,688	00
14	"	8,213 $\frac{1}{3}$	"	"	. . . . .	7,802	66 $\frac{2}{3}$
16	"	9,386 $\frac{2}{3}$	"	"	. . . . .	8,917	33 $\frac{1}{3}$
18	"	10,560	"	"	. . . . .	10,032	00

	8 feet wide, or	4,693 $\frac{1}{3}$	sq. yds., at	\$1.00 per yd.,	. . . . .	\$4 693	33 $\frac{1}{3}$
10	"	5,866 $\frac{2}{3}$	"	"	5,866	66 $\frac{2}{3}$
12	"	7,040	"	"	7,040	00
14	"	8,213 $\frac{1}{3}$	"	"	8,213	33 $\frac{1}{3}$
16	"	9,386 $\frac{2}{3}$	"	"	9,386	66 $\frac{2}{3}$
18	"	10,560	"	"	10,560	00

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