REPORT OF THE CHIEF ENGINEER

DELAWARE STATE HIGHWAY DEPARTMENT

July 1, 1951 to July 1, 1952

Dover, Delaware

To the Chairman and
Members of the State
Highway Department,
Dover, Delaware.

Gentlemen:

I have the honor to submit to you the Annual Report of the State Highway Department for the fiscal year ending July 1, 1952.

At the outset of this report, it seems appropriate to mention that fiscal 1952 was a year of record Department activity and accomplishment.

It is significant in that more miles of highways were under construction, and more new construction contracts were awarded and under actual construction than in any previous period of Department history. Of like importance were the surface treatment and road maintenance programs which were greater than any previous year.

Sixty-one projects, with a value of $14,250,000.00 were under active construction during fiscal 1952. Of these, 20 contracts with an unfinished value of $4,190,000.00 were carried over from fiscal 1951, and 41 contracts with a bid value of $10,060,000.00 were awarded and under construction during the period covered by this report.

This record construction program, representing 138.9 miles of new and reconstructed roads and several major bridge structures, added to 238 miles of surface-treated roads, rounded out a year which we feel may be considered as a progressive step toward meeting the direct challenge

that the now unpredictable traffic load is imposing on our highway plant.

The phrase "complete the job" cannot be used in the foreseeable future because it is my frank opinion that construction of new facilities and maintenance of existing roads will continue to trail the demands of traffic just as they have since the earliest day of motor transportation.

Fifty-three million motor vehicles, traveling 600 billion vehicle miles, are reported as using the highways of the nation during 1951. This represents an increase of 1 million vehicles and 150 billion travel miles over that reported for 1950.

The number of heavy transportation vehicles has increased to such an extent that now more freight is hauled over the highways than over rails. When we consider that 93% of the freight moved throughout the nation is at one time or another hauled over the highways, it surely bears out the statement of highway economists that next to "peace" the problem of adequate highways is a foremost one for officials of Government. A deteriorating highway system will have adverse influences on our expanding economy. Highway analysts and research authorities now predict that within the next fifteen years there will be 75 million vehicles on the nation's highways with a 900 billion travel mileage. Incredible and fantastic as these figures seem, they may prove to be underestimated, as has been most previous traffic predictions.

I would be remiss in my duty as Chief Engineer if I did not record in this report the seriousness of the highway problem that is now and will continue to be with us for some time to come.

During the past year there has appeared in national magazines dramatic advertising by motor car and truck manufacturers and associated industries, as well as articles by prominent authors, calling attention to the public of the paralyzing congestion on our present highways and demanding relief from these conditions.

It seems to me that calling attention to congested highways only confirms the common knowledge to motorists, but when State highway officials and affiliates present the pertinent financial facts, particularly when such facts point to additional revenue requirements, they are met with the cry of propaganda from the very organizations who are

demanding relief from the traffic congested and obsolete highways.

Highway engineers have often been criticised for lack of vision in not designing to meet today's weight and volume of vehicles. No one criticises the car or truck designer or engineer of those earlier years, yet the design of the car and truck is almost ridiculous in comparison with present-day models. The one major diffeernce is that the road continues to deliver service while the vehicles of yesterday have been scrapped for many years.

It seems evident that too much emphasis is being placed upon the engineering features of the highway situation, and not enough on the fundamental fact that the problem is about 90% financing and 10% engineering. We have the engineering know-how, most materials are available, and there are a sufficient number of competent contractors to perform the actual construction operation. Complete accord is required, plus a realistic approach to the problem of sufficient funds.

Fortunately for Delaware, Governor Elbert N. Carvel and the Members of the 1949 and 1951 General Assemblies have, by their foresight and discerning knowledge of the ever-present needs of the highway system, authorized highway improvement bonds totaling $22,500,000.00 for the past and current bienniums. From 1949 and extending over a period to the end of the approaching fiscal 1953, it is estimated that the highway system will have been improved to the extent of 30 million dollars which includes Federal Aid allotments.

It is my firm belief that, if we are to retain the advantages so gained, similar progressive construction programs must be continued throughout the next decade.

Permanent improvements to the highways in future years are entirely contingent upon the new funds that may be made available to the Department through additional highway improvement bonds or from revenue sources which at this time remain unexplored. In the report for fiscal 1951 it was indicated that emphasis was being placed upon the creation of a backlog of plans for urgent projects in order that there would be no delay in the contract awards, if and when the necessary funds became available. When it became known that the 1951 General Assembly had authorized highway improvement bonds totaling $13,500,000.00 for construction purposes in this current biennium, a concerted

effort toward the enlargement of the afore-mentioned backlog of plans was made. As a result of these efforts the Department was able to award 41 construction contracts during the period.

The construction program that was subsequently evolved is scheduled to extend through the next fiscal year. By the end of fiscal 1953 it is expected that the presently available construction funds will be entirely obligated, and that the construction projects so obligated will be approximately 80% complete. Therefore, additional new funds will be necessary, if the progress of rehabilitating the highway plant is to be continued.

During the year, the number of employees has increased over that of previous fiscal years. In view of the fact that construction and maintenance operations have mounted so tremendously, it is felt that this additional personnel was justifiable and in proportion with the end results.

Each year the public demand for services, both related and non-related to Department responsibilities, is steadily increasing. The Department has endeavored to render these services without favor, particularly as to flood control, drainage problems, and beach erosion. Flood control, surface water drainage, and beach erosion should be matters for serious consideration by the 1953 General Assembly. Legislation should be enacted to distinctly spell out the Departments responsibilites, if any, for these services. However, such duties should not be imposed without financial provisions being made for their fulfillment.

It has been necessary during this period to replace many pieces of maintenance equipment, due to obsolescence.

The streets and roads of the suburban communities throughout the State are placing heavy additional responsibilities on the maintenance forces. The demands by the residents of these communities are a continual problem that is difficult to entirely satisfy. Many of these streets and roads were accepted by the Department before the recent revision of specifications governing suburban communities. Due to the light construction of these roads and streets, many of them are beginning to break up because of the increased weights and speeds of present-day traffic. When submitting the budget for the next biennium, it is intended to include requests for sufficient funds to purchase equipment, and to provide personnel who will be specifically

assigned to the maintenance of suburban-community roads and streets.

It seems unnecessary to reiterate the causes of deterioration of our highways. The reports, which have been submitted in prior years, have pointed out the reasons for highway plant deterioration. The needs of the highway system are apparent to all who use them. To prevent traffic strangulation in the heavier populated areas of the State, new highways, bridges, and grade separations are urgently required. In addition, the present traffic demands, as to volume, weight, and widths, dictate the urgency of widening and resurfacing long stretches of the important arteries. Many of the secondary roads are carrying a volume of traffic that the present pavements are unable to withstand. In most cases, these roads need realignment and entire reconstruction.

Three new regional developments—Delaware Memorial Bridge, New Jersey Turnpike, and the nearly completed Chesapeake Bay Bridge in Maryland—will bring increased traffic to the through routes in Delaware. When the Chesapeake Bay Bridge and the Maryland expressways have been completed, they will afford an expressway system extending from New England to Washington, D. C. One link in this expressway system will be that section extending from Warwick, Maryland, to the Delaware Memorial Bridge.

To avoid unreasonable inconvenience to all highway users in the State of Delaware, positive action will be taken to provide an adequate link in Delaware. In addition to the anticipated generation of new northbound and southbound traffic, it is expected that the Chesapeake Bay Bridge will increase the seasonal traffic to the resort areas along the Atlantic coast.

To provide relief from traffic congestion that will result when these three regional developments become fully operational, several new highways and the reconstruction of many others must be given serious immediate consideration.

During this report period, the Department has collected data and performed much preliminary engineering towards the accomplishment of plans for future highway improvements.

The duties and responsibilities of the Department are continually increasing. Such additional responsibilities as construction of dykes, waterfront protection, beach erosion, drainage, flood control, sidewalk construction, installation

of aircraft warning lights, plus the regular legally-assigned duties, indicate that instead of being concerned with highways only, the Department now operates as a "Department of Public Works."

I am most grateful to the Members of the Department for their patient understanding of the many involved problems that were presented during the year. Sincerely appreciated was their counsel and guidance without which this year of accomplishments would have been impossible.

To the division heads, office staff, and other employees, I extend my warmest thanks for their valued assistance, cooperation, and efficient manner in which their assigned tasks were performed.

Detailed reports of the various activities and operations of the Department appear in the later pages.

PERSONNEL AND ADMINISTRATION

John A. Joslin, Administrative Assistant

Personnel

The greatest opportunity to further advance the effectiveness and efficiency of the highway operation rests in the attention given to the "human element." To take advantage of this opportunity the Department must first select personnel for ability and willingness to do the job.

The Department's greatest asset is a skilled, resourceful, and efficient force of satisfied employees. To obtain and retain such a force, the Department must offer steady employment, salary and wages commensurate with a person's skill and ability to produce, retirement security in the form of an adequate pension plan based upon current economic conditions, and last but not least, the assurance of civil service or merit system protection for his or her position.

At the end of this report period there were 899 employees on the Engineering, Maintenance, and Mosquito Control payrolls of the Department. This indicates an increase of 56 employees over that of fiscal 1951.

It has been mentioned in other sections of this report that the necessity for increasing the number of employees was a direct result of the large construction and maintenance programs underway during the period. To perform the numerous functions of the Department in a manner that would assure success to the construction and maintenance

efforts, this increase in personnel seemed justified and necessary.

Competition of industry, contractors and consultant firms continued to make it very difficult to attract engineering graduates to a highway career. In an effort to arouse the interest of engineering students in highway work, the Department offered temporary summer employment to students of nearby engineering colleges. It was felt that this was planning for the future. The thought was that if these students could be interested in highway work during their vacation period, it would greatly influence their career decisions upon graduation. It was very encouraging to note that the 16 students so employed performed their assigned tasks in a creditable manner, and all seemed very interested in highway work as their future career. These 16 are included in the above-mentioned increase of personnel.

Although it has never been, and is not now, the policy of the Department to compete with private industry as to wage scales, we were however required to increase our rates of pay in order to retain and obtain a sufficient and competent personnel. Recognizing the need for a revised pay scale to meet current economic conditions, the Department approved an increase of 6% for salaried employees and 10% for hourly employees, effective March 1, 1952. The increase for salaried employees was applicable only to classifications under $5,000.00. Notwithstanding this increase, the wages and salaries of many classifications are considerably below the nationwide average for highway employees. A few typical examples are shown:

Classification	Delaware Rate	Nationwide Average
Laborer	$186.00	$199.64
Gang Foreman	281.00	298.10
Mechanic	281.00	283.68
Project Engineer	395.00	412.50
Chief Survey Party	327.00	388.42
Plans Designer	395.00	416.09

During the fiscal period, 8 employees entered the Armed Services, 3 were pensioned, and 5 were deceased.

The following tabulation indicates the personnel by Divisions and Classifications, as of June 30, 1952:

TABULATION OF PERSONNEL

As of June 30, 1952

Division	Profes-sional	Sub-Profes-sional	Clerical Steno-grapher	Maintenance Mo.	Maintenance Bwkly	Total
Plans and Designs	10	10	1	—	—	21
Testing	5	27	1	1	—	34
Traffic and Planning	5	9	8	1	—	23
Bridge	6	—	—	—	—	6
Suburban Communities	2	—	1	—	—	3
Rights of Way	4	1	4	—	—	9
New Castle County	15	54	9	37	170	285
Kent County	4	20	7	25	132	188
Sussex County	10	31	7	42	211	301
Mosquito Control	2	—	1	—	13	16
Administration	4	2	6	1	—	13
	67	154	45	107	526	899

Administration

In addition to personnel matters, this office is responsible for the routine administrative details of the Department. Such responsibilities include preparing annual and other miscellaneous reports, preparing biennial and annual intradepartmental budgets, reviewing expenditures to assure division conformance with budgetary allotments, maintaining liaison between the Department and its attorney regarding matters requiring legal advice, preparing resolutions and routine agreements, assisting in the preparation of proposed legislation and its subsequent presentation for legislative consideration, compiling data for the numerous questionnaires received from other States and Federal Agencies, representing the Chief Engineer at hearings for the vacation of unnecessary roads, and other assignments as may be designated by the Chief Engineer.

FEDERAL AID AND ESTIMATING DIVISION

Robert C. Densten,
Fed. Aid and Est. Engineer

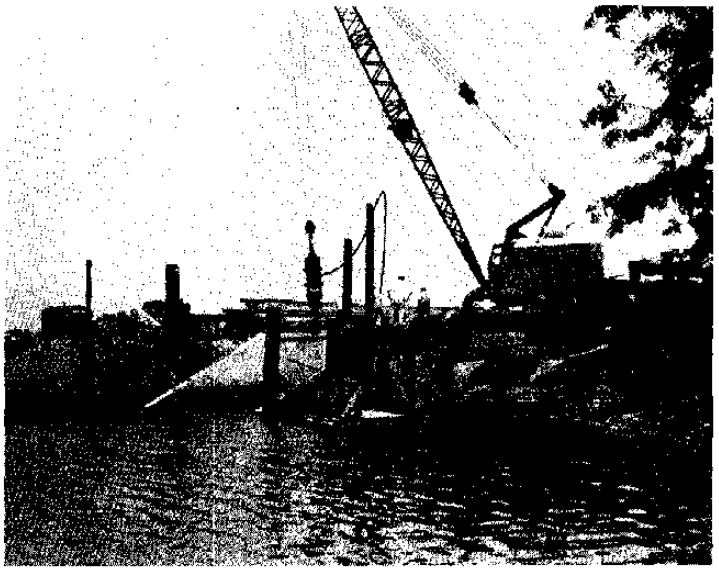
During the past fiscal year 19 advertisements for contractual bids were published in Delaware newspapers and trade magazines. The advertisements notified the public of projects to be offered at 17 lettings.

Prospective bidders obtained 369 copies of plans and specifications in order to compete for the 53 contracts involved. 239 bids were received and 52 contracts were awarded during the period. One contract was scheduled for award early in the next fiscal year.

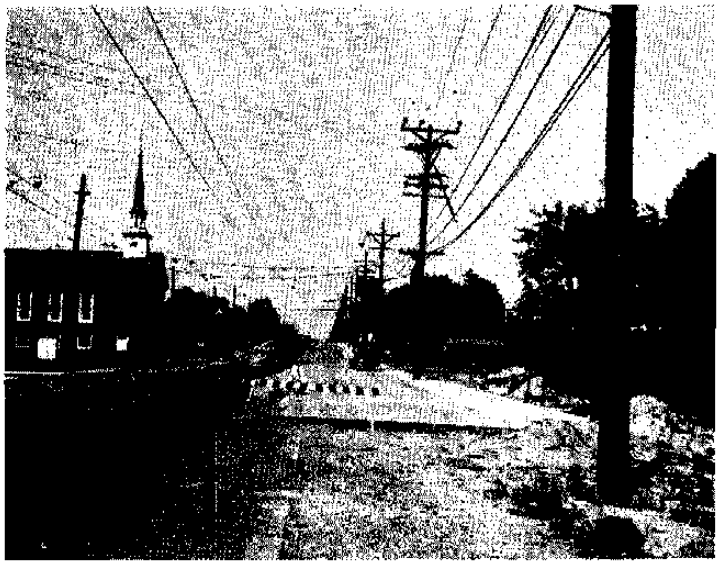
1900 proposals were mimeographed, assembled, and distributed to interested persons.

In addition to the contracts let during the current year, there were 20 construction and 8 miscellaneous contracts carried over as incompleted contracts from the previous fiscal year. 19 of these carry-over contracts were completed during the year.

182 estimates totaling $6,181,979.71 were processed for payment by this division. 13 of the carry-over contracts and 12 of the contracts awarded this fiscal year are being built in cooperation with the Bureau of Public Roads. 25 vouchers totaling $1,768,887.83 were submitted to claim Federal Aid funds due the State for construction purposes.



REPLACING AUGUSTINE SLUICE, NEW CASTLE COUNTY. DESTROYED BY STORM NOVEMBER 25, 1950. CONSTRUCTION STARTED FEBRUARY 1952. PROGRESS JUNE 30, 1952.



MARYLAND AVENUE, NEW CASTLE COUNTY, CONTRACT 798. AWARDED FEBRUARY 1952; OF CONCRETE CONSTRUCTION CONSISTING OF: 4-11′ TRAFFIC LANES, 2-8′ PARKING LANES. PROGRESS JUNE 30, 1952.

CONSTRUCTION

For this report period the number of projects, their dollar value and actual road mileage under construction, exceeded any previous construction effort of the Department.

There were 61 projects under contract, which provided for 138.9 miles of new and reconstructed highways, 6 new major bridges, extensive repairs to 4 bridge structures, repairs to dykes and sluiceways, as well as other miscellaneous construction responsibilities of this Department.

In the latter part of the 1951 session of Legislature, highway improvement bonds in the amount of $13,500 000.00 were approved for construction purposes and made available for the 1952-1953 biennium. When this became known, a construction program was prepared, based upon sufficiency and road-life studies, and included a number of projects which for many years have needed correction. Priorities were assigned, the most urgent being given first consideration.

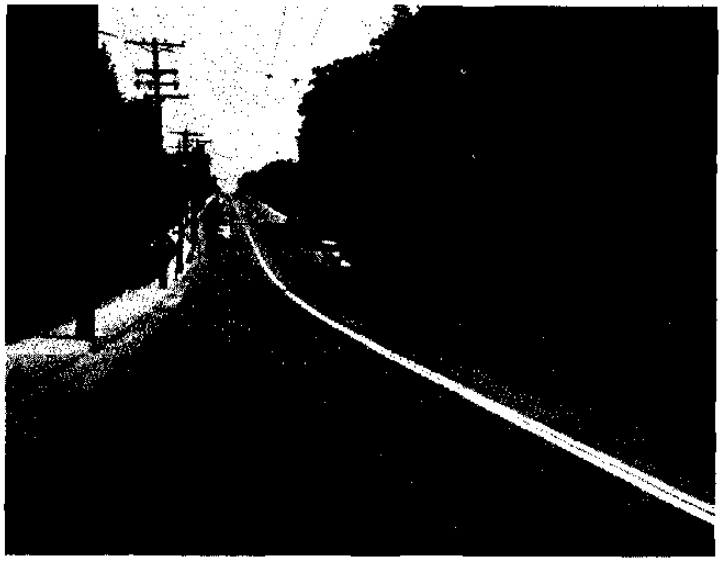
The awarding of the contracts was somewhat slowed in the earlier part of fiscal 1952 because the backlog of plans was practically exhausted by successive lettings in the prior biennium.

By a concerted effort of the field engineers and the establishment of scheduled overtime in the Design Division, plans and specifications were prepared at such a rate that by the end of the period the Department was able to award 41 contracts of the proposed program. These 41 contracts represented a bid value of $10,060,000.00.

During fiscal 1952, materials were in good supply, the exception being that of steel with its seemingly ever-present restrictions. Bid prices showed no perceptible increase over the previous period.

Of some interest and importance, three major contracts were advertised on an alternate-bid basis, concrete or bi-

PHILADELPHIA-WILMINGTON PIKE—U. S. 13 NEW CASTLE COUNTY LOOKING SOUTH, VICINITY OF MARSH ROAD—RESURFACING AND WIDENING—CONTRACT 880.



MARKET ST., WILMINGTON U. S. 13—LOOKING NORTH UP PENNY HILL—CONTRACT 880.

tuminous concrete. In each instance the bids for concrete were considerably lower than those for bituminous concrete. The following tabulation shows the lowest bid for each type of material:

Contract	Location	Mileage	Hot Mix	Concrete
843	Canterbury to Camden	5.850	$1,417,576.00	$1,192,904.00
1148	Georgetown-Laurel Road to Brown's Church	8.385	1,980,300.00	1,928,106.00
1149	Delmar to Georgetown	7.956	1,812,378.00	1,638,322.00
TOTALS		22.191	$5,210,254.00	$4,759,332.00

There was a substantial differential of $450,921 in the Department's favor by requiring alternate bids on the above three contracts. However, it should not be construed that these are typical for the factors of specifications and availability of material projected their influences in the bidding for these contracts. It could be the reverse in other sections of the State.

It will be recalled that when the dualing of the duPont Parkway was completed some years ago between Wilmington and Dover, it was the longest highway of its type in the nation. This was a distinction which has since been lost. The influence of this highway on the economy of the State is apparent to citizens and State officials alike. For many years the Department has recognized the importance of the realignment and the dualing of the duPont Parkway from Dover to the Maryland line. An effort was made by the Department during the past period toward the accomplishment of this intent. With the construction presently under way, and a proposed project scheduled for award in the approaching fiscal year, the dualing of the entire duPont Parkway will have become a reality.

The status of the construction contracts active during fiscal 1952 is indicated by the accompanying tabulation.

GRADING NEW DUAL—DOVER BY-PASS, U. S. 13, KENT COUNTY, CONTRACT 913

TABULATION OF ACTIVE CONSTRUCTION CONTRACTS

July 1, 1951 - July 1, 1952

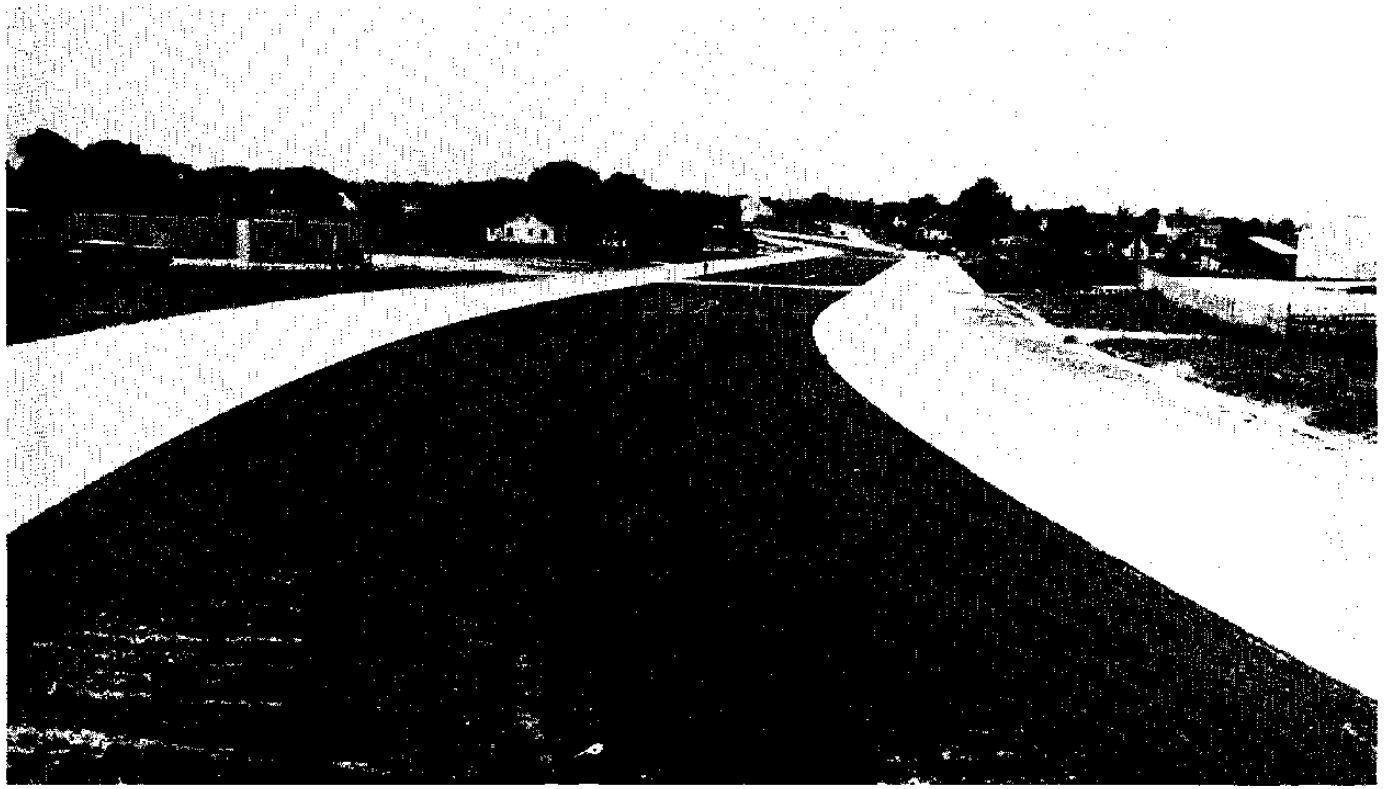
Contract Number	Fed. Aid %	Location	Active Beginning 1952 F/Y Remaining $ Value	%	Awarded During 1952 F/Y Award Amount	Date	Constructed During 1952 F/Y $ Value	%	Active End 1952 F/Y $ Value	%
425	40	Leipsic Bridge	138,191	62			102,455	46	35,736	16
674	St	Augustine Brdg. Painting			18,506	Oct. 1951	18,506	100		
720	St	Georgetown to Hardscrabble			391,970	Feb. 1952	166,761	43	225,209	57
769	St	Fed. & Union Sts., Milton			63,118	Nov. 1951	49,996	79	13,122	21
798	St	Md. Ave., Boxwood-Broom			575,394	Feb. 1952	93,589	16	481,805	84
816	40	Blackiston to Clayton	101,175	65			99,092	65		
843	47	Canterbury to Camden			1,192,904	Apr. 1952			1,192,904	100
880	40	Phila. Pike (30th St.)	363,609	84			282,175	65	81,434	19
913	47	Dover By-Pass	888,616	74			879,702	73	8,914	1
924	St	Brown's Sch. to Jacob's Sch.	283,224	100			229,149	81	54,075	19
977	47	Carpenters Brdg. & Appr.			172,063	Feb. 1952			172,063	100
983	St	Incidental Constr.	14,638	100			19,335	100		
993	40	Brandywine Blvd.	318,251	60			218,685	42	99,566	18
1007	47	Jacob's School-S. Greenwood	556,418	60			606,934	60		
1028	St	E. Market St.-Georgetown			6,876	Oct. 1951	8,622	100		
1030	40	Chas. Cullen Bridge	13,686	03			10,161	03		
1032	St	Third St. Bridge	133,045	100			141,135	100		
1037	St	Marydel to Pearson's Cor.			165,844	Apr. 1952			165,844	100
1043A	40	Seaford Bridge	3,422	19			4,077	19		
1045	40	Del. Mem. Bridge Appr.	32,743	16			55,031	16		
1048	St	Woodside to Camden			98,754	Sept. 1951	91,501	100		
1049	St	Milford Brdg. Flooring			11,795	Apr. 1952	12,334	100		
1050	40	Kenton-Pleasanton	34,588	29			22,287	29		
1057	40	New Castle Ave. Over-pass	204,014	48			175,945	41	28,069	07
1067	40	Susans Beach Road	8,441	05			21,846	05		

TABULATION OF ACTIVE CONSTRUCTION CONTRACTS—(Continued)

July 1, 1951 - July 1, 1952

Contract Number	Fed. Aid %	Location	Active Beginning 1952 F/Y Remaining $ Value	%	Awarded During 1952 F/Y Award Amount	Date	Constructed During 1952 F/Y $ Value	%	Active End 1952 F/Y $ Value	%
1068	47	Stein Highway			90,807	Nov. 1951			90,807	100
1070	40	Farnhurst Interchange	223,448	32			349,702	32		
1072	40	Middletown to Odessa	50,516	20			58,302	20		
1073	47	Md. Line to State Road			689,923	Sept. 1951	425,657	62	264,266	38
1075	St	Felton to Woodside			70,610	Sept. 1951	41,567	59	29,043	41
1076	St	43rd St. Exten.			57,984	Feb. 1952	16,124	28	41,860	72
1078	47	Murray's Cor. to Lewes			253,276	Oct. 1951	200,618	79	52,658	21
1082	St	Brandywine Riv. Crossing	569,620	95			205,032	34	364,588	61
1085	47	Ocean View to Bethany			68,167	Apr. 1951			68,167	100
1086	47	Greenwood to Andrewsville			72,430	Sept. 1951	17,929	25	54,501	75
1087	47	C.R. 381 to C.R. 387			112,148	Jan. 1952	9,943	9	102,205	91
1088	St	Hartly to Pearson's Cor.			162,686	Feb. 1952	134,046	83	28,640	17
1096	St	Rehoboth Beach Groins	12,978	78			12,716	78		
1097	St	Bethany Beach Protection	19,600	100			5,843	29	13,757	71
1098	47	Brandywine Riv. Cross App.			224,376	Aug. 1951	46,837	21	177,539	79
1099	St	Port Penn to Del. City			121,077	Aug. 1951	72,846	60	48,231	40
1103	St	Rec. Pond & Nan. Brdgs.			1,009,029	Oct. 1951	362,732	36	646,297	64
1123	St	Dagsboro Streets			52,037	Jan. 1952	18,780	36	33,257	64
1148	47	Gtown-Laurel Rd. to Br. Ch.			1,928,106	Apr. 1952	71,465	4	1,856,641	96
1149	47	Delm. to Gtown-Laurel Rd.			1,638,322	June 1952			1,638,322	100
1155	St	Nylon Blvd. Safety Island			2,510	Oct. 1951	2,557	100		
E1158	St	Dobbinsville Dyke Repairs			24,350	Aug. 1951	16,956	70	7,394	30
E1159	St	Greenwood Sch. Drainage			5,847	Aug. 1951	7,697	100		
1161	St	Sum. Brdg. to Tybouts Cor.			486,363	June 1952			486,363	100
1165	St	Farnhurst Fencing			2,071	Oct. 1951	1,972	100		

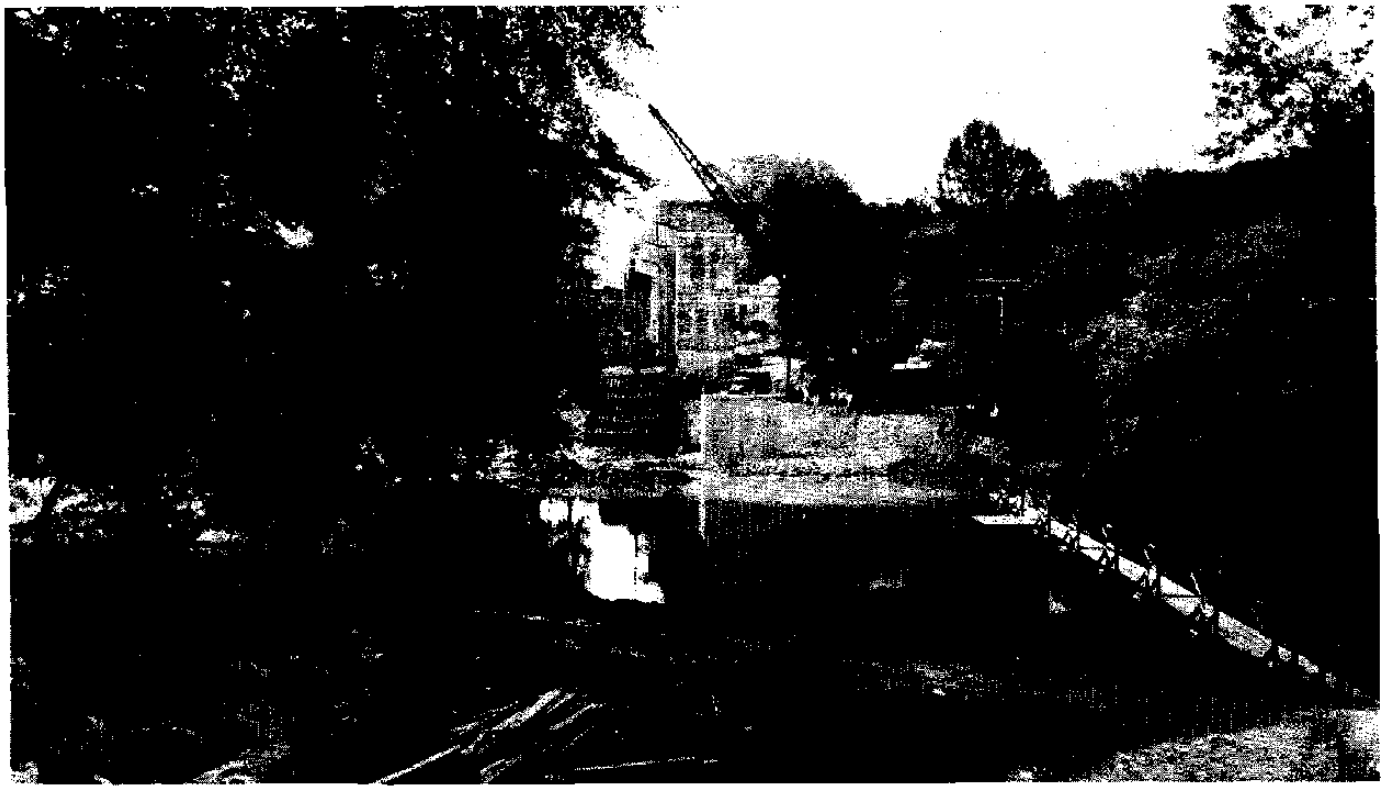
Contract Number	Fed. Aid %	Location	Active Beginning 1952 F/Y Remaining $ Value	%	Awarded During 1952 F/Y Award Amount	Date	Constructed During 1952 F/Y $ Value	%	Active End 1952 F/Y $ Value	%
1171	St	Augustine Sluice Way			52,715	Feb. 1952	26,053	49	26,662	51
1172	St	S. Market St. Cut-off			32,343	Apr. 1952			32,343	100
E1168	St	N. Castle Ave. & Ridge Rd.			47,577	Oct. 1951	51,085	100		
1166	St	Direction Signs-Farnhurst			7,970	Jan. 1952	9,932	100		
1174	St	Lighting-Rodgers Cor.			12,428	June 1952			12,428	100
1177	St	Leedom Est. Cross-over			8,164	Apr. 1952	8,810	100		
1180	St	S. E. Front St., Milford			34,536	June 1952			34,536	100
1182	St	Fr. Douglass Sch. Drainage			14,081	June 1952			14,081	100
1183	St	Basin Cor. Intersection			27,053	June 1952			27,053	100
1190	St	Krebs Sch. Sidewalks			5,333	June 1952			5,333	100
E1194	St	Del Park Approaches			47,767	May 1952	49,455	100		
		Adjustment for Over & Under Runs	3,970,223 220,154							
			4,190,377		10,059,310		5,533,974		8,715,713	



LOOKING SOUTH, DOVER BY-PASS U. S. 13, KENT COUNTY, CONTRACT 913, OFFICIALLY ACCEPTED AND OPENED TO TRAFFIC APRIL 16, 1952.

In addition to the 41 projects placed under contract during this report period, the construction program for the 1952-1953 biennium included 24 other highway and structural improvements that are of an urgent nature. The preliminary engineering details and the acquisition of the necessary rights-of-way were completed during this fiscal year. The plans and specifications are now near completion, and the prospects for having the entire program under contract by January 1953 seem very favorable. 20 of these projects are located in New Castle County, 3 in Kent County, and 1 in Sussex County. A list of these projects is as follows:

Contract No.	Location	Approximate Mileage	Estimated Cost
	New Castle		
755	Lancaster Pike	2.138	$ 175,000.00
799	Concord Pike	2.436	875,000.00
855	Maryland Ave. to Front St.	0.846	325,000.00
1080	11th St. Bridge Repairs	0.008	20,000.00
1154	Chrysler to Ogletown	3.262	250,000.00
1160	Middletown to Summit Bridge	7.388	550,000.00
1167	Gov. Printz Blvd.-Widening	0.460	79,000.00
1175	Broom St., Wilmington	0.677	310,000.00
1181	Possum Park Road	1.775	285,000.00
1187	Churchman Road	1.820	225,000.00
1188	E. Cleveland Ave., Newark	0.582	115,000.00
1189	Green St., Claymont	0.700	40,000.00
1192	Lambson Lane	1.300	120,000.00
1193	Westover Hills	1.260	20,000.00
1195	Elmhurst Drainage	0.820	48,000.00
1196	Burnt Mill Road	0.464	30,000.00
1197	Harvey Road Bridge	0.550	200,000.00
1208	White Clay Creek Br. & Appr.	0.440	200,000.00
1222	Milford Cross Rds near Newark	0.398	100,000.00
1224	Walnut St. Br. & Approaches	0.660	3,500,000.00
		27.984	$7,467,000.00
	Kent		
1156	Little Creek Bridge	0.170	$ 57,000.00
1169	Court St., Dover	0.480	500,000.00
1164	Glenwood Ave., Smyrna	1.106	230,000.00
		1.756	$ 787,000.00
	Sussex		
1063	Line Rd.—E. of Delmar	4.392	$ 100,000.00
	Projects scheduled for fiscal 1953	34.132	$8,354,000.00



BRANDYWINE RIVER CROSSING—CONTRACT 1082. AWARDED FEBRUARY 1951
CONSTRUCTION PROGRESS OCTOBER 2, 1951.
VIEW: LOOKING EAST FROM WEST BANK OF RIVER

BRANDYWINE RIVER CROSSING—CONTRACT 1082. CONSTRUCTION PROGRESS JUNE 30, 1952.
VIEW—LOOKING EAST FROM WEST BANK OF RIVER

It is pointed out that when these projects are placed under contract, the construction funds now available to the Department will be entirely obligated.

The number of pages limited for this report will not permit a discussion of each construction project. It seems, however, that the circumstances regarding the delay in construction of the Walnut Street Bridge (south approaches to Wilmington) should be recorded.

For a number of years the Department has conscientiously endeavored to find a solution for the Wilmington traffic problem, particularly as it affects the south approaches to the city. At considerable expense to the State, a number of surveys have been made by the Department and by qualified engineering consultants to determine the type of facilities and locations at which they are needed.

After a careful study of the factual data so obtained, it was determined by the Department that the problem caller for specific alternatives, and to be of value they must not be so grandiose in nature as to preclude their accomplishment in a reasonable time. The alternative selected was one that would provide a bascule-type bridge over the Christiana River at a point that Walnut Street could be utilized and directly connected with the duPont Parkway. The recommendations of the consultants were that this proposed facility would be for northbound traffic, and the existing roadway and river crossing at South Market Street for southbound traffic.

The State statutes provide that before the Department may proceed with the construction of bridges or roadways within corporated areas, prior approval of the local authorities must be obtained.

In expectation of a prompt approval of this project by the City authorities, the Department set aside a substantial amount of its available construction funds. The entire cost of the new facilities is to be defrayed from State construction and Federal Aid urban funds.

As of the end of this report period, the necessary approval by the city authorities has not been received.

Of much concern to the Department have been the reports which indicate that collateral issues, jurisdictional pride, and in a few instances, personal animosities, have clouded the real issues concerning this proposed improvement.

ROUTE 44 THROUGH HARTLY. CONTRACT 1088. RESURFACING AND WIDENING.

It seems well to mention that directly after the end of this report period, the Department Chairman, the Honorable J. H. Tyler McConnell, addressed a letter to the City authorities inviting them to meet with the officials of the Department in an attempt to clear the obstacles that are continuing to delay the commencement of this project. Mr. McConnell also pointed out that the Department would be very receptive to any suggestions by the City authorities which would be a more acceptable solution to the problem than that presently proposed.

It is the sincere wish of the Department that an amicable agreement will be reached at this proposed meeting. Further delay will certainly result in the loss of funds that are presently available to the Department for this project.

PLANS AND DESIGN DIVISION

Lester W. Novinger, Plans and Design Engineer

The ambitious construction program for fiscal 1952 placed emphasis for rapid and greater production of the necessary plans and specifications. Successive awards during the previous fiscal years practically exhausted the customary backlog of plans.

Capable additional help being unobtainable, it was necessary to inaugurate scheduled overtime to keep pace with this unusually large construction program.

In a few instances consulting engineering firms were employed to assist in the preparation of plans and specifications for specific urgent projects.

Anticipating the need for a larger volume of blue and white prints, a new machine was purchased which not only provided clearer prints but raised the production over double that of the old outmoded blueprinting equipment.

The following is a resume of the work performed during the year:

JULY 1951 TO JULY 1952

PLANS		
Base Line Plotted	116.6	Miles
Topography Plotted	116.6	"
Profiles Plotted	103.0	"
Index Maps Plotted and Traced	104.3	"
Plans Traced	106.3	"
Cross-Sections Plotted (Original)	112.7	"
Cross-Sections Plotted (Final)	56.1	"
Grades Established	61.2	"
Typical Sections	104	
Miscellaneous Drawings	135	
SURVEYS		
Base Lines	116.6	Miles
Topography	116.6	"
Preliminary Cross-Sections	112.7	"
Final Cross-Sections	56.1	"
Borrow Pits Preliminary	42	
Borrow Pits Final	38	

PRINTS - 29,400

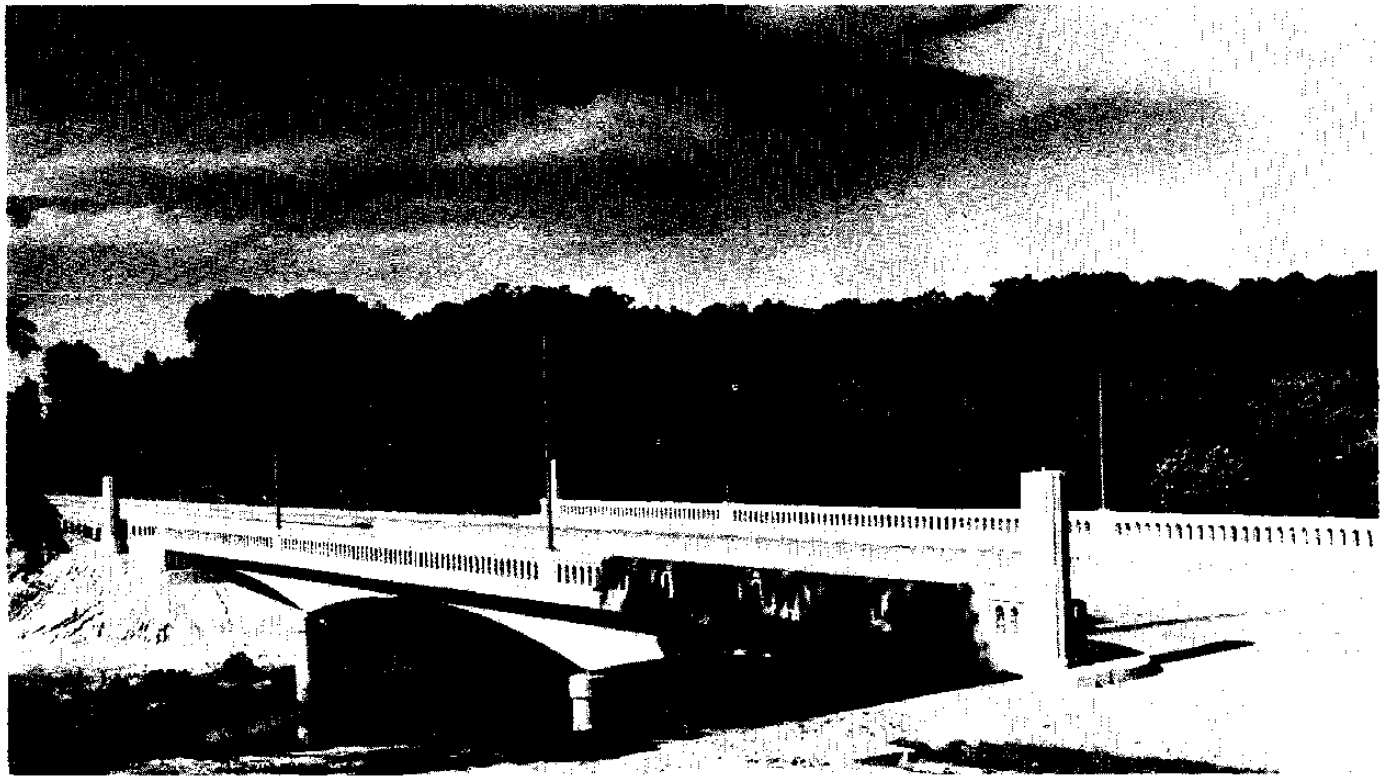
BRIDGE DESIGN DIVISION

Joe S. Robinson, Bridge Engineer

The principal responsibility of the Bridge Design Division is to design and prepare plans for bridges, culverts, overhead structures and retaining walls, as well as to develop special designs for any structures which are proposed to be built under the jurisdiction of the State Highway Department. In addition, its duties include the preparation of specifications covering the building of structures, checking details for steel fabrication, examining and reporting the condition and safety of existing bridges on the highway system.

During the report period this division participated in the design and preparation of specifications for 35 projects, the contracts for which were awarded during fiscal 1952.

A brief summary of the work performed by this division during fiscal 1952 is indicated in the accompanying tabulation.



SAINT JONES RIVER BRIDGE, DOVER BY-PASS, U. S. 13, KENT COUNTY
CONTRACT 913

BRIDGE DESIGN DIVISION

TABULATION OF WORK PERFORMED

Contract Number	Location	Date of Award	Bridges, Culverts, Storm Water Drainage, Drainage Under Crossovers
E-1159	Greenwood School Drainage	8-1-51	Constructed: 749' Storm Sewer in Greenwood.
E-1158	Dobbinsville Dyke Repair	8-2-51	Placed 24,000 Cu. Yds. Borrow and repaired timber sluice.
E-1099	Port Penn to Delaware City	8-21-51	Constructed: One three-cell sluice way and installed flood gates. Constructed and repaired 1342' of bulkhead. Placed 2,400 S. Y. of broken pavement rip-rap.
1098	Brandywine River Crossing, Highway Approaches	8-22-51	Prepared by Consulting Engineers.
1048	0.9 Mile South of Woodside to Camden	9-13-51	Placed 160'—12" R.C.P., adjusted 4 catch basins.
1086	Greenwood to Andrewsville	9-19-51	Constructed 9 R.C.P. culverts, placed 2 catch basins, and cut or cleaned and reshaped 3000' of ditches.
1075	Felton to Woodside	9-25-51	Constructed: 1 twin 60" R.C.P. culvert, 7 R.C.P. culverts, drainage under 3 crossovers and 8000 Lin. Ft. of ditching.
1073	Maryland Line to State Rd.	9-27-51	Constructed: Addition to one 18' R.C. Bridge, 426' Storm sewer, drainage under 1 railroad crossing, addition to 1 headwall, 38 additions to R.C.P. culverts, 3 new headwalls, regraded 4000' of parkway ditches and 2,400' of side ditches.
1028	East Market St., Georgetown	10-1-51	Placed 60'—12" R.C.P., built 3 catch basins and adjusted 9 catch basins and manholes.
1078	Murray's Cor. to Lewes	10-5-51	Constructed: 1623' of storm sewer in Lewes, 3 R.C.P. culverts, drainage under 2 crossovers and 1700' of ditching.

BRIDGE DESIGN DIVISION

TABULATION OF WORK PERFORMED—(Continued)

Contract Number	Location	Date of Award	Bridges, Culverts, Storm Water Drainage, Drainage Under Crossovers
1103 1104 & 1105	Records Pond, Nanticoke River and Nanticoke River (North Fork)	10-5-51	Constructed: 6 two-lane bridges of pile bents, steel beam and R.C. slab construction. 2 bridges 124' 2" in length at Nanticoke River, (North Fork), 2 bridges, 344'-5" in length at Nanticoke River and 2 bridges, 194'-2" in length at Records Pond.
E-1168	New Castle Ave. and Ridge Rd.	10-5-51	Constructed: 120' storm sewer and adjusted catch basins.
769	Federal & Union Sts., Milton	11-1-51	Constructed: Addition to 29'-6" R.C. bridge and 465' of storm sewer.
1068	Stein Highway to County Road Number 557	11-29-51	Constructed: 16 R.C.P. culverts and 5000 Lin. Ft. ditches.
1166	Direction sign frames—Farnhurst Interchange	1-3-52	Constructed: 3—17' by 70' span steel sign frames at Farnhurst Interchange.
1123	Dagsboro Streets	1-9-52	Constructed: 996' storm sewer in Dagsboro and completed 1250' of ditching.
1087	County Road No. 381 to County Road No. 387	1-16-52	Constructed: 1 twin 60" R.C.P. culvert and headwalls, 20 R.C.P. culvert, and completed 13,855 Lin. Ft. ditching. 1 R.C.P. culvert, and completed 13,855 Lin. Ft. ditching.
720	Georgetown to Hardscrabble	2-4-52	Constructed: 5 R.C.P. culverts added to 14 R.C.P. culverts, 2 headwalls, 1 cross road drainage, 1—8' span R.C. bridge, 1056' of storm sewer, and 5315' of ditching.
798	Maryland Ave. (Boxwood Rd. to Broom St.)	2-5-52	Constructed: 6371' storm sewer system.

BRIDGE DESIGN DIVISION

TABULATION OF WORK PERFORMED—(Continued)

Contract Number	Location	Date of Award	Bridges, Culverts, Storm Water Drainage, Drainage Under Crossovers
1088	Hartly to Pearson's Cor.	2-26-52	Constructed: Underdrains for 1 railroad crossing, underdrains for 1 crossroad, added to 3 R.C.P. culverts and completed 2000' ditching.
1171	Augustine Sluiceway—South of Augustine Beach	2-26-52	1 three-cell sluiceway, 150 S.Y. slope protection and 200 C.Y. sacked-sand cement rip-rap.
1049	Milford Bridge Flooring	4-1-52	Constructed: New open mesh steel floor on Milford Bridge. Repainted entire bridge.
1076	43rd St. Extension	2-14-52	Constructed: 282' storm sewer system, one 48" R.C.P. culvert.
977	Carpenter's Bridge and Apprs.	2-26-52	Constructed: A 175'—10½" steel beam, concrete slab bridge, spanning the B. & O. Railroad and removal of the present structure.
843	Canterbury to Camden	4-2-52	Construction: One 3-cell box culvert (2 cells 8' x 10'—1 cell 8' x 12'), 1 single-cell box culvert (10' x 7'), 17 R.C.P. culverts, 10 underdrains at crossovers, 4,589' of storm sewers and 7,960' of ditches.
1085	Ocean View to Bethany Beach	4-10-52	Constructed: 11 R.C.P. culverts added to 2 R.C.P. culverts, cleaned, reshaped and cut 6610' of ditches.
1172	South Market St. Cut-Off	4-18-52	Construction: Addition to 26' R.C. bridge, addition to 24' R.C. wall, one set of steps 8' wide, 19 treads.
1037	Marydel to Pearson's Cor.	4-21-52	Construction: Addition to 26' R.C. bridge, addition to 24' R.C. bridge, addition to 16' R.C. bridge, addition to 6' box culvert, 18 additions to R.C.P. culverts and 850' of ditching.

BRIDGE DESIGN DIVISION

TABULATION OF WORK PERFORMED—(Continued)

Contract Number	Location	Date of Award	Bridges, Culverts, Storm Water Drainage, Drainage Under Crossovers
1148	Georgetown-Laurel Road to Brown's Church	4-21-52	Constructed: One 3-cell (10' x 11') box culvert, 33 R.C.P. culverts, 27 drainage systems for crossovers, 300' storm sewer, two twin 48" R.C.P. culverts.
1180	S. E. Front St., Milford	6-3-52	Constructed: 2960' storm sewer in Milford.
1183	Basin Corner Intersection	6-3-52	Constructed: 400' of underdrains at crossover.
1182	Frederick Douglas School Drainage	6-3-52	Constructed: 2520' storm sewer in Seaford.
1190	Kent School Sidewalk	6-13-52	Constructed: 15' storm sewer.
1149	Delmar to Georgetown-Laurel Road	6-19-52	Constructed: 2—48" three pipe culverts, one 36" three pipe culvert, one twin 48" pipe culvert, 39 R.C.P. culverts, 29 drainage systems for crossovers and 400' of storm sewers.
1161	Summit Bridge to Tybout's Corner	6-27-52	Constructed: 2 R.C.P. culverts, added to 10 R.C.P. culverts, added to one bridge and placed 426' storm sewer in Kirkwood.

RECOMMENDATIONS

It is recommended that the following structures be considered for repair or replacement in the near future:

Replacement—Seventh Street Bridge, Wilmington

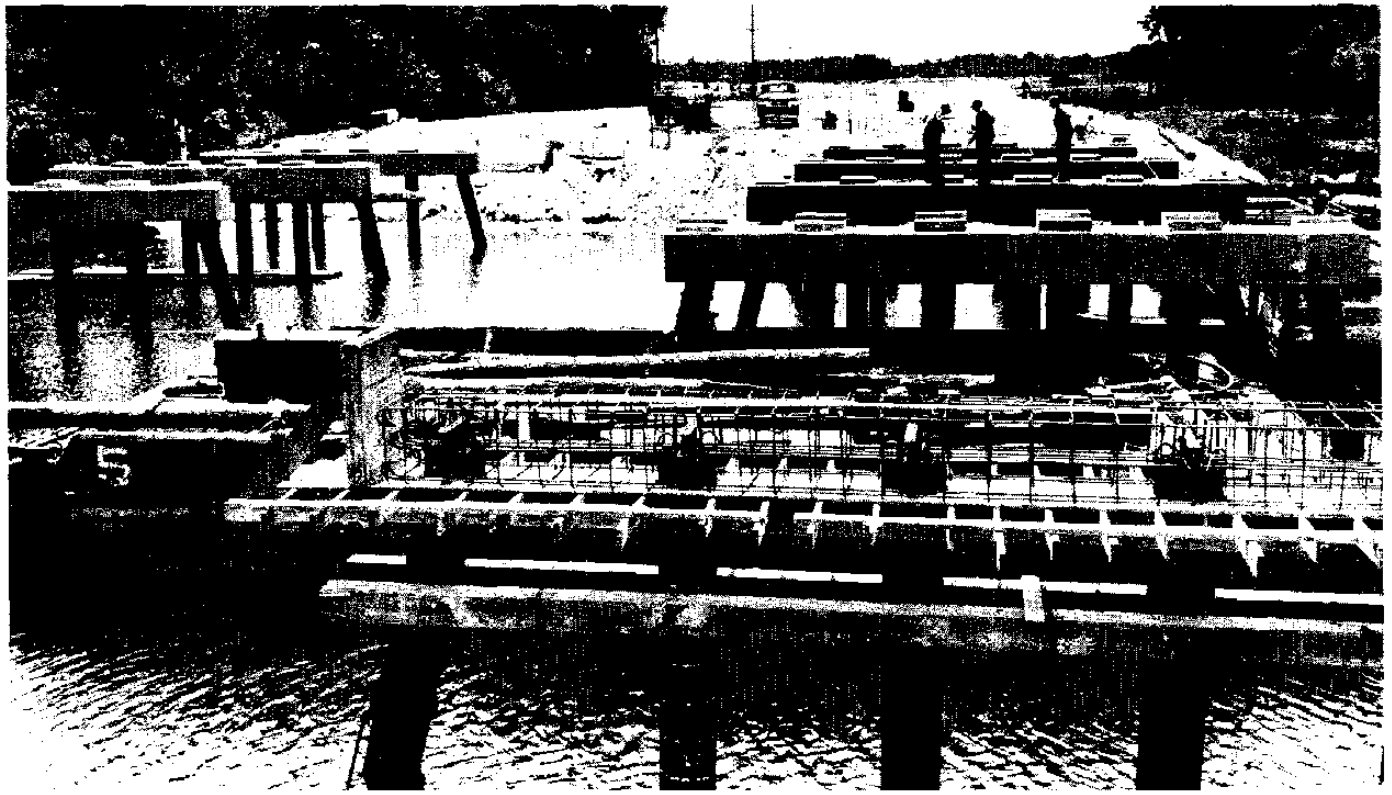
Replacement of numerous small steel bridges throughout the State

Reflooring—Broadkill Bridge (Sussex County)
Lewes Bridge (Sussex County)
Rehoboth Bridge (Sussex County)

Reflooring and
Sidewalk Repairs—Church Street Bridge, Wilmington

Replacement—Taylors Bridge (New Castle County)

Replacement—North Approach—Charles W. Cullen Bridge (Sussex County)



NANTICOKE RIVER BRIDGES NEAR SEAFORD. CONTRACT 1104. AWARDED AUGUST 1951.
CONSTRUCTION PROGRESS OF TWIN BRIDGES—NEW DUAL U. S. 13 SUSSEX COUNTY
JUNE 30, 1952

DIVISION OF TESTS

Ernest A. Davidson, Testing Engineer

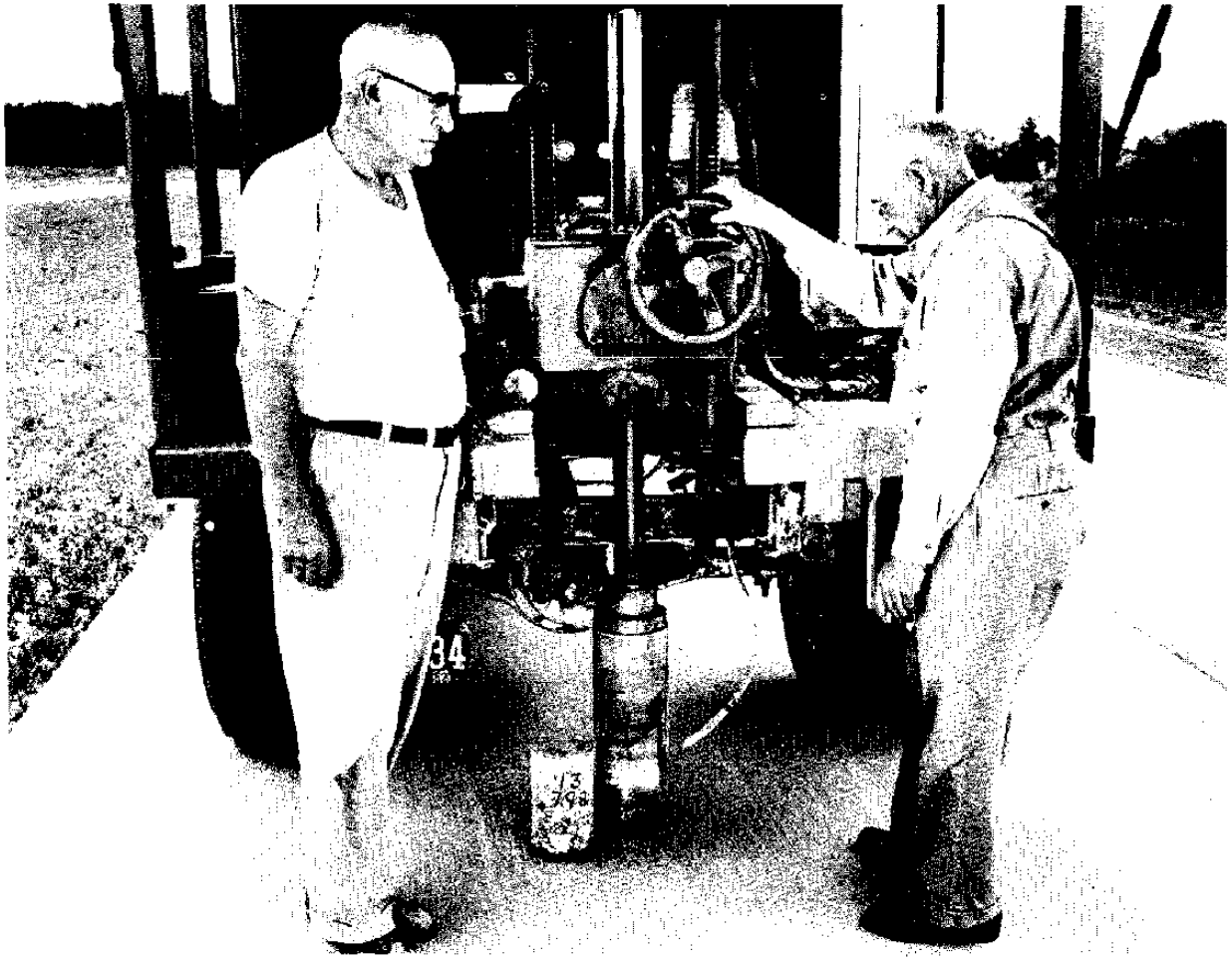
The Division of Tests' primary responsibility is insuring that all materials used by the State Highway Department meet the requirements of the specifications applicable to the various projects. In addition, it must constantly strive to improve the end result of construction by keeping abreast of the best practices in the use of materials, in improving the quality of materials, and in changing or improving specifications to get the best product possible within the range of economic limitations.

The Division's activities also include consulting services for the Plans and Design Division, Suburban Development Division, Bridge Division, and supervisory personnel in construction. Research work is undertaken whenever time and the availability of personnel permits.

The tremendous increase in the size of the construction program this fiscal year has taxed the facilities of the Division to its very limits. The amount of work involved in the inspection and testing of materials was further aggravated by the fact that the increased quantities resulted in additional and unfamiliar sources of supply being used, thus resulting in a need for basic information regarding these materials and for increased personnel to handle the additional inspection at the new sources. In spite of the difficulties involved, a determined effort was made to maintain the high level of completeness of inspection which has been largely responsible for the high quality of road materials used in past years. This is particularly true of hot-mix asphaltic concrete and Portland cement concrete.

The limitations of time and qualified personnel reduced to minor proportions the research work conducted during the year, however, an investigation of the adhesive and coating qualities of cut-back asphalts on stones resulted in a change in the specifications. Field results of this change have been encouraging. Hot-mix asphalt samples from pavements of various ages were obtained and analyzed to ascertain the performance and characteristics under traffic for various hot-mix designs. Concrete slabs of various ingredients were prepared for color considerations for the construction season. Characteristics of various stone screenings were investigated to assist in forming a new specification for their use in road construction.

Testing and inspection during this fiscal year was conducted for some 56 projects. In addition to those tests



DRILLING CORES TO CHECK PAVEMENT THICKNESS AND QUALITY OF CONCRETE
CONTRACT 913—DOVER BY-PASS

made for highway materials, assistance was given to other divisions in their efforts to control qualities of materials used. Typical examples are: oil for mosquito control, oil and gasoline used by the Department, automotive equipment for the Motor Vehicle Division, and paper and ink for the Archives Commission.

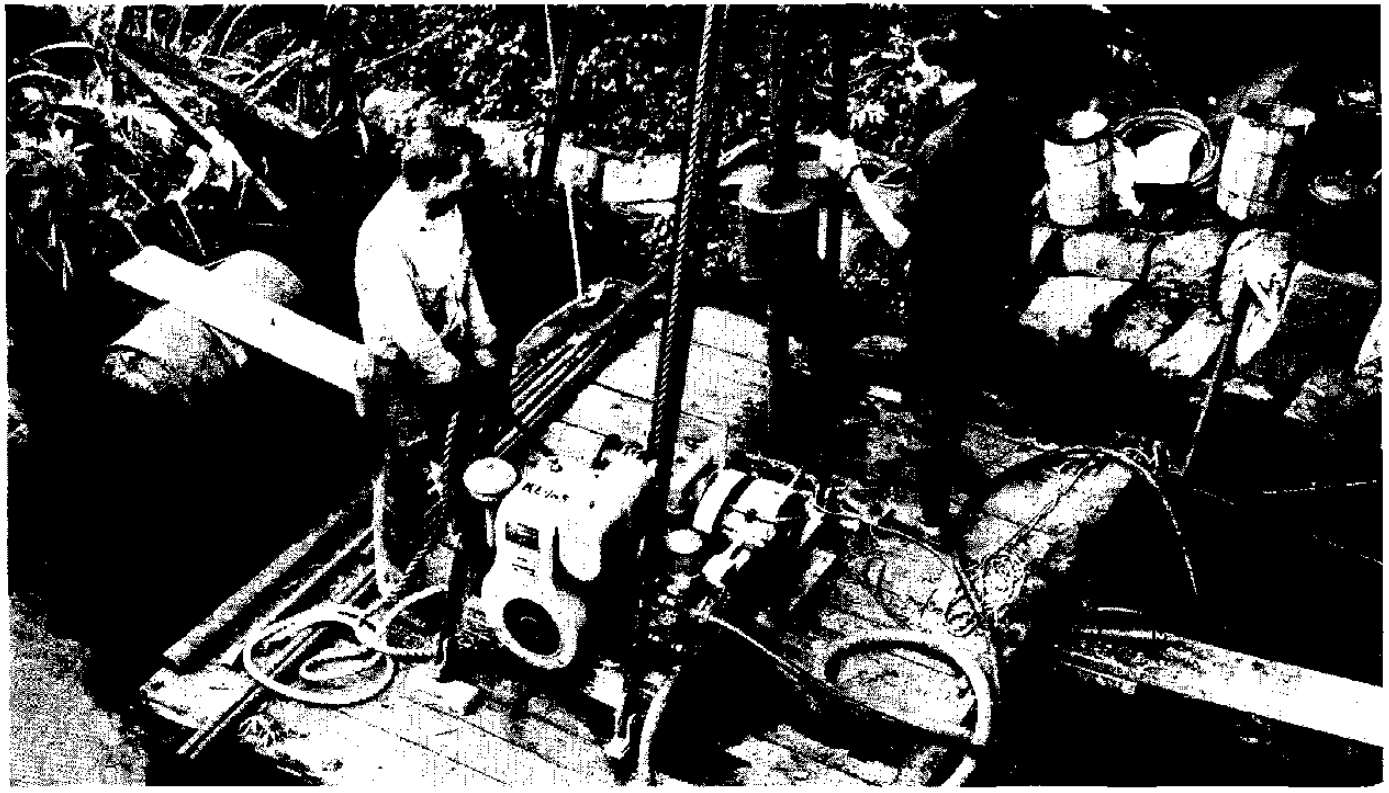
For purposes of organization the Division of Tests is formed into two sections, the Soils Laboratory and the Materials Laboratory. A description of the activities of each follows:

Soils Laboratory

The work of the Soils Laboratory begins with the establishment of a preliminary alignment for a new project. First, a subgrade survey is made of the alignment in order to determine the characteristics of the foundation soils and other physical conditions that may affect the proposed project. Samples are obtained, analyzed, and classified to termine their susceptibility to water and freezing, and their ability to remain stable and to support traffic loads under the widest range of weather conditions. Recommendations are then made to the Plans and Design Division for taking advantage of the better soils, and for corrective measures to be applied to unsuitable soils or other conditions that may require treatment. Investigations are then begun to locate suitable granular soils which present-day practices dictate must be placed under modern pavements. The work of obtaining samples for both the subgrade surveys and the suitable granular materials, and the analysis and classification of these samples, accounts for by far the greatest percentage of the activities of the soils work. During this fiscal year 4,639 samples were so handled.

If structures are to be built on the project, it is necessary to investigate foundation conditions. Depending on the magnitude of the structure, boring depths from 70 to 80 feet may be necessary. Investigations for structural foundations on 16 projects were conducted during the year for a total of 1,341 lineal feet of borings.

After construction of the project has begun, it is necessary to investigate the quality of and to control the placing of earth borrow used. Thirty-six common borrow and 27 selected borrow pits were investigated for direct use in contract work. In addition, 40 other proposed selected borrow pits were investigated for use in State maintenance work and 10 of these were recommended for purchase. The



OBTAINING SOIL SAMPLES FROM SAINT JONES CREEK AT DEPTH OF 50'. TO DETERMINE FOUNDATION CONDITIONS FOR PROPOSED NEW BRIDGE CROSSING—COURT STREET PROJECT DOVER—CONTRACT 1169

rapid depletion of known sources of selected borrow in the State poses a very serious problem to be faced within the next few years.

Control was maintained over the placement of 684,000 cubic yards of common borrow and 585,000 cubic yards of selected borrow throughout the year. This required 346 field density and moisture control tests, in addition to countless visual inspections. Other activities of the Soils Laobratory for the year were as follows:

Thirty-two maximum density and optimum moisture determinations were made to control the placing of soil.

Seventy-five California bearing ratio tests were made to determine the supporting ability of soils and to aid in pavement design.

Seventy-two subgrade investigations were made in suburban developments to determine the design of pavements.

Sixty-one and two-tenths miles of highway subgrade surveys were made during the period.

Investigations of subsurface water conditions leading to recommendations for elimination of water were made in 8 areas.

Of special note this year was the design and control by the Soils Laboratory of a new method of placing a road fill over deep marsh. Never before attempted in this State, the sand drain method of stabilizing deep marsh was undertaken at Leipsic. Much valuable information was obtained for future use and a stabilized fill was placed on a marsh 40 feet deep at a considerable saving in both fill material and settlement time.

Materials Laboratory

It is an undeniable fact that no structure, regardless of its nature, can be better than the materials of which it is composed. With this in mind the Materials Laboratory makes every effort to insure that only the best materials obtainable within the limits of the specifications and economic considerations are used in construction. The policy of sampling and testing at the source of supply, and thereby making rejections or corrections before shipments are made, is considered of paramount importance to practical application of this standard. Aggregates are inspected at the quarry, sand at the washer, cement at the mills, asphalt at

the refineries, piling in the forest, and concrete pipe at the plant.

A responsibility of major proportions of the Materials Laboratory is the design and proper proportioning of concrete mixes and asphaltic hot-mix. While our hot-mix design is well established, the control of the mixing is a continuous process requiring the constant attention of two or more men at each hot-mix plant. Concrete mix designs and batch weights are furnished by the Division of Tests to construction personnel for each item being constructed, and for the various combinations of materials being used. All central-mixed concrete is inspected by laboratory personnel while being mixed. Approximately 150 concrete-mix designs and batch weights were furnished this year. The Materials Laboratory also maintains constant vigilance over the concrete being produced. Sample concrete cylinders and beams are made in the field from material as mixed. These are brought to the laboratory, aged under constant temperature and moisture conditions, capped, broken under load, and the results tabulated. Any deficiency in quality is quickly noted and corrections made. The following tabulation shows the number of tests made during the past year for various materials:

Type Material	Number of Tests
Coarse aggregate (gravel, crushed rock and slag)	1,667
Sand	358
Cement	49
Hot-mix samples (analyses for mix control)	578
Reinforcing steel	10
Asphalt	543
Oils	5
Gasoline	2
Concrete cores (drilled from pavements and tested)	470
Concrete test cylinders	2,276
Concrete test beams	268
Brick	2
Creosote oil	3
Concrete pipe	110
Specific gravity of stone	12
Water for concrete	11
Asphalt adhesion tests	49

In its endeavor to control the quality of materials used in the construction and maintenance of Delaware's highway system, the Division of Tests has performed the necessary tests and inspections on the following approximate

quantities to insure that they meet specification requirements:

Materials	Quantity
Cement	106,330 bbls.
Bituminous concrete	123,452 tons
Cutback asphalts	1,463,845 gals.
Asphalt cement	1,600,000 gals.
Concrete pipe	65,694 l.f.
Lumber	21,537 b.f.
Piling	17,949 l.f.
Guard rail posts	345 ea.
Coarse aggregate	339,339 tons
Fine aggregate	70,063 tons
Reinforcing steel	1,105,636 lbs.
Structural steel	2,349,450 lbs.
Central mixed concrete	32,030 cu. yds.

MAINTENANCE

John I. Cahalan, Division Engineer, New Castle County
James B. Bice, Division Engineer, Kent County
Alfred W. Joseph, Division Engineer, Sussex County

The maintenance of our highways has approached an acceptable degree of efficiency only during the last decade. This has been accomplished largely by the discarding of hand methods and the adoption of mechanization, also by the training of maintenance personnel and through their awakening to a realization that highway maintenance means far more than just patching and smoothing a rough or broken roadway.

Modern maintenance includes: patching holes, filling ruts and cracks, cleaning ditches and culverts, removing snow, spreading cinders, fighting floods, mowing weeds, trimming and removing trees, erecting proper traffic controls and warning signs, and innumerable other operations, all of which are essential for the protection of the highway plant.

The personnel performing these various maintenance tasks are the least known among the employees of the Department. It is seldom realized that these public servants are on call 24 hours of the day. During heavy rain, wind, and snow storms, and other numerous emergencies, they perform their tasks efficiently and willingly. In many instances their tour of duty has included uninterrupted periods of 36 hours or more. They are the unsung employees of the Department and deserve a wider recognition for their services.

Delaware has a land area of 1961 square miles. This area is served by 3961 miles of roads, or an average of 2.02 miles of highways for each square mile of land surface.

Each succeeding year it is becoming more difficult to perform the maintenance of this network of highways. The often repeated statement of, "Constant traffic expansion, heavier loads, and wider truck and trailer bodies," is true today in a greater degree than heretofore. In addition to the conditions imposed on our highways by the aforementioned factors, the Department is confronted with the increasing demands of the public for services, both related and unrelated to highway maintenance.

During this period the Department has performed more maintenance per mile of highway than in any other prior period. It was realized that where schedules previously provided for periodic blading, grading, patching, etc., it is now necessary to give more protection to our roads by a frequency that amounts to 1.75 times that given in prior years.

This more frequent maintenance to our roads, added to the continual rising trend of wages and prices, has resulted in a 60% increase in cost of maintenance as compared with that of 1948.

Other factors that influence the increased cost of maintenance are that additional services require more personnel, and further, that many pieces of equipment have had to be replaced for reason of obsolescence.

Throughout the State the public is demanding at an alarming rate that the Department assume the responsibility for drainage problems which, in many instances, have existed for years and are even unrelated to the highway system. It has been very difficult for the Department to draw lines of demarcation and, therefore, some undeserved criticism has been directed at the maintenance forces.

Traffic Service

The rapid spread of business and amusement establishments along the main arteries of the highway system has been an important development during the year. In the vicinity of these new enterprises the local traffic has increased tremendously, resulting in the creation of numerous hazardous situations, the correction of which has taxed the resources of the Department.

This, with the increase of the regular traffic using the highways, has placed greater demands for traffic-actuated signals, warning signs, and more frequent painting of pavement markings.

The streets and roads of the numerous unincorporated communities that have been accepted by the Department for maintenance are placing additional demands on the traffic service operation. During the year many requests have been received from the various civic associations, which have included not only requests for warning signs of all types but also for traffic signals. The performing of these services to the unincorporated areas is time consuming and costly. It is just another factor that has helped to increase the over-all cost of traffic services.

During this period a study of the traffic service operation has been made to determine new policies and procedures that would tend to give more service, and at the same time reduce the cost of these services.

The following conclusions were reached:

(1) That the services performed were closely allied with the traffic engineering studies made by the Traffic and Planning Division.

(2) That the needs for the various traffic services emanate from the Traffic and Planning Division, and that time would be saved if the direction of this operation were made a responsibility of the Traffic and Planning Division.

(3) That savings, both as to number of personnel and in the purchasing of materials, would be possible if the traffic services were considered on a Statewide basis.

(4) That as a result of the study and subsequent conclusions, a Traffic Service Section would be be created and become the responsibility of the Traffic and Planning Division, effective July 1, 1952.

A ten-year comparison of the expenditures for traffic services appears in the following tabulation:

Fiscal Yr.	New Castle	Kent	Sussex	Total
1942-1943	$ 34,182.39	$ 14,100.43	$ 11,498.87	$ 59,781.69
1943-1944	34,572.96	12,502.39	6,435.53	54,510.88
1944-1945	33,567.55	13,243.70	5,512.76	52,324.01
1945-1946	37,530.42	18,329.44	12,828.23	68,688.09
1946-1947	45,534.10	17,254.17	14,580.11	77,368.38
1947-1948	54,944.91	17,926.34	12,765.88	85,637.13
1948-1949	69,254.30	27,406.18	17,659.57	114,320.05
1949-1950	76,719.33	28,366.68	37,913.90	142,999.91
1950-1951	86,405.12	30,293.82	37,812.38	154,511.32
1951-1952	103,078.25	30,749.21	43,303.05	177,130.51
Totals	$575,789.83	$210,172.36	$200,310.28	$986,271.97

Snow Removal

The winter season of this report period again compared favorably with those of the previous three fiscal years. The snows, with one exception, were very light and the few sleet storms were of short duration.

On December 14, 1952, a blizzard-type storm occurred throughout the State and caused considerable confusion to transportation and public utilities. Heavy snow began to fall at 1:00 P. M. and four hours later over eight inches of snow covered the entire State.

In New Castle County traffic was brought almost to a standstill for reason that many motorists were not equipped with chains, sufficient gasoline, and fully charged batteries. Although the Department was prepared to combat blizzard-type storms, they were severely handicapped due to the fact that most of the roads were completely blocked by vehicles. In many instances the snow removal crews proceeded to the tie-up point on foot, and by hand methods removed snow and sanded pavements, which eventually opened the road sufficiently to allow the snow equipment to complete the operation.

Many motorists abandoned their vehicles in the running lanes of the roads, and before the roads could be opened to traffic these vehicles had to be removed by the Department. The expenditures for snow and ice removal for the

last ten fiscal periods are indicated in the following tabulations:

Fiscal Yr.	New Castle	Kent	Sussex	Total
1942-1943	$ 21,075.98	$ 4,937.30	$ 3,168.62	$ 29,181.90
1943-1944	18,383.81	4,432.73	2,671.05	25,487.59
1944-1945	39,443.57	3,266.13	1,244.92	43,954.62
1945-1946	30,553.61	8,318.34	8,062.61	46,934.56
1946-1947	49,578.15	13,007.78	6,775.90	69,361.83
1947-1948	60,866.54	21,797.22	33,069.91	115,733.67
1948-1949	35,913.29	5,879.91	10,748.06	52,541.26
1949-1950	25,260.36	4,405.21	2,798.10	32,463.67
1950-1951	39,363.76	4,841.22	10,679.21	54,884.19
1951-1952	47,221.23	8,145.29	6,904.95	62,271.47
Totals	$367,660.30	$79,031.13	$86,123.33	$532,814.76

TRAFFIC AND PLANNING DIVISION
William J. Miller, Traffic and Planning Engineer

The Traffic and Planning Division is charged with the responsibility of providing the information to the other Divisions of the Department necessary for good highway planning. To do this, the various functions of the Highway Planning Survey have been undertaken and are continuing. The results of many of these are listed below.

In addition, all the traffic engineering work for the State Highway Department is performed in this Division.

Road Inventory

The State Highway Department has a network of 3960.6 miles of roads and streets in its several systems. Table I shows this latest information by mileage of streets and highways by surface type by county. A comparison with previous years will show definite changes in the mileage of certain types of highways. This is attributed to four things. First, the construction and maintenance program which was completed during the past year. Second, the increase in suburban development roads. Third, a reclassification as to surface type of roads. Last, but most important, the Road Inventory Study completed in 1951 corrected many survey errors that existed.

Table II shows the existing road and street mileage for the four systems which are controlled by the State Highway Department. The urban mileage as listed is the extension

of primary rural roads within cities of 5,000 or more population. These cities include Wilmington, Elsmere, Newark, New Castle, Dover and, Milford. The Primary System includes the main arterial routes through the State with the exception of that described in the urban mileage. It is also the same as the Federal Aid Primary System. The Secondary System includes the intermediate roads of the State and is identical with the Federal Aid Secondary System. The Tertiary System includes all other roads within the State which are on the highway system other than those described in the three systems above. The Tertiary System includes 220.01 miles of suburban development roads. Of this mileage the State Highway Department maintains 113.96 miles. Any noticeable changes in each system mileage over past years is due to the establishment of the Urban System, as well as the transfer of mileage from one system to another. Additional suburban development mileage has kept the Tertiary System mileage up, although several miles of that system were transferred to the Secondary System.

A complete set of road inventory tables is available in this office showing mileage by types, by surface widths, and by traffic volumes.

TABLE I

MILEAGE OF STREETS AND HIGHWAYS

BY SURFACE TYPE BY COUNTY

Delaware 1/1/52

SURFACE TYPE	NEW CASTLE	KENT	SUSSEX	TOTALS
Concrete	215.54	160.23	266.32	642.09
Bituminous Concrete	50.30	139.65	104.62	294.57
Brick	.68	4.45	—	5.13
Belgian Block	—	.51	—	.51
Bituminous Penetration	1.05	326.62	56.22	383.89
TOTAL PAVED	267.57	631.46	427.16	1,326.19
Other Low Type Bituminous	22.21	25.08	107.11	154.40
Bituminous Surface Treated	162.49	116.11	276.53	555.13
Gravel or Stone	66.91	14.87	9.17	90.95
Soil Surfaced	452.69	170.44	414.01	1,037.14
TOTAL SURFACED	704.30	326.50	806.82	1,837.62
Graded and Drained Earth	73.95	6.49	609.36	689.80
Unimproved	1.73	7.66	16.74	26.13
Primitive	1.46	—	—	1.46
TOTAL UNSURFACED	77.14	14.15	626.10	717.39
TOTAL TWO AND FOUR LANED HIGHWAYS	1,049.01	972.11	1,860.08	3,881.20

DIVIDED HIGHWAYS

Concrete	6.03	20.32	.68	27.03
Bituminous Concrete	6.47	37.13	7.26	50.86
Low Type Bituminous	—	.11	—	.11
Bituminous Surface Treated	—	.60	.68	1.28
Soil Surfaced	—	.12	—	.12
TOTAL DIVIDED HIGHWAYS	12.50	58.28	8.62	79.40
TOTAL ALL TYPES	1,061.51	1,030.39	1,868.70	3,960.60

TABLE II

MILEAGE OF STREETS AND HIGHWAYS BY SYSTEM CLASSIFICATION BY COUNTY

New System Urban (over 5,000 population)	9.95	38.27	2.56	50.78
Primary (F.A.P.)	112.74	145.82	205.17	463.73
Secondary (F.A.S.)	312.51	304.93	635.37	1,252.81
Tertiary (No F.A.)	626.31	541.37	1,025.60	*2,193.28
TOTAL	1,061.51	1,030.39	1,868.70	3,960.60

* 106.05 Miles not State maintained.

Traffic

Table III shows results of the traffic volume statistics which have been obtained from four of the Automatic Counter Stations which have been in constant operation since 1940. For fiscal 1952 there is a 17.28 per cent gain in traffic over fiscal 1951 for these stations. This also indicates an increase of 80.22 per cent over traffic in fiscal 1942.

To a considerable extent the opening of the Delaware Memorial Bridge has influenced traffic volumes in the State, moving them in a constant upward spiral. The traffic volume statistics which are collected for each rural road in the State as a part of the annual traffic study indicate this rise.

TABLE III

TRAFFIC VOLUMES AT FOUR AUTOMATIC COUNTER STATIONS BY YEAR BY MONTH WITH RELATED PERCENTAGES

Month	AVERAGE DAILY TRAFFIC 1941 1942	1950 1951	1951 1952	PERCENT CHANGE 1951-52 1941-42	1951-52 1950-51
July	22,721	30,505	32,910	+ 44.84	+ 7.88
August	22,328	30,463	35,456	+ 58.80	+16.39
September	19,902	26,169	32,635	+ 63.98	+24.71
October	17,491	24,634	29,489	+ 68.60	−19.71
November	17,056	23,225	28,142	+ 65.00	+21.17
December	16,174	23,053	25,571	− 58.10	−10.92
January	13,421	20,952	24,592	+ 83.24	+17.37
February	13,736	21,559	26,758	+ 94.80	+24.12
March	14,062	23,363	26,315	+ 87.14	+12.64
April	15,583	25,584	30,015	+ 92.61	−17.32
May	14,744	28,717	32,790	−122.40	+14.18
June	13,810	30,696	37,628	+ 172.47	−22.58
TOTAL	201,028	308,920	362,301	+ 80.22	+ 17.28

Mapping

During the fiscal year a new General Highway Map was completed, the first of its type by the State Highway Department. Also during the fiscal year a new and revised Tourist Map was prepared and distributed. This map, which shows all the state highways and many tourist points with colored photographs, has been particularly in demand. 50,000 maps were distributed during the fiscal year, an increase of about 100% over previous years.

Another new map series was completed with the preparation of the Maintenance Maps for each of the three counties. On the three Maintenance Maps were indicated all the highway maintenance numbers for each road. These new maps replace Maintenance Maps that had originally been prepared as far back as 1935. The new maps indicate the road locations, the type of road, and the location of the drainage facilities.

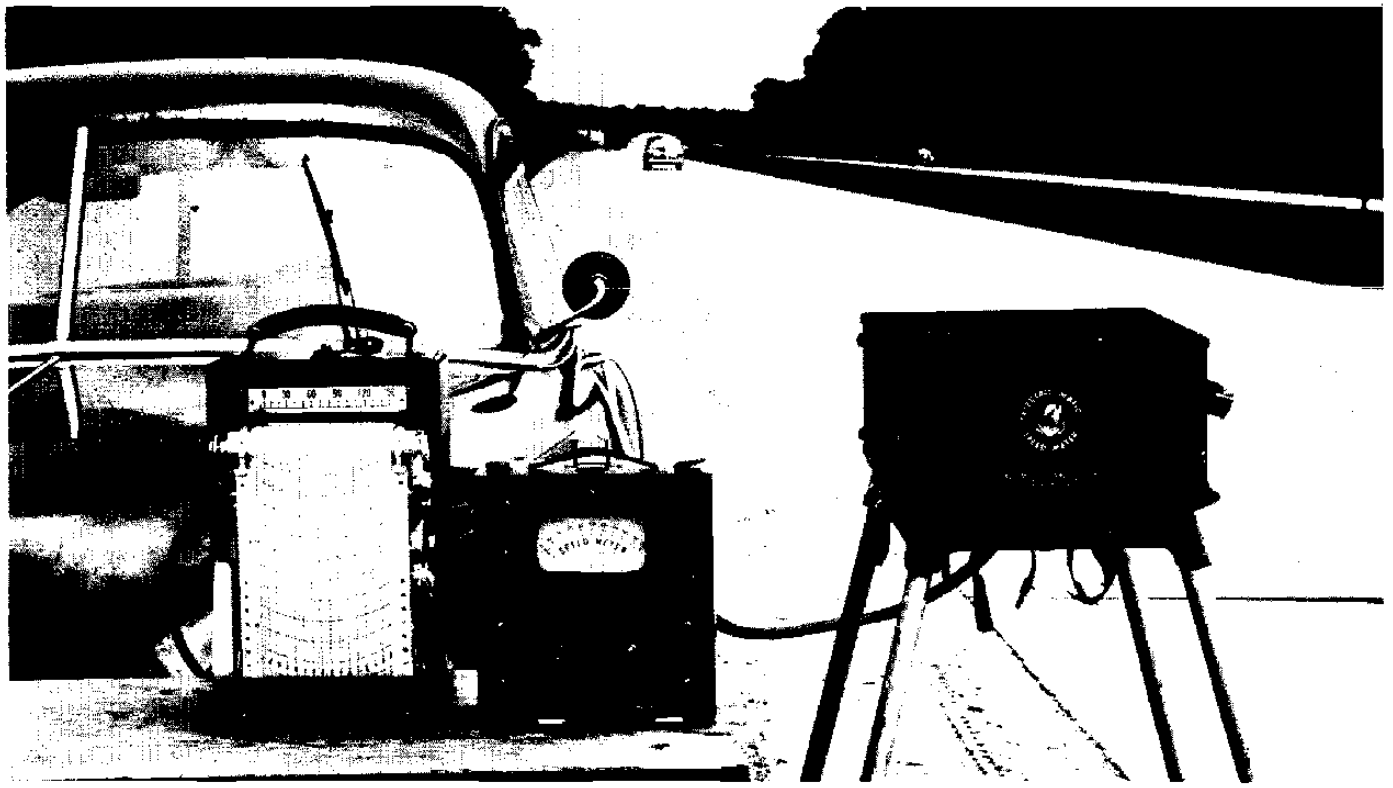
Another popular map was completed when the Kent County Traffic Flow Map was received from the printer at the end of the fiscal year. Traffic Flow maps for New Castle and Sussex Counties are under way and will be available in the near future. The above-mentioned maps are available to the general public at the Traffic and Planning Division office.

LOADOMETER SURVEY

The Loadometer Survey was continued during the fiscal year. This study is made in cooperation with the U. S. Bureau of Public Roads and with the assistance of the Delaware State Police. In the study, trucks are counted and weighed at various locations throughout the State four times each year. Information concerning the seasonal movements of trucks is thus obtained. It is intended that this information be used in a nation-wide study, as well as for our own State use in order to determine the type and extent of pavement failures which can be traced to heavy vehicle loads.

Road Life Study

Since fiscal 1948 the Traffic and Planning Division has been conducting a Road Life Study. Information is recorded annually indicating reconstructed roads and when the same road surface has been retired. Thus, the Road Life Study can be used to determine the probable average life of the several highway surface types in use in the State high-



RECORDING VEHICLE SPEEDS BY MEANS OF RADAR-PRINCIPLE INSTRUMENTS

way system. With this determined, the retirement rates for each type of system can be set up and future financial requirements of the system more accurately estimated.

Fiscal Study

Since fiscal 1948 a study directed primarily towards a determination and analysis of highway income and expenditures in all units of government throughout the State has been made. This Fiscal Study is prepared by interviewing each local government in the State annually.

Road Use Study

In 1942 a Road Use Study was made by the Traffic and Planning Division, and in 1952 another one was initiated. This study will show the traffic habits of motor vehicle owners and the relative use of the different highway systems by the motor vehicle operators. The study will be under way during most of the next fiscal year before it is finally completed. It will be used by the U. S. Bureau of Public Roads in combination with similar studies in other States to determine the same answers on a national basis.

Speed Survey

At various times throughout the year the State Highway Department samples the speeds of vehicles on highways in order to determine safe speed limits and for various traffic engineering analysis work. The vehicular speeds are measured by an electronic device called a Speed Meter which operates on the principle of radar. A picture of the device is included in this report.

Permits For Overloaded or Oversized Vehicles

The number of permits issued to the operators of overloaded or oversized vehicles is indicated in the tabulation below. Of the 4,587 permits issued in the State, 2,329 were issued from the Dover office and 1,634 from New Castle County. The table this year shows considerable increase over the last previous year. There were, during the year, 168 permits issued gratis to the U. S. Army and other Governmental agencies.

Total Permits
July 1, 1951 to June 30, 1952

Heavy hauling permits	3,332	$11,385.36
30 day piling permits	407	4,070.00
Trip piling permits	345	690.00
House moving permits	335	670.00
Free permits	168	—
Total	4,587	$16,815.36

It is very significant to note the low accident rate experienced with the number of vehicles issued permits, credit for which must be given to the Delaware State Police for their assistance and vigilance. Acknowledgment also is made for the assistance rendered by the Bridge Division of the State Highway Department, who assisted in the routing of heavy loads where special bridge conditions were encountered.

Petitions

Within the past fiscal year the State Highway Department received 84 petitions for improvements or alterations to roads, streets, bridges, construction and relocation of crossovers, and installation of traffic signals, which were investigated by the Traffic and Planning Division. These 84 petitions represent an increase of 14 per cent over fiscal 1951 and 42 per cent over fiscal 1950.

Investigation of existing conditions at the location, a field visit with the Division Engineer concerned, sketches of the roads or intersections involved, and the compilation of factual data are required for each petition. This information is reviewed by the Department and is the basis for evaluating the merits of each request.

Accident Reports

For the past three years arrangements have been made whereby the State Police furnish the Traffic and Planning Division a copy of each traffic accident report. For the purpose of analysis it has been most valuable to indicate these accidents by colored pins on spot maps of the three counties, and to prepare a cross index location file of this information. For comparative purposes at the end of each calendar year, color slides are prepared of these spot maps. This historical record has proved very useful in design work where traffic accidents have been involved.

DEPARTMENT OFFICIALS ACCEPTING TRAFFIC ENGINEERING AWARDS. FIRST PLACE: EASTERN REGION, THIRD PLACE: NATIONALLY. LEFT TO RIGHT: J. H. TYLER McCONNELL, CHAIRMAN, RICHARD A. HABER, CHIEF ENGINEER, NATHAN CHERNIACK, PRESIDENT, INSTITUTE OF TRAFFIC ENGINEERS, SAMUEL N. CULVER, DEPARTMENT MEMBER.

Traffic Engineering Studies

As has been mentioned in previous reports, the rapidly increasing traffic volumes on our highways and streets are further evidence of the need for additional traffic engineering studies to determine the most efficient methods for moving motorists and commodities safely and conventiently from origin to destination. Although the traffic accident problem continues to grow, there is every indication that some favorable results are being obtained each year throughout the State in designing and effecting highway safety regulations.

During the past fiscal year the Traffic and Planning Division conducted 53 studies and investigations pertaining to traffic signalization, channelization, parking, speed zoning, road and street marking, and traffic accident analysis. This number is a substantial increase over the number of traffic investigations made during the two previous years.

Among the incorporated cities and towns in Delaware, in which traffic engineering studies were made, are Wilmington, Dover, Hartly, Frederica, Blades, Delmar, Rehoboth Beach, Selbyville, Seaford, Magnolia, Kenton, Elsmere, Georgetown, Bridgeville, Milford, Odessa, Lewes, Bellefonte and Milton. Traffic surveys were also made in many of the unincorporated areas throughout the State.

Annual Inventory—National Safety Council

Each year the State Highway Department submits, through the Delaware Safety Council, to the National Safety Council a report which shows the amount of work performed in connection with traffic engineering services by the Department. This report is combined by the National Safety Council with reports from other State agencies, which include the State Police and Motor Vehicle Departments. From the combined reports the National Safety Council awards for progress in highway safety are determined. The traffic engineering section report, prepared by the State Highway Department, is judged separately. During the 1951 calendar year, the State Highway Department was awarded first place in the eastern region for their progress in traffic engineering and third place nationally for the same period.

Overhead Directional Signs

A step forward was taken during this fiscal year in the methods used to direct traffic on Delaware highways. At

OVERHEAD DIRECTIONAL SIGNS, duPONT PARKWAY
U. S. 13 AT FARNHURST INTERCHANGE

the Farnhurst Interchange on U. S. 13, where traffic approaches or leaves the Delaware Memorial Bridge, there were erected three overhead directional signs. These signs combine the latest thinking of the traffic engineer and the outdoor advertising authorities.

The signs are designed to direct traffic efficiently and to provide this service for a long period of time with a minimum amount of maintenance. The color contrast in the day time, and the neon lighting behind the letters during the hours of darkness, make the signs visible from a long distance. The immediate favorable response indicated after the signs were erected has led to the suggestion that this type of sign be installed in other locations on our highways where critical traffic conditions exist.

Report on Arterial Highways and Streets in The Wilmington Metropolitan Area

During the fiscal year the State Highway Department engaged the firm of Parsons, Brinckerhoff, Hall & MacDonald to prepare a report for the Wilmington Metropolitan Area. The completed report was presented to the Department in May of 1952. The report covers a study made to develop methods of reducing traffic congestion on the arterial highways and streets in Wilmington and the Metropolitan Area.

Included in the report is a discussion of highway work which has recently been completed or is under construction in the Wilmington Metropolitan Area. Roads planned for construction are discussed, and improvements are recommended for the reduction of traffic congestion on various arterial highways and streets. For the relief of traffic congestion in the City of Wilmington, the most important recommendation is for a new entrance into Wilmington from the south which involves an additional crossing of the Christiana River.

Miscellaneous

The Traffic and Planning Division also prepared numerous monthly and annual reports for the United States Bureau of Public Roads, other State agencies, and the general public. Among these are Monthly Traffic Tables, Monthly Detour and Construction Bulletins, Annual State Mileage Tables, Annual Report for the Delaware Safety Council, Traffic Paint Tests, and other types of statistical information.

The Division also participated in the preliminary work incidental to traffic operations in connection with the 150th Anniversary of the duPont Company, and the preliminary work necessary for routing traffic to and from Delaware Park.

RIGHT OF WAY DIVISION

Howard W. Jones, Chief Right of Way Agent

During fiscal 1952 negotiations for the acquisition of rights of way were very time consuming and required exceptional tactfulness and patience on the part of the Department representatives. Owners placed inflated values on their properties when it became known that certain parcels of their lands would be needed for highway purposes. These values were considerably higher than the prevailing land values of the locality. It was very difficult to deal with these owners, and in some instances it was necessary to resort to condemnation proceedings, for reason that the land was urgently required to allow preliminary construction work to progress. However, it is pleasing to report in those instances where the condemnation laws were invoked, settlements reflecting a truer land value were eventually made without continuing condemnation proceedings.

It is thought that the 1951 condemnation law greatly influenced settlements for rights of way which would have in other years required settlement by a condemnation jury.

During fiscal 1952 the expenditures for rights of way totaled $435,514.12.

The following is a tabulation of the rights of way activities for fiscal 1952:

Options obtained	511
Trespass and other Agreements executed	68
Drainage Agreements executed	48
Slope Easements executed	21
Deeds executed	237
Mortgage and Judgment releases executed	88
Descriptions written	382
Condemnations appealed	1
Condemnations heard	—
Plats prepared	47
Parcels of State land sold	10
Sale of buildings	2
Borrow Pits purchased	7
Claims settled	22

SUBURBAN DEVELOPMENTS DIVISION

Chauncey O. Simpson, Suburban Development Engineer

The function of the Suburban Development Division is to perform the duties imposed upon the State Highway Department by the Laws of Delaware relating to the acceptance for maintenance of streets and roads within unincorporated suburban communities that have been, or are intended to be, dedicated for public use.

Under the Suburban Road Laws the freeholders of any unincorporated community may petition the Levy Court for the construction or reconstruction of all or any portion of their streets. If the petition and community comply with certain preliminary requirements as stated in the laws, the Levy Court is authorized to issue bonds covering the costs of the improvements. The Levy Court notifies the State Highway Department to survey, prepare plans, specifications, and costs estimates. After the freeholders have been informed by the Levy Court of the estimated cost, they may approve or reject the improvement by means of a referendum held in the Levy Court. If the project is approved construction is carried on under the supervision of the State Highway Department, and when completed is incorporated into the highway system for maintenance.

For developers constructing streets intended to be dedicated for public use, such streets must be constructed to the standards as set forth in the "Rules and Regulations" published by the Department.

The developers of the streets are required to post a performance bond in order to insure conformity to Department specifications.

The plans for proposed construction of streets in subdivisions are thoroughly examined with regard to drainage, pavement design, and entrance upon State highways. When any of these items are found to be unsatisfactory, the developer is advised to correct the plans so as to meet the requirements of the Department.

The following is a tabulation of the street mileage which has been accepted into the State Highway system during the fiscal year:

Contract	Development	Mileage
SD-30	Christiana Acres	0.564
Developer	Clifton Park Manor	1.082
Developer	Deerhurst	0.229
Developer	Deerhurst	0.051
Developer	Dunleith	2.477
Developer	Garden Court Apartments	0.132
SD-27	Hilltop Manor	0.456
SD-10	Holly Oak Terrace	0.597
Developer	Kiamensi Gardens	1.039
Developer	Leedom Estates	0.155
Developer	Manor Park, Section "A"	0.320
Developer	Manor Park, Section "B"	0.993
Developer	Normandy Manor	0.088
Developer	Northfield	0.521
Developer	Pembrey	0.167
Developer	Penarth	0.150
SD-36	Roseville Park	0.326
Developer	Woodside Hills	0.184
Developer	Silverside Heights	0.055
Developer	Simonds Garden	1.356
SD-33	Westwood Manor	0.434
Developer	Windsor Hills	0.778
Developer	Shellburne	0.319
	Total Mileage Accepted	12.473

In addition to the streets constructed and accepted under the Suburban Road Laws, the following petitions have been received, investigated, and are being designed:

Contract	Development	Mileage
SD-4	Roosevelt Avenue	0.405
SD-9	Blue Rock Manor	0.425
SD-39	DuRoss Heights	1.680
SD-40	Westwood Manor	0.374
SD-41	Maplewood Lane	0.174
SD-42	Blue Rock Manor	0.358
SD-43	Woodcrest	0.449
SD-45	Edgehill	1.130
SD-46	McDaniel Heights	0.146
SD-47	Roseville Park	1.027
SD-48	Brack-Ex	0.296
SD-49	McDaniel Crest	0.332
SD-50	Woodcrest	0.085
	Total Mileage	6.831

There is one project being finished under the Suburban Road Laws at the present time:

Contract	Development	Mileage
SD 38	Old Deerhurst	0.293

During the year two petitions were rejected:

Contract	Development	Mileage
SD-44	Woodward Addition	0.150
.....	Ardencroft	2.020
	Total Mileage	2.170

During the year the 10% performance bond was posted for the following construction:

Subdivision	Contract Amounts
Cooper Farms	$14,000.00
Garfield Park	92,908.80
Westview	1,821.00
Hyde Park	3,485.20
Villa Monterey	6,457.50
Woodcrest	5,700.00
Shipley Heights	3,288.80
Llangollen Estates	1,065.90
Cleland Heights	5,560.00
Manor Park	14,500.00
Manor Park	20,500.00
Manor Park	15,000.00
Hyde Park	29,454.40
Morris Estates	20,000.00
Total	$233,741.60

MOSQUITO CONTROL DIVISION

Frank D. Cannon, Mosquito Control Engineer

Fiscal 1952 can be looked upon as presenting another milestone in the history of mosquito control for the State of Delaware. With the advent of drainage ditches in 1933 and airspraying in 1947, it was thought that from then on controlling the mosquito would be a fairly simple problem. However, during July, 1951, our several teams of inspectors began to report the constant presence of larvae in marsh

areas that were receiving sufficient spray treatments. This situation was reported to the Department of Entomology, University of Delaware, which immediately instituted a series of field tests to determine the trouble. Under the supervision of Dr. R. F. Darsie, Jr., Assistant Research Professor, it was proved that DDT insecticide-resistance was present in Delaware salt-marsh mosquito larvae.

A general review of the results shows that the degree of resistance varied in each marsh according to the number of times it had been sprayed over the last 5 years.

The following table shows results in per cent for two areas. Conch Point is a marsh which had never been sprayed, and Littleton's had received more spraying than any other single spot.

		Number of Larvae		Per Cent Dead	
Locality	Test	Test	Control	Test	Control
Conch Point	I	1200	100	98	7
Conch Point	II	1200	200	99	10
Littleton's	I	1200	100	61	1
Littleton's	II	1200	200	67	0.5

In conjunction with this test it was found that a considerable build-up of DDT residues had occurred in Littleton's Marsh. The following table shows the effect of water from Littleton's on Conch Point mosquito larvae and vice versa.

Source of Water	Source of Larvae	Number of Larvae	Per Cent Dead
Littleton's	Littleton's	300	0.3
Conch Point	Littleton's	300	0.6
Littleton's	Conch Point	300	70.0
Conch Point	Conch Point	300	9.0

Along the same line soil samples from Littleton's marsh were analyzed. It was found from a series of 7 samples that the average amount of DDT in pounds per acre was 0.55. As the spray rate is only 0.2 pounds per acre, this indicates that the larvae can stand 2.7 times the original lethal dose.

The above tests proved conclusively that resistance was present, and that some new insecticide would have to be used. The Entomology Department, after much inquiry and

deliberation, recommended BHC to be sprayed at the rate of 0.1 pound per acre. This chemical was used during the latter part of fiscal 1952 and appears to be satisfactory. It should be pointed out that resistance to BHC will probably appear much more quickly in the strain that have built up a resistance to DDT. Other States find that two years is about as long as good results can be expected.

During the summer, several inquiries were received relative to the effect of the spray solution on goldfish. The people seeking this information live in Rehoboth and have large out-door fish ponds. From a series of tests, conducted by Dr. Darsie, both in the laboratory and in the field, it was concluded that DDT and lindane (BHC) insecticides as applied in Delaware will kill goldfish on contact.

The salaries and wages, which make up the bulk of the expenditures (49%), represent about 17 yearly employees plus 6 for summer operations. These employees are either directly or indirectly connected with the ditch-cleaning program. This ditch-cleaning program is carried on throughout the entire year, as drainage is the permanent solution to the mosquito control problem. Due to resistance greatly affecting the degree of the control by temporary means, i.e., chemicals sprayed from both air and ground, much more emphasis is being placed on drainage ditches, the permanent means.

The hand-cleaning crews this fiscal year cleaned 629,925 linear feet of ditches. During fiscal 1952 more ditches were cleaned (629,925 feet compared to 567,262) than the prior fiscal year at less cost $16,031.11 compared to $17,636.00). This reduces the cost per foot in this fiscal year to .025 against .032 for the preceding year. The reduction in cost was made possible by the new scavel plow ditch cleaner.

It was not possible to operate the machine cleaner the entire year because machine crews are used in other capacities during the summer months. The few permanent employees allowed by the budget must work on inspection and airspraying in the mosquito breeding season.

One large project that cut down on the machine cleaning time was the disking of marshes filled in by the dredging of the Indian River and the Indian River Bay. The dredging was done during the summer of 1951, and by late fall the filled marshes had dried and begun to crack. Cracks are ideal places for mosquito breeding and the one permanent remedy is disking; to date over 100 acres have been disked. The disking problem is far from being solved

as it is estimated that there are 500 to 600 acres of filled marshes which require disking. The filling of marshes is of no help to the problem of mosquito control. Even after the dirt blown in has dried out, there are many low spots left to hold water. This is especially true around the edges where dikes were thrown up to contain the dredged material. The original drainage ditches having been covered, this water remains to offer an ideal breeding situation.

The machine crew is also the construction or repair crew. During the year, outlet boxes, culverts, and dikes were maintained. There are several cases, especially along the Indian River, where the outlet boxes are the only way small streams can empty into the larger body of water. If the boxes are not kept in good repair, the winter storms seal off the entrance completely, leaving large amounts of water back in the marshy areas. This year a complete new box was installed at Cripple Creek; dikes were installed at Littleton's and Joseph's; and several culverts were constructed in the vicinity of Dewey Beach.

The main summer operation is air-spraying. A total of 121,292 acres were sprayed as follows: July to September 1951, 100,045 acres, and during June 1952, 21,247 acres. The cost per acre in 1951 while using DDT was approximately 33¢ per acre but the use of BHC in 1952 has increased the cost to about 40¢ per acre.

The greatest benefit from the aerial spraying is received by the summer resort areas of Lewes, Rehoboth, Bethany Beach and Oak Orchard. However, during this fiscal year some 20,000 acres were sprayed in Kent and New Castle Counties. The spraying in these two counties consisted of one application over vast areas of marshland, and it is doubtful enough permanent good resulted to warrant the expense.

In 1951 we had in operation 9 of the New Jersey light traps. These traps were located throughout the State, and were watched by private individuals who consented to give their time. The traps not only give us a count of the mosquito population for each area, but the collections are used by the Department of Entomology for identification. In this respect all insects, not only mosquitoes, are of great value to the entomologists at the University of Delaware.

During the year several new items of equipment were purchased that should prove very valuable for the work in 1952. The equipment that was purchased included:

(1) Tifa fog machine. This fogger has been in use since the latter part of fiscal 1951 and has given

excellent results. It needs only one man for operation and will rid a town, camp, etc., of adult mosquitoes in a most gratifying fashion.

(2) OC-3 Cletrac complete with Ware loader and scavel plow. This provides two complete ditch-cleaning machines for use in the coming year.

(3) Pumps and tanks for mixing plant. By use of new and larger tanks and pumps the chemical mixing plant has been renovated. At the present time it is possible to mix 1,000 gallons of insecticide in one batch when heretofore 200 gallons was the maximum mixing capacity.

It is pointed out that even though 1951 was non-successful from the standpoint of control because of DDT resistance the solution to the problem seems to be at hand. It is in work such as this that cooperation of the University of Delaware is fully realized and appreciated.

PROPOSED BUDETARY REQUESTS 1954-1955 BIENNIUM

For reason that 1953 is a Legislative year, and that the budget requests of State agencies will be reviewed and funds allotted for the 1954-1955 biennium, it seems appropriate to indicate in this report the estimated construction, maintenance, and mosquito control requirements for the next biennium.

CONSTRUCTION

Explanation of Expenditures and Requests

In years prior to the current biennium, the funds for construction purposes—appropriations and bond sales—were credited to one account designated as "construction fund," account #101-1270-60.

At the beginning of the present biennium the State Auditor set up the construction funds in such a manner as to separate appropriated funds from those derived from bond sales, and also included a separate account for Federal Aid reimbursements. As a result, the construction funds for the current biennium are now indicated by the following accounts:

101-1270-60	Appropriated Funds
363-1200	1949 Highway Improvements Bonds
364-1200	Federal Aid Reimbursements
365-1200	1951 Highway Improvements Bonds

Since our construction funds are now shown in four separate accounts, it is intended for budgetary purposes to submit individual exhibits for each construction account in order that a clear picture of our construction expenditures may be presented, and also to assist the Budget Commission to better evaluate our requests.

In prior years the salaries paid to employees for the performance of work related to the construction effort lost their identity in the one construction account. For the fiscal years 1951-1952 it was possible to charge construction salaries to the specific project for which the services were performed, e.g., salaries of employees performing such services as surveys, plans and designs, testing of materials, and field inspections for and in connection with certain construction projects were considered lawfully chargeable to the funds derived from the sales of highway improvement bonds.

Salaries of employees for miscellaneous construction engineering services, which were not identified with any specific construction contract, were therefore considered chargeable to the usual construction operation appropriations.

The total salaries paid for the entire construction effort for fiscal 1952 were $868,222.03 and were charged to the various construction fund accounts as follows:

101-1270-60	Appropriated Funds	$295,469.54
363-1200	1949 Highway Improvement Bonds	358,767.56
365-1200	1951 Highway Improvement Bonds	199,196.76
	1951 Supplemental Appropriations	14,788.17
Total Construction Payroll		$868,222.03

It will be noted that for fiscal 1952 the greater portion of construction salaries was chargeable to highway improvement bonds.

Assuming that further construction programs will be continued for the 1954-1955 biennium, it is estimated that $975,000.00 will be required for the 1954 fiscal year, and $1,000,000.00 for the 1955 fiscal year for salaries, if we are to retain our present personnel who are directly connected with the construction effort. The greater portion of these salaries will be defrayed from new funds other than those

usually appropriated for construction operations, the breakdown of which is as follows:

	1954	1955
Appropriated Funds	$375,000.00	$ 400,000.00
New Funds	600,000.00	600,000.00
Total Salary Requests	$975,000.00	$1,000,000.00

The amount intended to be requested for salaries includes provisions for the regular yearly increments for deserving employees, and also provides for an Assistant Chief Engineer and a Construction Engineer which the Department has lacked in the past fiscal year. The request will be based upon the number of employees and existing salary and wage schedules as of June 30, 1952.

The requests for funds usually appropriated as construction operations will be made as follows:

	1954	1955
Salaries and Wages	$ 375,000.00	$ 400,000.00
Highway Planning	25,000.00	25,000.00
Laboratory	30,000.00	30,000.00
Engineer & General	120,000.00	120,000.00
Maintenance Construction	500,000.00	500,000.00
Miscellaneous Drainage Projects	100,000,00	100,000.00
Civilian Defense	2,000.00	2,000.00
Total	$1,152,000.00	$1,177,000.00
Less:		
Miscellaneous Receipts	10,000.00	10,000.00
	$1,142,000.00	$1,167,000.00

Permanent improvements to our highway plant are entirely contingent upon the new funds, which may be made available to the Department through additional sales of highway improvement bonds or from other sources that at this time remain unexplored. It is realized that new funds requested for substantial highway improvements will not be considered by the Budget Commission as budgetary items. It is intended, however, when submitting the budget for the next biennium to include these requests for informational purposes only and preparatory to the Department's request to the next General Assembly.

The construction funds now available to the Department will be entirely obligated by the end of fiscal 1953.

The Department therefore intends to request, in in addition to the usual appropriation for construction operations, new funds in the amount of $10,950,000.00 for the 1954 fiscal year and $9,100,000.00 for the 1955 fiscal year, or a total of $20,050,000.00 for the biennium. A tabulation and explanation of these intended requests are as follows:

	1954	1955	Biennium
To match Federal Aid	$ 2,258,000.00	$2,258,000.00	$ 4,516,000.00
100% State Construction	1,500,000.00	1,000,000.00	2,500,000.00
Special Construction Projects	5,000,000.00	4,500,000.00	9,500,000.00
Rights of Way	700,000.00	500,000.00	1,200,000.00
Surveys and Plans	250,000.00	200,000.00	450,000.00
Engineering and Inspection	500,000.00	400,000.00	900,000.00
New Bldg. for New Castle County	500,000.00		500,000.00
Other Costs and Contingencies	242,000.00	242,000.00	484,000.00
Total New Requests	$10,950,000.00	$9,100,000.00	$20,050,000.00
Salaries	600,000.00	600,000.00	1,200,000.00
Permanent Improvements	10,350,000.00	8,500,000.00	18,850,000.00
	$10,950,000.00	$9,100,000.00	$20,050,000.00

To Match Federal Aid

Federal funds apportioned to the State, under the provisions of the Federal Aid Highway Acts, are approximately $4,516,000.00 for the biennium. We will require funds to match this amount. If matching funds are made available, the State will benefit to the extent of $9,000,000.00 in highway improvements.

100% State Construction

These funds are required to cover the cost of new structures, numerous major bridge repairs, sidewalks and roadway contracts that are either not eligible for Federal participation, or must be built by State money when Federal Aid funds are exhausted.

Special Construction Projects

This fund is to cover new roads, at new locations, urgently required to avoid traffic strangulation in the heavier populated areas. In addition, the present traffic demands both as to volume, weight, and widths, dictate the urgency of widening and resurfacing long stretches of our important arteries, and further, many of our secondary roads are carrying a volume of traffic that the present pavements are unable to withstand, and in most cases these roads need realignment and entire reconstruction.

Rights of Way

These funds are necessary to cover the purchase of property in connection with all construction projects.

Surveys and Plans

A fund to cover the cost of all surveys and plans and designs for all construction projects, including consultant services.

Engineering and Inspection

A fund to cover the cost of engineering and field inspection while the projects are under construction.

New Building for New Castle County Division

This fund is to defray the cost of erecting a new building to house construction and maintenance forces of New Castle County. The land upon which this building is intended to be erected is State land under the jurisdiction of the Department. The architectural design and plans for this building have been completed.

Other Costs and Contingencies

This fund is requested to defray miscellaneous costs in connection with construction work, and at least in part to cover unforseen conditions of an emergency nature, such as bridge and highway washouts, etc.

MAINTENANCE

An explanation of the intended requests for maintenance funds for the 1954-1955 biennium is as follows:

Salaries and Wages

The actual expenditures for salaries and wages for fiscal 1952 exceeded the appropriation by $270,000.00. The original request for maintenance salaries for the 1951-1952 biennium was based upon the number of employees and existing rates of pay at the time the maintenance budget was submitted. These requested funds were lessened $150,000.00 for each of the fiscal years when the maintenance budget was finally approved by the Legislative Committee.

As the maintenance responsibilities of the Department were constantly accumulating, it was impossible to reduce our maintenance forces to conform with the funds appropriated and to continue to perform protective maintenance to the highways. The weights and widths of the ever increasing number of vehicles using the highways precluded any policy of retrenchment.

In addition to this immediately apparent deficit in in salaries and wages, the Department was required (due to prevailing economic conditions) to raise rates of pay in order to

retain and obtain a sufficient and competent maintenance force.

This increase in rates of pay, added to the aforementioned reduction in the original budgetary requests, accounted for the excess of payroll expenditures in fiscal 1952 over that appropriated.

As has been the case in other years, deficits of this nature have been satisfied by transfers from the regularly appropriated construction operations fund.

For the approaching 1954-1955 biennium, the Department intends to request for salaries $1,780,000.00 for fiscal 1954 and $1,805,000.00 for fiscal 1955. Included in the salary requests are the yearly increments to deserving employees, and provisions for the hiring of additional personnel to perform constant maintenance within unincorporated areas that are the responsibility of the Department under the Suburban Road Act and other recent legislation.

Office Expense

The Department intends to request $8,400.00 for each of the fiscal years in the next biennium.

Operations

For this item of expense it is intended to request $360,000.00 for fiscal 1954 and $370,000.00 for fiscal 1955. The funds to be requested are less than those granted in the prior biennium.

Repairs and Replacements

This budgetary item includes expenditures for the following functions, viz., repairs to buildings, repairs to equipment, auto maintenance, replacement of equipment, miscellaneous repairs, and materials for the repair of the highway system.

The amounts intended to be requested for repairs and replacements are $850,000.00 for fiscal 1954 and $830,000.00 for fiscal 1955. These requests indicate a substantial increase over the funds appropriated for the 1952-1953 biennium. Much of this requested increase is accounted for by the further urgent need to replace much of the heavy equipment, many pieces of which are obsolete, also inoperative, and a number of which need such extensive repairs that it would be more economical to replace them. Further, if the Department is to meet the demands for more frequent maintenance of the numerous unincorporated developments,

provisions must be made to acquire the additional necessary material.

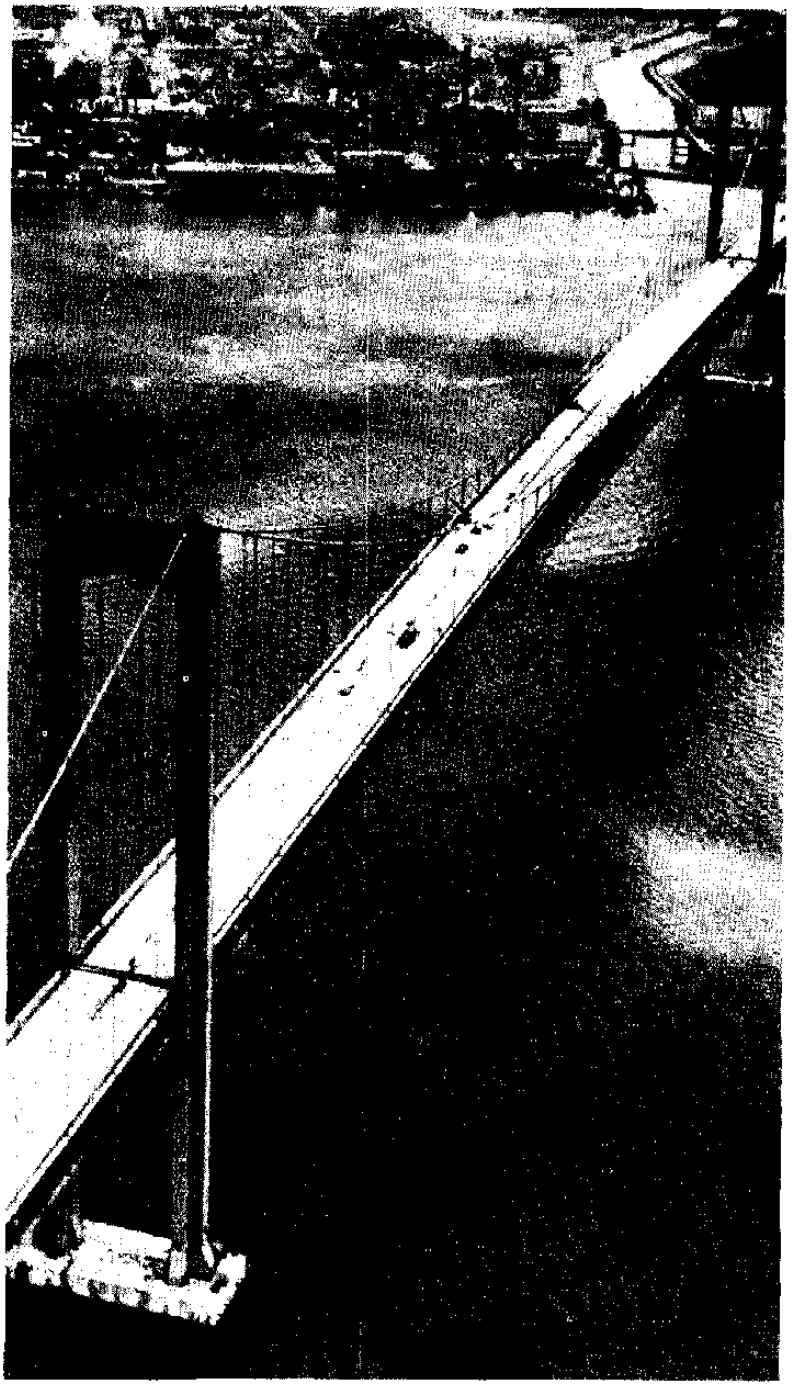
Equipment

Modern methods of maintenance require modern equipment. Not only should the Department continue to construct new roads to keep pace with the economic progress of the State, but modern methods of maintenance must be adopted, the foremost of which is the mechanization of maintenance forces.

It is intended to request an additional allowance to cover the purchase of new equipment which includes provisions for equipment intended to be specifically assigned to the maintenance of the added responsibility of suburban roads. The funds to be requested for equipment are $127,000.00 for fiscal 1954 and $97,000.00 for fiscal 1955.

A tabulation of the maintenance request is as follows:

	To be Requested 1954	1955
Salaries and Wages	$1,780,000.00	$1,805,000.00
Office Expense	8,400.00	8,400.00
Operations	360,000.00	370,000.00
Repairs and Replacements	850,000.00	830,000.00
Equipment	127,000.00	97,000.00
TOTAL	$3,125,400.00	$3,110,400.00



DELAWARE MEMORIAL BRIDGE
OPENING DATE—AUGUST 16, 1951

DELAWARE MEMORIAL BRIDGE
G. Lester Daniels, Manager

The Delaware Memorial Bridge became operational at 12:01 A. M., August 16, 1951. The operational record from the opening date to May 31, 1952, is indicated in the Department annual report for the first time.

At the time the bridge was opened, John I. Cahalan, New Castle County Division Engineer for the Highway Department, was Acting Bridge Manager and Warren Van Arsdalen served as Superintendent. Subsequently Mr. Van Arsdalen resigned and Charles H. Salmon (one of the sergeants of the toll collectors) was named Acting Superintendent.

The operating personnel included 26 toll collectors, 4 sergeants, 11 maintenance men, 6 accounting, and 2 administrative employees, with 2 weeks of training and the most modern toll recording equipment, undertook to give the public and the bondholders courteous service and a strict accounting of all funds received.

Prior to the opening of the bridge, toll collectors and sergeants were given a training course under the supervision of Mr. C. A. Cover of the firm of McConnell & Breiden, certified public accountants, which included the receipt of toll in the form of tickets and cash, the operation of the toll registering equipment, the preparation of reports by the toll collectors and the sergeants, and the deposits of cash and tickets in the respective depositories in the Bridge Administrative Building.

The register manufacturer's representative, a technical expert in the repair of the toll registering equipment, undertook the training of maintenance personnel and stood by to repair the equipment in the event of an emergency. Other maintenance personnel were instructed in the operation of the sweeper, sprinkler, snowplow, towtruck, tractor and other maintenance equipment.

The accounting personnel was instructed in the accounting system by the certified public accountants. Thereafter, the regular accounting personnel undertook the preparation of the monthly operating report.

At 12:01 A. M., August 16, 1951, six of the eight toll booths were in operation. Sunday, August 19, 1951, was the largest single day the bridge was to enjoy during the period of this report. On that day, 35,921 vehicles passed through

TOLL BOOTH PLAZA
DELAWARE MEMORIAL BRIDGE

the toll booths from 8:00 A. M. to 4:00 P. M., averaging more than 400 transactions per hour. In order to expedite this heavy traffic, temporary toll booths were set up.

At the November meeting of the State Highway Commission, Mr. G. Lester Daniels of Middletown was appointed Bridge Manager, and Mr. Charles H. Salmon, Bridge Superintendent.

In the early part of December, 1951, it was apparent that the monthly budget of $25,000.00 recommended by the consulting engineer was inadquate to provide for efficient operation. The monthly budget was exceeded on several occasions in order to employ sufficient toll collectors to meet the heavy traffic requirements.

Policing of the bridge was undertaken by the Delaware State Police from the day of the opening. However, the State Police were seriously handicapped because they were undermanned and a recommendation was made that a Bridge Police Force be organized. Additional personnel for maintenance was also recommended.

A revised budget was submitted to the consulting engineer who approved it to become effective February 1, 1952. The revised budget provided for a Bridge Police Force, and the cleaning and painting of the bridge superstructure. Large quantities of sand, salt, and chemicals placed on the bridge for snow and ice removal necessitated these additional maintenance operations.

On May 24, 1952, 7 Delaware Memorial Bridge Police were given their oath of office by Associate Judge Daniel L. Herrmann in the presence of Governor Elbert N. Carvel and other State officials. They are working closely with Delaware State Police and arrangements are being made to empower them as Deputy Sheriffs of Salem County, State of New Jersey.

The first Sunday that the bridge was opened, traffic set a record which stood high for a single day's business during the period of this report. For the balance of the month of August, a total of 16 days, 346,049 vehicles passed through the toll booths.

September, 1951, brought the first full month of operation and gave an indication of what was to be expected in the future. With the Labor Day week end and subsequent fine weather, a total of 498,472 vehicles used the span, for a daily average of 16,616, compared with a daily average of

DELAWARE MEMORIAL BRIDGE POLICE
AFTER BEING SWORN IN BY ASSOCIATE JUDGE DANIEL L. HERRMANN IN THE PRESENCE
OF GOVERNOR ELBERT N. CARVEL AND DEPARTMENT MEMBERS, MAY 24, 1952.

21,628 for the first 16 days. It must be remembered, however, that publicity in connection with the dedication and opening attracted many visitors during the first few weeks of operation.

During the fall and winter months there was a fluctuation with regard to passenger cars and trucks, first one then the other gaining. However, early spring traffic became steady and monthly gains were recorded in all categories.

Coverdale & Colpitts, consulting engineers, estimated that from August 16, 1951, through January 25, 1952, 2,202,000 vehicles would cross the span. They also estimated that income would be $2,032,000.00. Actually during that period, 2,383,000 vehicles were clocked through the toll booths, and revenue amounted to $2,088,000.00. Traffic was eight per cent higher than the estimate and revenue three per cent higher. The variance in this figure is due to the sale of commutation tickets at a lower cost to individual motorists. In February another estimate was made by the consulting engineers. They predicted that the volume from August 16, 1951, through May 31, 1952, would be 4,096,000 and that revenue would amount to $3,586,000.00. Again the actual business topped the estimate; during that period 4,329,873 vehicles used the span, an increase of 233,873 over the estimate and total revenue was $3,775,842.20, or $189,842.20 above the estimate.

By October 15, 1951, at approximately 6:10 P. M. the millionth vehicle crossed the span. This was a huge trailer truck driven by Jack Mehsling of Baltimore, Maryland. The arrival of the millionth car was noted, photographed, and publicized with Mr. John Cahalan, Acting Manager, on hand to greet the driver. There was a total of 396,834 bridge users during the month of October.

At this point a breakdown of revenue indicated that while truck traffic accounted for about one-sixth of the bridge traffic, it was producing about one-half of the revenue. The daily average for October dropped to 12,801. A study of traffic figures at that point by Coverdale & Colpitts indicated that there was an increase of 7.3 per cent in heavy truck traffic from September to October and commuting trips showed a 19.8 per cent increase. The decrease in traffic had been almost entirely in passenger cars.

There was an upsurge in traffic during the month of November, with daily crossings jumping to 13,055 compared to 12,801 for October. The Sunday following Thanksgiving a total of 25,151 vehicles crossed the span.

During December, which was marked by a severe two-day snow and sleet storm, (December 18-19) traffic fell to a total of 377,656. It was on December 16, 1951, that the lowest day's business to date was recorded. On that day only 5,862 vehicles pressed their way through the icy blasts and sudden snow that blanketed this entire area. Bridge equipment, the snowplow and all other mechanical devices, were put to their first real test. While there were minor incidents and accidents, there was no serious damage done to vehicles or to bridge property. During December the average daily crossings were 12,182 compared to the 13,055 during November.

On December 31, New Year's Eve, shortly before 8:00 P. M. the two-millionth vehicle was recorded. The passenger car was driven by David Ferber, Washington, D. C., en route to Philadelphia. Mr. Ferber was greeted and congratulated by Mr. G. Lester Daniels, General Manager.

The financial report at the end of December indicated that total income from August through December was $1,675,934.82 and the net income for the month totaled $309,772.81 compared to $328,595.73 for the month of November.

January, 1952, was the lowest traffic month to date, with 371,179 vehicles passing through the toll registers. This accounted for a daily average of 11,973 as compared to 12,182 for December. The financial reports indicate that the total income to date in excess of paid expenses was $1,979,121.21, and the net income for January was $303,186.39. There was an increase in the number of trucks using the span, but passenger traffic declined during the month

Meanwhile, the General Assembly of the State of Delaware was in special session and finally approved the purchase of the Delaware-New Jersey Ferry Company for the sum of $2,500,000.00. The ferries had ceased operations the day the span was opened to the public. This purchase was in line with agreements entered into with the bondholders that competition to the Delaware Memorial Bridge would be eliminated and was one of the conditions under which the Delaware Memorial Bridge Bonds were offered for sale.

During the month of February, traffic showed an appreciable increase with daily crossings jumping to 14,932. Total traffic for the month reacher 433,031, being the highest monthly figure to date. The George Washington birthday week end contributed greatly to this increase, with the three-day holiday period traffic totaling 73,019 vehicles. Sunday,

February 24th was the high day of the month when 32,348 vehicles crossed the bridge. This was the second largest day's business to date.

In March, daily crossings averaged 14,177 while the total for the month was 439,484. At this time Coverdale and Colpitts estimated that, based on this figure, the yearly daily average would reach 18,168 vehicles per day. The financial reports show at the end of March that the total income, in excess of paid expenses, had climbed to $2,688,575.67, and the net income for March was $362,520.20 compared to $346,934.26 for the Month of February. On Saturday, March 15, 1952, Mrs. Martin J. Synott of Montclair, New Jersey, drove the three-millionth vehicle across the span.

Work was begun in April on the construction of the new maintenance building and the widening of the toll plaza. A traffic survey was also started to determine the percentage of Delaware cars using the bridge in comparison to cars from other States. Total crossings for April amounted to 536,083 vehicles with a daily average of 17,869, showing that the spring and summer months would bring peak volumes. A study of traffic figures at this time revealed that the total number of trucks, passenger cars, and commutation tickets increased during the month. Easter Monday, April 14, brought the highest count for a single day during the month with 28,834 vehicles.

The traffic survey was completed in May and after study these figures were released. The results of the 14-hour staggered survey showed cars representing 45 States, Alaska and 8 foreign countries (Cuba, Germany, Japan, Newfoundland, Nova Scotia, Ontario, Panama and Quebec) had used the bridge. New Jersey accounted for the highest percentage of passenger cars with New York second. Delaware averaged 10.8 per cent passenger cars and 12.1 per cent trucks or a combined average of 11 per cent. The truck traffic revealed a total of 25 States being represented during the 14-hour check period.

New Jersey passenger cars brought 28 per cent of the traffic, New York 17 per cent, Maryland 10.7 per cent, and Pennsylvania 7.7 per cent.

In the truck traffic tabulation, New Jersey was first with 29.1 per cent, Delaware 12.1 per cent, Maryland 11.7 per cent North Carolina 10.7 per cent, New York 5.5 per cent, and Pennsylvania 4.9 per cent.

During the month of May the total number of vehicles to cross the bridge was 539,426, the highest monthly total to

date. This represented a daily crossing of 17,400 vehicles. On May 15, 1952, the four-millionth vehicle crossed the span, a passenger car driven by Mr. William R. Davis of Catonsville, Maryland.

From August 16, 1951, to the close of this report period, the bridge had been used by a total of 4,329,873 vehicles.

The financial reports up to the end of May 31st indicated that the total income to date in excess of paid expenses was $3,550,679.20. The net income for May, the heaviest traffic month recorded during this report, was $430,731.37.

Following are tables recording in detail the traffic accommodated and the income derived from August 16, 1951, through May 31, 1952.

MONTHLY CROSSING TOTALS

AUGUST	346,049
SEPTEMBER	498,472
OCTOBER	396,834
NOVEMBER	391,659
DECEMBER	377,656
JANUARY	371,179
FEBRUARY	433,031
MARCH	439,484
APRIL	536,083
MAY	539,426
TOTAL	4,329,873

TOTAL NUMBER OF VEHICLES

Passenger cars, light trucks	3,356,037
Commuters tickets	242,083
Two-axle trucks	141,352
Three-axle trucks	291,183
Four axle trucks	294,312
Specials	2,585
Free Vehicles	2,321
TOTAL	4,329,873

BREAKDOWN OF RECEIPTS

Passenger cars, light trucks @ .75	$2,517,027.75
Commuters tickets (Avg. 35c)	84,720.45
Two axle trucks @ $1.00	141,352.00
Three axle trucks @ 1.50	436,774.50
Four axle trucks @ $2.00	588,624.00
Specials ($2.00 & $5.00)	7,343.50
TOTAL	$3,775,842.20

LARGEST DAYS

August 19, 1951	35,921
September 3, 1951	30,436
October 14, 1951	21,116
November 25, 1951	25,151
December 22, 1951	22,250
January 20, 1952	17,124
February 24, 1952	32,348
March 30, 1952	23,270
April 14, 1952	28,834
May 30, 1952	34,158

SMALLEST DAYS

August 22, 1951	14,856
September 25, 1951	10,438
October 30, 1951	9,450
November 7, 1951	8,813
December 18, 1951	5,862
January 22, 1952	9,043
February 19, 1952	10,408
March 11, 1952	9,531
April 1, 1952	12,475
May 13, 1952	12,274

DAILY AVERAGE (By Month)

August	21,628
September	16,616
October	12,801
November	13,055
December	12,182
January	11,973
February	14,932
March	14,177
April	17,869
May	17,400

Largest Day—Report Period	Aug. 19, 1951—35,921
Smallest Day—Report Period	Dec. 18, 1951— 5,862
Daily Average—Report Period	14,930

CLASSIFICATION OF VEHICLES CROSSING THE DELAWARE MEMORIAL BRIDGE
FROM AUGUST 16, 1951 TO MAY 31, 1952

PASSENGER CARS, LIGHT TRUCKS UP TO 2,000 LBS. AND COMMUTATION

		Total Vehicles	Autos & Light Trucks Vehicles	% of Total	.75 Rate Vehicles	% of Total	Commuters Rate Approx. .35 Vehicles	% of Total
1951	August	346,049	300,474	86.8	300,474	100.0		
	September	498,472	421,009	84.5	400,085	95.0	20,924	5.0
	October	396,834	313,566	79.0	288,514	92.0	25,052	8.0
	November	391,659	318,107	81.2	292,757	92.0	25,350	8.0
	December	377,656	314,320	83.2	289,095	92.0	25,225	8.0
1952	January	371,179	299,408	80.7	272,555	91.0	26,853	9.0
	February	433,031	363,844	84.0	336,262	92.4	27,582	7.6
	March	439,484	363,334	82.6	334,457	92.1	28,877	7.9
	April	536,083	454,111	84.7	423,506	93.3	30,605	6.7
	May	589,426	449,947	83.4	418,332	93.0	31,615	7.0
Grand Total, Aug. 16, '51 to May 31, 1952		4,329,873	3,598,120	83.1	3,356,037	93.3	242,083	6.7

TRUCKS OVER 2,000 LBS. AND SPECIALS (CONTRACTOR'S EQUIPMENT)

		Total Buses, Trucks, Tractors & Trailers Vehicles	% of Total	Two Axle Trucks 1.00 Rate Vehicles	% of Total	Three Axle Trucks 1.50 Rate Vehicles	% of Total	Four Axle Trucks 2.00 Rate Vehicles	% of Total	Specials 2.50 & 5.00 Rate Vehicles	% of Total	Free Vehicles	% of Total
1951	August	45,548	13.2	10,086	22.2	20,920	45.9	14,483	31.8	59	.1	27	....
	September	77,405	15.5	17,283	22.3	33,815	43.7	26,097	33.7	210	.3	58	....
	October	83,065	20.9	16,902	20.3	36,542	44.0	29,374	35.4	247	.3	203	.1
	November	73,451	18.8	13,427	18.3	31,042	42.2	28,699	39.1	283	.4	101	..
	December	62,905	16.7	11,826	18.8	25,024	39.8	25,841	41.1	214	.3	431	.1
1952	January	71,126	19.1	13,165	18.5	27,002	38.0	30,727	43.2	232	.3	645	.2
	February	68,978	15.9	13,454	19.5	25,980	37.7	29,286	42.4	258	.4	209	.1
	March	75,883	17.3	13,453	17.7	28,831	38.0	33,277	43.9	322	.4	267	.1
	April	81,784	15.3	15,243	18.6	30,165	36.9	35,995	44.0	381	.5	188	....
	May	89,287	16.6	16,513	18.5	31,862	35.7	40,533	45.4	379	.4	192	....
Grand Total, Aug. 16, '51 to May 31, 1952		729,432	16.8	141,352	19.4	291,183	39.9	294,312	40.3	2,585	.4	2,321	.1

CLASSIFICATION OF RECEIPTS BY TYPE OF VEHICLE CROSSING THE DELAWARE MEMORIAL BRIDGE FROM AUGUST 16, 1951 TO MAY 31, 1952

PASSENGER CARS, LIGHT TRUCKS UP TO 2,000 LBS. AND COMMUTATION

		Total Receipts	Autos & Light Trucks Receipts	% of Total	.75 Rate Receipts	% of Total	Commuters Rate Receipts	Approx. .35 % of Total
1951	August	295,935.00	225,355.50	76.2	225,355.50	100.0		
	September	428,111.65	307,387.15	71.8	300,063.75	97.6	7,323.40	2.4
	October	356,296.60	225,146.10	63.2	216,385.50	96.1	8,760.60	3.9
	November	346,691.35	228,436.85	65.9	219,567.75	96.1	8,869.10	3.9
	December	327,300.00	225,650.00	68.9	216,821.25	96.1	8,828.75	3.9
1952	January	329,627.00	213,807.00	64.9	204,416.25	95.6	9,390.75	4.4
	February	373,585.20	261,841.20	70.1	252,196.50	96.3	9,644.70	3.7
	March	385,171.60	260,940.10	67.7	250,842.75	96.1	10,097.35	3.9
	April	461,926.15	328,336.65	71.1	317,629.50	96.7	10,707.15	3.3
	May	471,287.65	324,847.65	68.9	313,749.00	96.6	11,098.65	3.4
Grand Total, Aug. 16, '51 to May 31, 1952		3,775,842.20	2,601,748.20	68.9	2,517,027.75	96.7	84,720.45	3.3

TRUCKS OVER 2,000 LBS. AND SPECIALS (CONTRACTOR'S EQUIPMENT)

		Total Buses, Trucks Tractors & Trailers Receipts	% of Total	Two Axle Trucks 1.00 Rate Receipts	% of Total	Three Axle Trucks 1.50 Rate Receipts	% of Total	Four Axle Trucks 2.00 Rate Receipts	% of Total	Specials 2.50 & 5.00 Rate Receipts	% of Total
1951	August	70,579.50	23.8	10,086.00	14.3	31,380.00	44.5	28,966.00	41.0	147.50	.2
	September	120,724.50	28.2	17,283.00	14.3	50,722.50	42.0	52,194.00	43.2	525.00	.5
	October	131,150.50	36.8	16,902.00	12.9	54,813.00	41.8	58,748.00	44.8	687.50	.5
	November	118,164.50	34.1	13,427.00	11.4	46,563.00	39.4	57,398.00	48.6	776.50	.6
	December	101,650.00	31.1	11,826.00	11.6	37,536.00	36.9	51,682.00	50.9	606.00	.6
1952	January	115,820.00	35.1	13,165.00	11.4	40,503.00	35.0	61,454.00	53.0	698.00	.6
	February	111,744.00	29.9	13,454.00	12.0	38,970.00	34.9	58,572.00	52.4	748.00	.7
	March	124,231.50	32.3	13,453.00	10.8	43,246.50	34.8	66,554.00	53.6	978.00	.8
	April	133,589.50	28.9	15,243.00	11.4	45,247.50	33.9	71,990.00	53.9	1,109.00	.8
	May	146,440.00	31.1	16,513.00	11.3	47,793.00	32.6	81,066.00	55.4	1,068.00	.7
Grand Total, Aug. 16, '51 to May 31, 1952		1,174,094.00	31.1	141,352.00	12.1	436,774.50	37.2	588,624.00	50.1	7,343.50	.6

STATEMENT OF INCOME & EXPENSES
August 16, 1951 to May 31, 1952

TOLL INCOME		
Cash Tolls Reported & Received	$3,413,272.00	
Tickets Presented for Tolls	338,621.95	
Tolls to be Billed to Users	23,948.25	
Calculated Tolls (See Below)	$3,775,842.20	
Collections in excess of Cal. Tolls	692.90	
		$3,776,535.10
Income from unused Commutation Tickets	7,511.55	
Miscellaneous Income	693.16	
		8,204.71
Gross Income		$3,784,739.81
DEDUCTIONS FROM INCOME		
Salaries & Wages—Operating	$ 85,746.16	
Salaries & Wages—Bridge Police	4,444.16	
Salaries & Wages—Maintenance	32,370.79	
Salaries & Wages—Clerical	26,091.84	
Salaries & Wages—General Mgr.	6,704.21	
	$ 155,357.16	
Depository Service & Trustee Expenses	17,106.53	
Consulting Engineer	5,000.00	
Rents	695.30	
Police Protection	12,025.97	
Publicity, Advertising	799.63	
Matl. & Expense—Collectors	6,799.14	
Matl. & Supplies—Maintenance	16,606.12	
Matl. & Supplies Office	2,962.38	
General Expenses	2,858.50	
Insurance	2,464.95	
Printing Tickets	2,116.71	
	224,792.39	
Equipment Purchased	9,268.22	
		$ 234,060.61
INCOME IN EXCESS OF EXPENSES		$3,550,679.20

CALCULATED TOLLS

Class	Description	Rate	Transactions	Revenue
1	Passenger Cars (all types) trucks, reg. wt. 2 tons or less	.75	3,356,037	$2,517,027.75
2	2 Axle Vehicles, Buses	1.00	141,352	141,352.00
3	3 Axle Vehicles	1.50	291,183	436,774.50
4	4 Axle Vehicles	2.00	294,312	588,624.00
5	5 Axle Vehicles	.50/axle	2,585	7,343.50
6	Free		2,321	
8	Commutation—Passenger Cars		242,083	84,720.45
			4,329,873	$3,775,842.20

REVENUE FUND

August 16, 1951 to May 31, 1952

CASH BALANCE BEGINNING			$
CASH RECEIVED			
Cash Tolls Reported		$3,413,272.00	
Tickets sold for future use			
Regular Rate	$310,318.00		
Commutation Rate	91,368.00		
		401,686.00	
Deposits received on Ticket Sales		7,542.00	
Collection in excess of Cal. Tolls		698.15	
Payments received on Accts. Rec.		31,999.25	
Miscellaneous Receipts		693.16	
			$3,855,890.56
CASH DISBURSEMENTS			
Transfers to Operation Fund		$ 309,870.32	
Transfers to Maintenance Fund		70,000.00	
Transfers to Sinking Fund			
Interest Account		1,776,200.00	
Interest Reserve Account		1,252,019.96	
			$3,408,090.28
CASH BALANCE			$ 447,800.28

OPERATION FUND

August 16, 1951 to May 31, 1952

CASH RECEIVED		
Transferred from Revenue Fund		$309,870.32
CASH DISBURSEMENTS		
Salaries & Wages		
General Manager	$ 6,704.21	
Superintendent	4,593.33	
Toll Collectors & Sergeants	78,892.28	
Janitor	2,260.55	
Maintenance	32,370.79	
Clerical	26,091.84	
Bridge Police	4,444.16	
	155,357.16	
Less Taxes & Other Deductions	4,651.08	
	150,706.08	
Maintenance Supplies	15,665.31	
Maint. & Operation—Passenger Car	261.87	
Maint. & Independent Contract Repairs	678.94	
Office Supplies & Expenses	1,063.95	
Stationery & Printing	1,898.43	
Publicity & Advertising	799.63	
Fees & Expenses—Depository Service	17,106.53	
Fees & Expenses—Police Protection	12,025.97	
Fees—Consulting Engineer	5,000.00	
Rents	695.30	
Auto Licenses	633.00	
Miscellaneous	1,117.90	
Expenses Collection Personnel	4,625.24	
Electric	2,067.50	
Telephone & Telegraph	1,107.69	
Water Rent	106.40	
Insurance	2,464.95	
Printing Tickets	2,116.71	
	220,141.31	
Equipment Purchased	9,268.22	
		$229,409.53
CASH BALANCE, END		$ 80,460.79

SINKING FUND — INTEREST ACCOUNT

August 16, 1951 to May 31, 1952

BALANCE BEGINNING	$
CASH RECEIVED	
Transferred from Revenue Fund	$1,766,200.00
DISBURSEMENTS	
Semi-annual interest on $46,400,000.00 Bridge Bonds (Dec. 1, 1951 to May 31, 1952)	$1,776,200.00
CASH BALANCE, MAY 31, 1952	$

FUNDS ON DEPOSIT, ON HAND AND INVESTMENTS
MAY 31, 1952

DEPOSITORY—Equitable Trust Co., Wil., Del.		
Construction Fund		
Trustee Account 3939A Principal		$ 215,792.36
Trustee Account 3939A Income		3,367.59
Revolving Fund		248,180.74
		$ 467,340.69
Revenue Fund		
Trustee Account 3939B		$ 447,800.28
Interest Account		
Trustee Account 3939DA		$
Interest Reserve Account		
Trustee Account 3939DB		$ 233.02
Maintenance Fund		
Trustee Account 3939C		$ 5,701.91
DEPOSITORY—Farmers Bank of the State of Del. Wilmington, Dela.		
Operation Fund		$ 74,010.79
CASH ON HAND		
Superintendent & Collection Force		$ 6,450.00
INVESTMENTS—Construction Fund		
U. S. Treasury Discount Bills		
$1,100,000.00 Due June 26, 1952		$1,097,254.67
$1,375,000.00 Due July 31, 1952		1,370,909.37
		$2,468,164.04
INVESTMENTS—Maintenance Fund		
U. S. Treasury Ctf. of Indebtedness		
$25,000.00 1⅞% Due Oct. 1, 1952		$ 25,055.53
9,000.00 1⅞% Due Dec. 1, 1952		9,015.51
30,000.00 1⅞% Due Feb. 15, 1953		30,071.50
Accrued Interest		155.55
		$ 64,298.09
INVESTMENTS—Sinking Fund Int. Reserve Acct. 3939DB		
U. S. Treasury Ctf. of Indebtedness		
$824,000.00—1⅞% Due Dec. 1, 1952		$ 825,617.89
420,000.00—1⅞% Due Feb. 15, 1953		420,702.18
Accrued Interest		5,466.87
		$1,251,786.94

The Equitable Trust Company, Trustee, advised that they hold the following as Collateral Security for the deposit of funds shown above in the Equitable Trust Company:

$2,400,000.00 U. S. Treasury Bonds 2% Due Sept. 15, 1951/53, and the following for funds on deposit in the Farmers Bank of the State of Delaware.

$100,000.00 The State of Delaware, State Highway Imp. Bonds of 1949 Series A, 1.40% Due Dec. 1, 1957.

$50,000.00 The State of Delaware State Highway Imp. Bonds of 1949 1.40% Due April 1, 1963.

DELAWARE MEMORIAL BRIDGE
OFFICIAL TOLL SCHEDULE
SINGLE ONE WAY TRIP RATES

	No. of Axles	Total Cost
PASSENGER CARS (All Types)	2	.75
Including		
Light Delivery Trucks (Reg. Wt. 2 Tons or Less)		
Animal Drawn Vehicles		
Hearses (Except in Funeral Procession)		
Book of 20 Accommodation Tickets		15.00
TWO AXLE TRUCKS	2	1.00
Including		
All Types with Rg. Wt. Over 2 Tons		
Buses and Tractors		
Book of 20 Accommodation Tickets		20.00
THREE AXLE TRUCKS	3	1.50
Including		
Tractor or Combination Tractor and Trailer		
Passenger Cars with One Axle Trailer		
Buses (All Three Axle Types)		
Book of 20 Accommodation Tickets		30.00
FOUR AXLE TRUCKS	4	2.00
Including		
Tractor or Combination Tractor and Trailer		
Passenger Cars with Two Axle Trailer		
Book of 20 Accommodation Tickets		40.00
5-AXLE TRUCKS OR TRUCK COMBINATIONS	5	2.50
6-AXLE TRUCKS OR TRUCK COMBINATIONS	6	3.00
7-AXLE TRUCKS OR TRUCK COMBINATIONS	7	3.50
VEHICLES REQUIRING SPECIAL PERMIT	Variable	5.00
Including		
Contractors' Equipment and Machinery		
All Vehicles Exceeding One or More of the Limitations of Delaware Law		
NON REVENUE VEHICLES	Variable (Pass Required)	None
Including		
Bridge Maintenance, Funeral Processions, Ambulances, Fire & Police Vehicles		
COMMUTATION TICKETS		18.00
Book of 52 Tickets good for one Calendar Month Only, Issued to Passenger Cars **Only.**		

CONCLUSION

We are extremely proud of the results accomplished during the past year. These results are the end product of specific changes in policy and methods of operation, and have resulted in a high standard of performance and services to the public. Engineering and other personnel have been reassigned to positions for which they seemed best qualified. I feel that in each instance the changes have benefited Department operations and promoted a higher standard of morale among the employees.

The cooperation of the Department members in the recognition of the need for revised wage scales to approximate those of private industry has been instrumental in retaining a stable engineering organization. It seems important to relate that in these years of full employment the Department retained its engineering personnel without a single loss during fiscal 1952.

Throughout this report period considerable attention has been given to the matter of better public relations. Positive instructions were issued by this office to all personnel that contacts with the general public must be handled expeditiously, courteously, and particularly without favor. It is my firm belief that this policy has aided the improvement of relations between the Department and the general public. Every citizen contacting this office, either in person or by mail, has received the courtesy of a reply and, whenever possible, attention to his problem.

Respectfully submitted,

R. A. HABER,
Chief Engineer.