REPORT OF THE CHIEF ENGINEER

DELAWARE STATE HIGHWAY DEPARTMENT

July 1, 1950 to July 1, 1951

Dover, Delaware

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

Gentlemen:

This report of the activities of the Delaware State Highway Department for the fiscal year 1950-1951 covers a period of eight months which were under the administration of the former Chief Engineer, the late M. Allan Wilson, and four months under my administration. Mr. Wilson's death on February 23, 1951, was a distinct loss to his associates within the Department and to his friends in the State and the profession.

The present administration of the State Highway Department began with my appointment as Acting Chief Engineer on March 7, 1951. My appointment as Chief Engineer was effective June 1, 1951.

At this point I would like to acknowledge the assistance and full cooperation which I have received from the Division Heads and from other responsible personnel within the Department. I am particularly appreciative of the loyalty of the office staff during these difficult months of reorganization. I would also like to express my appreciation to Mr. J. A. Joslin, Administrative Assistant, for his work in the preparation of this report. The cooperation and consideration which have been shown me by the Chairman and the Members of the Delaware State Highway Commission have been without question the primary reason for the achievements which we have managed over these past four months. I have received in every instance the fullest con-

sideration from each Member of the Commission in solving the problems of reorganization. I also wish to acknowledge the contributions of Mr. J. F. Sullivan and Mr. William O. Comella of the U. S. Bureau of Public Roads. Their help has been much appreciated.

At the end of this report period the state highway system comprised 3,925 miles of highways, of which 1,015 miles are State Primary, 2,592 miles State Secondary and 318 miles urban extensions and private developments. 1,187 miles of these highways are surfaced with concrete or high type bituminous material, 1,888 miles have lower type bituminous or macadam surfaces and the remaining 850 miles have gravel or other earth type surfaces.

A conservative appraisal of our highway system with its network of roads and numerous bridges and structures would, based upon present day costs, total over 325 million dollars.

These figures tell in part the story of the huge plant that has been constructed to handle the traffic throughout the State since the birth of the Department in 1917.

Although we continue to enjoy wide recognition for our excellent highways we still are faced with deficiencies, many of which require immediate correction. A majority of our highways were designed for yesterday when traffic was not expected to reach its present volume for a number of years to come. Our roads were pounded by heavy wartime traffic and mistakenly considered expendable, consequently they deteriorated alarmingly. Now 52 million motor vehicles, half again as many as in 1941, are crowding the highways of the nation, and with the tremendous increase in miles traveled (450 billion miles in 1950) place further unpredictable demands on the highway agencies.

42% of this highway load is centered in the east coast section of the country and much of it is heavy interstate traffic. The midway location of Delaware, in the highly industrialized and densely populated east coast section of the nation, virtually fixes the State as the crossroads of the East. This will be further amplified within the next sixty days, when the Delaware Memorial Bridge will become operational.

This constantly expanding traffic with its increased weights and widths is depreciating our highways at a rate that far exceeds the rate of increase in funds the General

Assembly has been able to make available for the upkeep of our present roads and the construction of new ones.

The major influence in our lack of sufficient highway funds is, of course, the continually rising cost indexes. The highway dollar today is worth considerably less than what it was in 1941, and as a consequence, complex problems were created in the stretching of our funds throughout the State, particularly in the latter months of this report period. We realize many things were left undone as the basic needs of our highway system were all we could afford, however no section of the State was entirely ignored.

If we are to continue to enjoy the privilege of having good roads and streets under our cars, trucks, and busses, then the vehicle owners and users must be willing to share a more equitable portion of the highway costs than they are at this time. For every dollar the motorist spends for owning and operating his vehicle, he spends only a fraction over 6¢ for licenses and gasoline taxes. It should also be remembered that Delaware is one of the few states that does not impose taxes on real estate for the upkeep of its roads.

Each succeeding year the people depend more and more on the highway system in the pursuit of their livelihoods and other endeavors. Every legitimate means should be used to awaken the citizens that highways built to modern capacity and safety standards are the concern of everyone. Moreover, they should also be aware that State Government cannot meet this highway crisis unless the present antiquated tax structure is revised.

This question of highway financing is a subject of a nationwide study by the United States Bureau of Public Roads in conjunction with the states. An answer must be found in the near future if a free system of highways is to be maintained. Toll highways, bond financed, are an answer for the long-distance traveler between major cities but do not solve the problem of the commuter, the shopper, and the family group on a Sunday drive.

The construction needs which exist on the state highway system include improvements extending from low type bituminous surfaces for lighter traffic to concrete and asphaltic concrete for heavier traveled roads; the widening of important arteries to 4- and 6-lane divided pavements in accordance with the needs on each route, and the extension of the duals in the southern part of the State. Of our 3,925 miles of highways, 3,705 miles have only two traffic lanes and many miles of them are inadequate.

Many old bridges should be replaced and lack of additional bridges and railroad grade separations are causing much concern in the more densely populated areas of the State.

The rapid and continuing growth of northern New Castle County has placed a new and expensive burden on the Department with the inclusion of the streets in subdivisions. The added traffic load on older streets, which were not designed to carry the heavy vehicles using them to reach the new areas, has caused rapid deterioration.

The biennium ending with this fiscal year has proved to be an important but inconclusive phase of the Department's history. It was a period when, in spite of creditable construction and operational accomplishments, the needs of the state highway system continued to grow and the progress toward remedying these needs was slowed by the upsurge of costs and the short supply of steel and other materials.

The State administration and the Legislature have recognized this need for continued rehabilitation and expansion of the highway plant by passing bond issue legislation, in the session just closed, which gives the Department the largest construction budget in its history. A program for the improvement of the highway system in Delaware will be submitted to the Department at the July, 1951, meeting.

I wish to again express my appreciation for the help and for the many courtesies shown me by the Members of the Department over the past difficult months.

DIVISION OF PLANS AND DESIGN

Lester W. Novinger, Plans and Design Engineer

The responsibilities of the Division of Plans and Design begin immediately after a highway improvement program has been approved by the Members of the Department. Normally the work schedule will be in accordance with the priority established when the program was approved. This routine may be varied at times due to emergency work or knowledge of pending financial possibilities which would require emphasis for a certain type of work.

Comprehensive studies of many influencing factors must be made before specifications governing the geometric and general physical design of a project can be established.

Numerous field surveys must be made to obtain essential information concerning alignment, topography, drainage, soil types, public and private utilities and expected traffic volumes.

On Federal Aid Projects a step-by-step concurrence is obtained by frequent consultations with the District Engineer of the Public Roads Administration.

In addition to the regular construction program this Division prepares many miscellaneous plans, sketches and charts for the use of other Divisions of the Department. The Division is also responsible for the specifications and plans for the improvement of streets in suburban communities in conformance with the Suburban Road Act of 1945.

The following tabulations indicate the work accomplished for the fiscal year ending June 30, 1951.

Surveys

Base Lines	77.5	miles
Topography	77.5	miles
Preliminary Cross Section	71.0	miles
Final Cross Section	76.0	miles
Patch Survey	42.0	miles
Borrow Pits—Preliminary	43	(Number)
Borrow Pits—Final	39	(Number)

Plans

Base Line Plotted	77.5	miles
Topography Plotted	83.2	miles
Profiles Plotted & Traced	81.4	miles
Index Maps Plotted and Traced	70.6	miles
Plans Traced	83.7	miles
Cross Sections Plotted (Original)	71.0	miles
Cross Sections Plotted (Final)	76.0	miles
Grades Established	37.0	miles
Quantities Established	87.5	miles
Typical Sections	(Number) 90	
Miscellaneous Drawings	(Number) 145	

Blue Prints and Black and White Prints
25,500 Prints

Plans and specifications for the following projects were begun during the latter part of the fiscal year and will be advertised for bids early in the 1951-1952 fiscal year:

New Castle County

Contract 1073	Maryland Line to State Road

Kent County

Contract 1048.....Camden to Woodside
Contract 1075.....Felton to Woodside
Contract 1086.....Greenwood to Andrewsville

Sussex County

Contract 1068.....Stein Highway to County Road 557
Contract 1078.....Murray's Corner to Lewes
Contract 1155.....East Main Street Georgetown
Contract 1028.....Nylon Island Seaford
Contract 1103.....Bridge & Approaches Record Pond
Contract 1104....Bridge & Approaches Nanticoke River
Contract 1105....Bridge & Approaches Nanticoke River (North Fork)

It has not been possible to prepare a construction program for the next fiscal year because the funds to be made available to the Department have not been determined by the General Assembly. Preparations have been made, however, along the lines of known construction requirements from which a program may be set up when the funds are available.

FEDERAL AID AND ESTIMATING DIVISION

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

The work of this Division is concerned with the handling and processing of construction monies and the liaison between the Department and the U. S. Bureau of Public Roads relative to Federal participation in State projects.

Reiteration of the detail of this Division's functions in processing its work from initiation to completion is deemed unnecessary. The report is confined to the details of the major functions and end results.

Contracts

Unavoidable delays to the proposed construction notwithstanding, there were thirty-four contracts authorized for advertising. Advertising commenced in July 1950 and continued at intervals through June 1951.

CLASSIFICATION OF CONTRACTS

	ROADS			BRIDGES		MAINTENANCE CONTRACTS		SURFACE TREATMENT		MAINTENANCE MATERIALS		PEST CONTROL		FUELS
	No.	Miles	Total	No.	Total	No.	Total	No.	Total	No.	Total	No.	Total	No.
F.A. Primary	4	18.416	$2,641,132.19	..										
F.A. Secondary	1	9.624	$ 159,499.50	1	$222,120.00									
State Projects	2	2.374	$ 297,862.50	2	$733,748.75	2	$63,818.00	3	$399,890.00	10	$173,778.70	2	$18,605.00	*7
TOTALS	7	30.414	$3,098,494.19	3	$955,868.75	2	$63,818.00	3	$399,890.00	10**	$173,778.70	2	$18,605.00	*7

*Indicated as to Number of Contracts Only.

**No Bids Received — Contract 1134 — Creo. Timber.

NOTE: Eight subdivision contracts and thirty-five contracts for mechanical and automotive equipment were also processed in this Division.

F.A. — Federal Aid.

A total of ninety-nine bids were received on the classified projects. These bids were carefully checked and tabulated and mimeographed copies of the tabulations were distributed to those interested.

Contracts for the period required the preparation and assembly of two thousand two hundred proposal forms for bidding and departmental uses.

At the beginning of the fiscal year there were thirty-three contracts active. This number gradually decreased through completion to eighteen at the close of the fiscal year. The active projects required the processing of one hundred eighty-six periodic estimates, representing payment of $5,371,570.23. Federal Funds applicable to this expenditure were in the amount of $2,361,466.81.

Unobligated balances in the construction account were in the amount of $530,053.48 as of June 30, 1951. Accounts receivable from Federal Aid on current projects on that date were $842,617.61.

Federal Aid

Processing of Federal Aid projects during the year indicated a vigorous program of construction to be undertaken in the early part of the coming fiscal year. It should be stated, however, that the processing was not confined to Federal Aid projects alone. Projects in process involving expenditure of State funds only were in the majority. Federal participating projects were only seven in number, however, they were very major projects.

Fifty-two reimbursement vouchers were prepared and presented for payment on current and completed projects. The value of these vouchers was $2,077,113.43. Reimbursements to June 30, 1951, totalled $2,042,524.39.

The status of Federal Funds as of June 30 indicates an unprogrammed balance of $2,272,640.75, which are classified as Primary, $1,010,733.96; Secondary, $574,007.51; Urban, $687,859.28. Funds for the next biennium have not as yet been allocated. All Federal Funds bearing due date of June 30, 1951, have been expended or are obligated to projects for construction.

BRIDGE DESIGN DIVISION

Joe S. Robinson, Bridge Engineer

The preparation of plans and specifications for the construction, reconstruction or repair of bridges, culverts,

drainage facilities and railroad crossings are the main functions of this Division. Centered in the Dover headquarters of the Department is a pool of competent designers and engineers who are available at all times for the solving of the many complex problems in structural design and road drainage which constantly arise in all sections of the State.

Periodic inspection of highway structures are made by engineers of the division. To avoid neglecting bridges, culverts, and other highway structures, this Division maintains a complete inventory of such facilities in which each of them is fully described.

During this report period 11 contracts were awarded that required major participation by the Bridge Design Division. A brief summary of the work performed by this Division on these projects is indicated in the following tabulation.

CONTRACTS AWARDED JULY 1, 1950 - JUNE 30, 1951

Contract Number	Location	Date of Award	Bridges, Culverts, Storm Water Drainage, Drainage Under Crossovers
1072	Middletown to Odessa	7/10/50	528 L. F. of storm sewer in Odessa 323 L.F. of storm sewer in Middletown 7 R.C.P. Culverts 2 box Culverts
1079	Silver Lake Road	7/10/50	Constructed: Addition 7'-7" R.C. Span 2 R.C.P. Culverts
425	Leipsic Bridge & Approaches	8/1/50	546'-4" I-Beam with Concrete Deck Bridge & Drainage
1067	Susan Beach's Cor. to Portsville	8/3/50	Constructed: 31'-8" Timber Bridge, 78 L.F. Corr. Metal Twin Pipe Arch, 2 Twin R.C.P. Culverts, 15 R.C.P. Culverts
880	Philadelphia Pike (33rd St. to Bellevue Road)	9/11/50	Constructed: 38 L.F. of Rubble Masonry Ret. Wall; 87'-10" Bridge Sidewalk; 2263 L.F. of storm sewer
			Under Construction: 1047 L.F. of Storm Sewer; Adjustments & Addings to present storm sewer system
1050	Kenton to Pleasanton's Garage		Constructed: Addition to 12'-0" R.C. Span & to R.C.P. Culvert, Repair of 16 R.C.P. Culverts (Additions)
913	Dover By-Pass	11/8/50	Constructed: 7759 L.F. of storm sewer 5'x5'x165' 2-Cell concrete box culvert, 9 R.C.P. Culverts, Completed Plans & Spec. Prov. for St. Jones River Bridge Under Construction: Drainage under 6 crossovers

CONTRACTS AWARDED JULY 1, 1950 - JUNE 30, 1951—(Continued)

Contract Number	Location	Date of Award	Bridges, Culverts, Storm Water Drainage, Drainage Under Crossovers
1007	Jacobs School to 1 Mile S. of Greenwood	12/6/50	Constructed: Bridge 21'-4" R.C. Span (151'-8" long) Bridge addition of 18'-0" R.C. Span (Add 58'-1" & 6'-5") 829 L.F. of storm sewer, 8 R.C.P. Culvert Under Construction: Drainage under 16 crossovers
1082	Brandywine River Crossing	2/8/51	Plans prepared by consultants
924	Brown's Church to Jacob's School	5/15/51	Constructed: 84'-7" Additions to present 5'-0" R.C. Span Under Construction: 5 R.C.P. Culverts Drainage under 8 crossovers
1032	River Front Bridge Repairs	5/24/51	Reconstruction of bridge floor over bascule leaves. New fender system, 56'-11" of steel bulkhead specifications for repair work including painting of complete bridge

In addition to the contracts let this year, 18 contracts held over from the prevous fiscal year continued to require the attention of the Division. In the latter months of the period a number of new projects were in preparation for award, the most important of which were the designing of the three twin bridges on the proposed dual extension of U.S. 13 in the vicinity of Seaford and Laurel. Two of these bridges will span the north and south forks of the Nanticoke River and the other will afford a crossing at Records Pond. These plans and specifications were about 60% complete at the end of this report period.

Another important future project on which considerable design work was performed by this Division is the Carpenter's Station Bridge which will provide a more modern crossing for Naaman's Road over the Baltimore and Ohio Railroad, in upper New Castle County. Plans for this project were 65% complete at the end of the period.

Considerable design work has been performed by this Division on the Maryland Avenue and Concord Pike highway construction projects and has progressed to the extent that the contracts should be ready for award early in the next fiscal period. Both of these are major projects which upon completion will be of great benefit to the residents of New Castle County.

Brief summaries outlining the work performed on the more important active projects of the year are as follows.

Leipsic Bridge

This bridge is located in Kent County and affords a crossing for State Route 9 over the Leipsic River. The main spans are of continuous steel stringer construction with a reinforced concrete slab deck on pre-cast concrete pile bent piers. The work performed by this Division includes a revision of the original plans and specifications that had been nearly completed during the previous report period and numerous field inspections during construction. Actual construction was started on September 8, 1950, and at the end of this report period the work was approximately 15% complete.

St. Jones River Bridge

This bridge carries the Dover By-Pass over the St. Jones River in Kent County. It has a continuous reinforced concrete girder superstructure supported by reinforced con-

crete piers and abutments on cast-in-place concrete piles. Construction was begun December 14, 1950. This Division designed and prepared the contract plans and specifications and estimates and provided inspections during construction. The project was approximately 28% complete at the end of this report period.

Barley Mill Bridge

This bridge carries Barley Mill Road over Red Clay Creek in New Castle County. It is constructed of continuous steel stringers with a reinforced concrete deck slab on concrete piers and abutments. This Division provided field and final inspections and the project was completed on October 4, 1950.

Charles W. Cullen Bridge

This bridge is located on Route 14 in Sussex County and spans the Indian River Inlet. Construction was started May 8, 1950, and completed June 9, 1951. The plans and specifications for the replacement of the south end of this bridge, destroyed by a storm in 1948, were prepared by consultants and the field construction inspections were made by engineers of this Division.

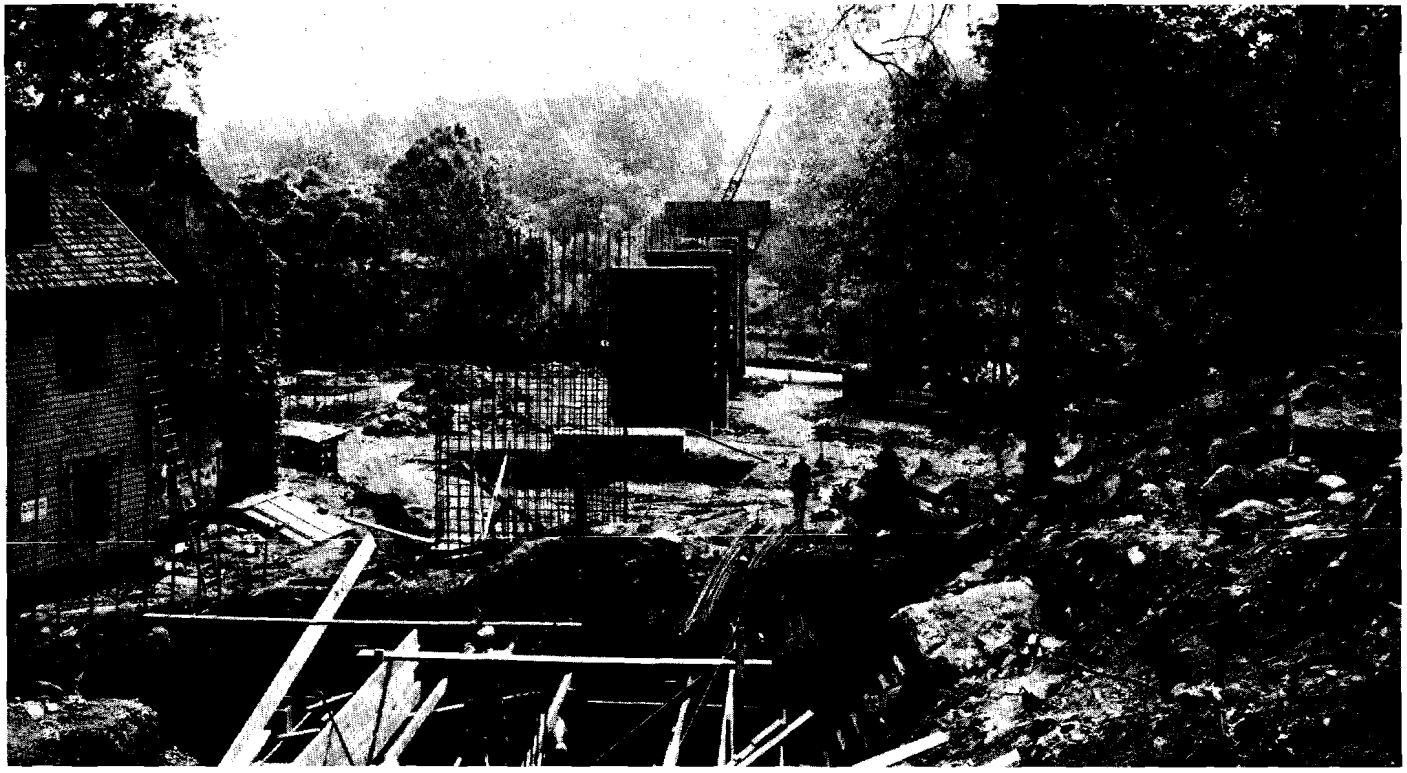
New Castle Avenue Overpass

The New Castle Avenue Overpass is a part of the approach system to the Delaware Memorial Bridge. Although this bridge was designed by consultants and constructed under the supervision of the Delaware River Crossing Division, the Bridge Division provided field inspection. The overpass was approximately 90% complete at the end of this report period.

Seaford Bridge Reflooring

Although the contract for reflooring this bridge was awarded in June of the previous report period, work was not started until February 27, 1951, due to the contractor's inability to procure necessary open mesh steel grid flooring. Field inspections were made by members of this Division and the project was 99% complete at the end of this report period.

CHARLES W. CULLEN BRIDGE SPANNING INDIAN RIVER INLET AFTER REPLACEMENT OF SOUTH END, WORK COMPLETED JUNE 9, 1951.



BRANDYWINE RIVER BRIDGE — CONSTRUCTION STARTED MARCH 14, 1951
WEST ABUTMENT JUNE 30, 1951

Third Street Bridge

Third Street Bridge is one of the three important bridges in the Wilmington area as it carries U.S. 13 over the Christiana River. The repairs necessary to keep this bridge in service were started May 24, 1951. During the fiscal year the Bridge Division revised the plans and specifications for the proposed repairs to the bridge and were responsible for the supervision of the work.

Brandywine River Bridge

Due to the changed traffic conditions this bridge is being rebuilt at a new site. It was designed by consultants and construction is being supervised by the Bridge Division. Construction was started March 14, 1951, and was approximately 6% complete at the end of this report period.

Farnhurst Interchange Bridges

These three grade separation bridges are a part of the interchange between U.S. 13 and the western approach to the Delaware Memorial Bridge at Farnhurst in New Castle County. This project was designed by consultants and construction was started on July 12, 1950, under the supervision of the Delaware Crossing Division. During construction field inspections were made by this Division. The project was approximately 70% complete at the end of this report period.

Storm Damage and Shore Protection

During the fiscal year a number of investigations, reports, and recommendations were made by this Division of the storm damages to our coast line and protective installations. The most severe storm of the year occurred on November 25, 1950, when much damage was inflicted on the shore line particularly in New Castle County. These damages include the washing out of the road and sluiceway between Port Penn and Delaware City, the destruction of the sluiceway at Augustine Beach, the washing out of the dyke and damage to the sluiceway at Dobbinsville, the flattening of the coast line dunes at Henlopen Acres and Indian River Inlet.

The General Assembly, during the 1951 session, appropriated funds and enacted legislation directing the State Highway Department to make repairs to certain of the dam-

aged areas in New Castle County. The repairs to the dunes along the Atlantic Ocean were made by the maintenance forces of the Department.

At the end of the report period plans and specifications were well under way in this Division for the repairs to the damaged areas.

Bridge Repairs and Maintenance

Under the supervision and frequent inspection of engineers of this Division considerable maintenance work and repairs were performed on numerous bridges throughout the State. One of the most noteworthy examples was the repairs to the bridge over the Assawoman Canal on State Route 26 in Sussex County. For some time this bridge had been posted for a 6-ton load and it was, therefore, necessary to detour military equipment and other loads in excess of this posted load. After the placement of stiffening diaphragms between the steel stringers and the installation of a new treated timber floor by our Sussex County maintenance forces the load limit on this bridge was increased to 20 tons with permissible crossings by the heavier military loads when necessary.

Although some progress has been made in the replacement of the floors on a few of our moveable spans with modern type flooring, many other bridge floors should be considered for replacement as soon as steel allocations are eased. This modern type of flooring is urgently needed for the Milford, Lewes, Broadkill, and Church Street Bridges.

Recommendations

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

Augustine Bridge (Wilmington)—Painting

Seventh Street Bridge (Wilmington)—Painting and Repairs

Milford Bridge (Kent County)—Reflooring

Broadkill Bridge (Sussex County)—Reflooring

Lewes Bridge (Sussex County)—Reflooring

Church Street Bridge (Wilmington)—Reflooring and Sidewalk Repairs

Taylor's Bridge (New Castle County)—Replacement

Little Creek Bridge (Kent County)—Replacement

Lebanon Bridge (Kent County)—Replacement

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

The need for replacement of several of the above-listed bridges is primarily due to neglect in the painting of the steel members in the superstructure. With these as examples, it is strongly urged that additional funds be made available for painting and other maintenance work on bridges throughout the State.

DIVISION OF TESTS

Ernest A. Davidson, Testing Engineer

It is the function of the Division of Tests to inspect and test all materials used by the Highway Department in its construction and maintenance of roads and bridges, to test other materials used by the Department in its various activities, and to determine their suitability for use as established by the specifications.

The Division's activities, however, cover a much wider range than this in that it assists in the preparation of specifications for construction, maintains a materials consulting service for the Plans and Design Division and for construction personnel, and provides the field control for many of the materials placed during construction. It also conducts research activities within the limits of time and personnel available.

This fiscal year the volume of the inspection, testing, and research continued at about the same pace as for the previous year, with the number of certain types of tests being in keeping with the nature of the projects which the Department had undertaken. No small part of the Division's work was in connection with the construction of the Delaware River Memorial Bridge and its approaches. This work placed heavy demands on personnel engaged in concrete and soils inspection. With deadlines set for completion of projects and because of the volumes involved, work often continued late at night or through the weekends. This work very often had to be scheduled in addition to

routine construction projects undertaken by the Department.

The research work conducted made considerable headway with some findings indicating a need for modification of specifications. Considerable investigation was performed to determine the relative stability of various hot mix designs. The effect of drying and curing time was investigated for soils. Results of these tests have already been included in the specifications for current construction and it is expected that they will result in more satisfactory construction methods for bases and subbases of pavement. An investigation has been started to establish a correlaton between data obtained from foundation borings made under "standard" conditions and the length, type, and bearing capacity of piles for bridge foundations. It is hoped information can be obtained which will permit more accurate interpretation of foundation conditions for design purposes. The need for continued research along the many lines of the Department's activities cannot be overemphasized.

Of prime importance among the activities of the Division of Tests are its routine reports which record the progress and quality of all projects, and the specifications which incorporate their findings to assure that the best material and equipment are secured. Also of importance and contributing to success in testing and research is the continuous contact maintained with other testing and research organizations, societies, and other state highway departments. Through the Division's contact with The American Society of Testing Materials, The American Association of Highway Officials, The American Road Builders' Association, The American Concrete Institute and The American Wood-Preservers' Association, the Division of Tests is kept abreast of the latest methods and ideas.

Testing and inspection during this fiscal year was conducted for some 58 projects. In the course of inspecting and testing the materials and processes used in these projects and in the Department's increased maintenance activities, the Division of Tests performed countless investigations to insure a product of the highest quality and best workmanship. In addition to those tests made for highway materials, assistance was given to other divisions in their efforts to control quality of materials used. Typical examples are: oil used in mosquito control work, gasoline and oil used by the Department, and automotive equipment for the Motor Vehicle Division.

SOILS LABORATORY

Joseph L. Petroski, Soils Engineer

An engineering structure, whether it be of massive and romantic proportions, like a dam or skyscraper, or of less spectacular proportions, like a bridge or highway can be no better than the materials of which it is composed or the foundation upon which it rests. It is with this latter, the foundations upon which bridges and roads rest, that our Soils Laboratory is primarily concerned. Investigations of these conditions vary considerably in their characteristics. The least complex tests consist of a superficial investigation as to the type of soils involved. The more complicated tests may have to do with predicting the load capacity of soil strata many feet below the surface, or predicting the magnitude of settlement which will occur under given loading conditions, and predicting the time required for this settlement to take place. Other investigations performed by the Soils Laboratory include: subsurface water conditions: how they affect pavements and corrections that can be made; roadway subgrade exploration: how various types of earth can be expected to perform under the multitude of weather and temperature conditions that occur throughout the life of the project, and what corrective measures must be taken to minimize adverse factors; borrow pit exploration: to find material having the strength and other characteristics needed in the requirements of corrective materials.

The largest single activity of the Laboratory is the identification and classification of soils for use in highway construction. Once soils have been classified their behavior under various conditions can be predicted with considerable accuracy. This does not mean that the work of the Soils Engineer has been completed. It is only a tool by which he is aided in the interpretation of the data obtained.

Worthy of special mention this year is the increase in deep boring information obtained in connection with bridge foundation work. Boring contracts, with inspectors furnished by the Soils Laboratory, were let for the St. Jones River Bridge, the Records Pond Bridge, the Nanticoke River Bridge, and the North Fork Nanticoke River Bridge. These projects involved approximately 3,000 linear feet of deep borings. From interpretation of the information obtained, it was possible to predict to within 2 feet the length of piling required for the St. Jones River Bridge and to reduce the amount of bridging involved for the other projects above-named by over 50%. These are but examples

of the value that can be obtained from satisfactory foundation information.

Throughout the year 10 other foundation investigations of lesser magnitude were made ranging in nature from small bridges and culverts to foundation conditions for buildings to be constructed for the National Guard.

The Soils Laboratory has continued its intensified research for selected borrow pits. During this year a total of 72 proposed pits have been drilled and tested. Of these 16 have been recommended for purchase by the Department or approved for use by the contractor. While the number of pits recommended for use is somewhat greater percentagewise than in former years, our cost analysis records show that we are still having to devote too large a percentage of our time and effort in locating suitable selected borrow sources. We believe this is caused by the present outmoded hand method of drilling and that the greatest consideration should be given to obtaining suitable mechanical drilling machinery.

The Soils Laboratory also provides adequate laboratory and field control to insure that proper compaction and placing of soils is obtained. Two men from the Laboratory devoted their full time to this inspection service, and over 187,000 cubic yards of selected borrow and approximately 95,000 cubic yards of common borrow, in addition to all excavation, were tested and inspected to insure that specification density requirements had been fulfilled. To insure adequate densities 692 field control densities were made.

In providing a consulting service to the Plans and Design Division, the Soils Laboratory made sub-grade surveys for approximately 23 miles of road. For larger projects this consists of actually mapping and preparing a profile of the soils encountered. From interpretation of these surveys road grades may be altered and provisions made in design to take advantage of the better soils or to make necessary corrections. It is in these surveys that unfavorable ground water conditions are first discovered, proper corrective methods can then be provided for in advance of actual construction.

Of increasing magnitude this last year has been the work done for the Suburban Development Division. The Soils Laboratory was called upon to make certain physical examinations to determine if minimum street requirements had been met by the developers for the acceptance of their

streets into the highway system. The greatly increased number of developments under consideration has led to considerable time being expended on these projects by soils laboratory personnel.

The major contributions of the Soils Laboratory are the furnishing and interpretation of data which will permit the avoidance of costly mistakes, and the promotion of a better understanding of soil and foundation conditions both of which will lead to lower over-all costs and more durable highways. In carrying out this work the Soils Laboratory conducted over 4,200 analysis and classification tests, 77 various types of strength tests, 4 major subsurface drainage and water control investigations, and a great number of assorted tests and investigations which in one way or another have contributed to our understanding of the many factors involved in the building of better highways and structures.

Materials Laboratory

J. Paul Martin, Materials Engineer

The policy of sampling and testing materials at the source of supply has been continued by the Laboratory without delay to the contractor in spite of the difficulties involved in training new personnel and the distances encountered in performing the sampling. Three men have been employed almost constantly at the three central mix concrete plants in the Wilmington area. At least one and often two men have been required for coarse aggregates at their source of supply in Pennsylvania and Maryland. Although the desired practice of placing three men at each of the hot mix plants has not always been obtained, especially when four plants were in operation, we have endeavored to do so at every opportunity. Cement, coarse and fine aggregates, asphalts, concrete pipe, lumber, piling, and steel have been inspected and preliminary tests made before shipments of these materials were released.

The following tabulation shows the number of individual laboratory quality control tests conducted during the past fiscal year:

Type Material	Number of Tests	Type Material	Number of Tests
Sand	332	Water	13
Cement	41	Stone	1,811
Gravel	221	Slag	220
Concrete Cylinders	2,476	Brick	10
Concrete Beams	284	Asphalt	350
Concrete Pipe	88	Creosote Oil	5
Galvanizing	5	Motor Oil	5
Gasoline	7	Concrete Cores	348
Bituminous Concrete	398	Specific Gravity	181
pH Measurements	14	Asphalt Adhesion Tests	18

In addition to the above tests, investigations have been carried on by Materials Laboratory personnel whenever time and men were available in the continuing endeavor to improve the quality of end products. During this fiscal year an investigation to determine the effects of certain gravels on the durability and strength of concrete has been completed. A study to determine the stability of various hot mix asphaltic concrete designs as determined by the triaxial compression method of testing has been undertaken. It is anticipated that among other values received this series of tests will permit us to make a satisfactory design for placing hot mix asphaltic concrete at heavily traveled intersections.

The Materials Laboratory has played a vital role in the selection and use of materials employed in the construction and maintenance of Delaware's Highway System. During the past fiscal year it has tested and inspected the following approximate quantities of materials:

MATERIALS	QUANTITY REPRESENTED
Cement	111,000 bbls.
Bituminous Concrete	95,168 tons
Asphalt	1,437,264 gallons
Concrete Pipe	71,635 lineal feet
Lumber	237,084 bmf.
Piling	15,532 lineal feet
Guard Rail Posts	3,082 each
Coarse Aggregate	208,228 tons
Fine Aggregate	27,503 tons
Reinforcing Steel	1,532,076 lbs.
Structural Steel	3,301,240 lbs.
Central Mix Concrete	59,856 cubic yards

TRAFFIC AND PLANNING DIVISION

William J. Miller, Traffic and Planning Engineer

The diversified activities of the Traffic and Planning Division are herein recorded for the 1950-1951 fiscal year.

Road Inventory

The end of the fiscal year found the State Highway Department with a network of 3,925.62 miles of roads and streets in its several systems. Table I shows this latest information by mileages of streets and highways by surface type by county.

Table II shows the existing highway mileages for the Federal Aid Primary and Secondary Systems, which indicate the mileage eligible for Federal Aid participation for construction purposes.

At the end of this fiscal year, another inventory of all roads in the State was underway. This 1951 survey will bring up to date the information previously acquired in 1941, particularly with regard to the number and location of residences and businesses along our highways.

TABLE I

MILEAGE OF STREETS AND HIGHWAYS BY SURFACE TYPE BY COUNTY

Delaware 4/11/51

SURFACE TYPE	NEW CASTLE	KENT	SUSSEX	TOTALS
Concrete	144.71	175.09	238.34	558.14
Bituminous Concrete	128.34	35.14	106.35	269.83
Brick	.82	.51	.05	1.38
Belgian Block	.55	.04	—	.59
Bituminous Penetration	169.77	4.66	48.73	223.16
Dual Type	33.58	52.98	42.25	128.81
Combination Type	1.71	—	3.34	5.05
TOTAL PAVED	479.48	268.42	439.06	1,186.96
Sand Asphalt	4.91	.40	15.78	21.09
Bituminous Surface Treated	207.19	166.97	307.66	681.82
Other Low Type Bituminous	54.52	6.40	5.30	66.22
Gravel or Stone	31.55	108.90	27.19	167.64
Soil Surfaced	140.94	413.62	396.91	951.47
TOTAL SURFACED	439.11	696.29	752.84	1,888.24
Graded and Drained Earth	13.24	74.13	630.51	717.88
Unimproved	14.85	5.31	28.48	48.64
Primitive	.38	2.18	19.65	22.21
TOTAL UNSURFACED	28.47	81.62	678.64	788.73
TOTAL TWO AND FOUR LANED HIGHWAYS	947.06	1,046.33	1,870.54	3,863.93

DIVIDED HIGHWAYS

Concrete	15.22	4.17	.71	20.10
Bituminous Concrete	9.71	.28	—	9.99
Brick	—	—	.03	.03
Dual Type	25.54	6.03	.—	31.57
TOTAL DIVIDED HIGHWAYS	50.47	10.48	.74	61.69
TOTAL ALL TYPES	997.53	1,056.81	1,871.28	3,925.62

TABLE II

MILEAGE OF STREETS AND HIGHWAYS BY SYSTEM CLASSIFICATION BY COUNTY

Primary F.A.P.	172.33	121.58	209.69	503.60
Secondary F.A.S.	306.13	309.93	607.35	1,223.41
Tertiary	519.07	625.30	1,054.24	2,198.61
TOTAL	997.53	1,056.81	1,871.28	3,925.62

Traffic

Table III shows the results of the traffic statistics compiled at four of the Automatic Counter Stations which have been in constant operation since 1940. The fiscal year 1950-1951 indicates a 15.21% increase in traffic over 1949-1950 at the same stations. During this fiscal year there was an increase of 53.67% over that of ten years ago.

In addition to the information shown in this table, traffic volume data has been collected for each rural road in the State. On an annual continuing basis, traffic volume counts are made on each road in the State. This up-to-date traffic information is available to any interested individual as well as to various divisions in the Department. The data provides a basic tool for use in the preparation of highway construction programs and is an influencing factor in the design of new or reconstructed facilities.

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

Month	AVERAGE DAILY TRAFFIC 1941 1942	1949 1950	1950 1951	PERCENT CHANGE 1949-50 1941-42	1949-50 1950-51
July	22,721	25,389	30,505	+ 34.26	+20.15
August	22,328	24,349	30,463	+ 36.43	+25.11
September	19,902	23,589	26,169	+ 31.49	+10.94
October	17,491	22,554	24,634	+ 40.84	+ 9.22
November	17,056	20,759	23,225	+ 36.17	+11.88
December	16,174	18,841	23,053	+ 42.53	+22.36
January	13,421	18,062	20,952	+ 56.11	+16.00
February	13,736	19,304	21,559	+ 56.95	+11.68
March	14,062	20,642	23,363	+ 66.14	+13.18
April	15,583	23,502	25,584	+ 64.18	+ 8.86
May	14,744	23,721	28,717	+ 94.77	+21.06
June	13,810	27,427	30,696	+122.27	+11.92
TOTAL	201,028	268,139	308,920	+ 53.67	+15.21

Road Inventory of Incorporated Towns

For the first time in the history of the State, an accurate survey has been completed which shows the number of street miles in each incorporated town in Delaware. This survey was started in 1949-1950 and completed during the past fiscal year.

Table IV shows by counties, the 1950 population figures for each town, the total street mileage and the mileage maintained by the State Highway Department.

TABLE IV

INCORPORATED TOWNS OF DELAWARE SHOWING STREET MILEAGE IN 1950

Towns	1950 Population	Maintained by State Highway Department	Maintained by Town or City	Total
KENT COUNTY				
Bowers Beach	284	1.38	.73	2.11
Camden	606	1.87	1.79	3.66
Cheswold	292	.90	.44	1.34
Clayton	825	2.59	4.25	6.84
Dover	6,223	8.59	24.96	33.55
Farmington	113	.67	.20	.87
Felton	455	1.05	2.68	3.73
Frederica	675	1.83	1.62	3.45
Harrington	2,241	3.89	11.56	15.45
Hartly	139	.98	.05	1.03
Houston	332	2.15	1.46	3.61
Kenton	211	1.05	.75	1.80
Leipsic	253	1.49	.82	2.31
Little Creek	266	.84	.04	.88
Magnolia	207	1.01	.13	1.14
Milford	5,179	10.91	27.61	38.52
Smyrna	2,346	2.38	9.15	11.53
Viola	134	1.30	.41	1.71
Woodside	157	1.20	.37	1.57
Wyoming	911	2.66	2.78	5.44
TOTAL		48.74	91.80	140.54

NEW CASTLE COUNTY				
Bellefonte	1,472	5.28	.29	5.57
Delaware City	1,363	.84	5.71	6.55
Elsmere	5,314	2.50	8.58	11.08
Middletown	1,755	1.43	5.59	7.02
New Castle	5,396	5.44	11.80	17.24
Newark	6,731	1.17	15.64	16.81
Newport	1,171	.86	3.69	4.55
Odessa	467	2.46	1.62	4.08
Townsend	441	.89	1.65	2.54
Wilmington	110,356	21.01	152.98	173.99
TOTAL		41.88	207.55	249.43
SUSSEX COUNTY				
Bethany Beach	190	2.98	3.35	6.33
Bethel	271	1.19	1.30	2.49
Blades	789	1.30	3.06	4.36
Bridgeville	1,468	3.33	6.22	9.55
Dagsboro	474	4.57	.66	5.23
Delmar	1,015	2.03	4.48	6.51
Ellendale	321	.77	3.24	4.01
Frankford	615	2.78	1.84	4.62
Georgetown	1,923	2.13	12.32	14.45
Greenwood	746	1.87	3.83	5.70
Laurel	2,700	4.49	9.41	13.90
Lewes	2,904	6.33	15.06	21.39
Millsboro	470	1.76	3.95	5.71
Millville	270	3.38	.00	3.38
Milton	1,321	2.83	6.15	8.98
Ocean View	450	4.72	1.77	6.49
Rehoboth	1,794	3.40	14.46	17.86
Seaford	3,087	2.48	14.28	16.76
Selbyville	1,086	2.07	4.87	6.94
Slaughter Beach	85	1.73	.00	1.73
TOTAL		56.14	110.25	166.39
STATE				
GRAND TOTAL		146.76	409.60	556.36

Mapping

The mapping of the incorporated towns of the State was started in the previous fiscal year and has now been

completed. This project was in cooperation with the Bureau of Public Roads. The maps have been published in booklet form and individual sheets and are available to the public for a reasonable fee.

During this report period work was started on a State General Highway Map which will be the first wall map of this type prepared by the State Highway Department. The entire highway system by road type will be indicated. The road net will be in black and the drainage facilities in blue. In addition to the latitude and longitude coordinates, the official Delaware State grid, which is the transverse Mercator system, will be superimposed on the map. The scale of this map will be approximately 1" = 2 miles.

At the end of this period this map was essentially completed and is expected to be available for distribution in the early part of the next fiscal year.

A new tourist edition of the official highway map of the State was also near completion at the end of the report period. This map will contain more new features than any tourist map ever presented by the Department and will include the use of color photographs and colered line work.

Loadometer Survey

Using the scales located at the various State Police Stations, the yearly Loadometer survey was made as a part of the highway planning survey conducted in cooperation with the U. S. Bureau of Public Roads. During this past fiscal year the extent of this survey was expanded in order to assist in a nation-wide study, the purpose of which will be to determine the type and extend of pavement failures traceable to heavy vehicle loads. In addition to the weighing, measuring, and counting trucks on the roads, certain test sections have been designated throughout the State which will be inspected periodically and a report prepared showing any structural changes which may have occurred. The data prepared in Delaware will be consolidated with that of other states by the U. S. Bureau of Public Roads. As a further step, speed checks of the various vehicle types are being prepared in connection with this survey. The new radar type speedmeter acquired by the Department this fiscal year is being used for this purpose.

Petitions

During the past year, this Division investigated 74 petitions presented to the Department for improvements

or alterations to roads and bridges within the State. This represents an increase of 15 petitions over the 1950 fiscal year and 50 over the 1949 fiscal year. Each petition required traffic volume statistics and investigation of conditions at the location, a field visit with the Division Engineer concerned, sketches of the roads involved, and compilation of the information in report form. The data obtained from these petitions serves to advise the Department of the wishes of the citizens of the State, and the results obtained from the survey work enables the Department to evaluate each request on its merits.

Reports For Overloaded or Oversized Vehicles

This is the second year that permits to road and trucking contractors were issued from this office for overloaded or oversized trucks. The explanatory manual and new forms which were prepared during the past fiscal year are now in constant use and have proved quite satisfactory.

During the past fiscal year, the following number of permits were issued:

30-Day Piling Permits 445½ @ $10.00 each	$4,455.00
Single Trip Piling Permits 271 @ $2.00 each	542.00
House Moving 14 @ $2.00	28.00
Overweight Heavy Machinery 556 Permits	3,772.74
Oversize Only 657 @ $2.00 each	1,314.00
Total	$10,111.74

One hundred permits were issued gratis to the Kent County Conservation District for the moving of their heavy equipment through the county. Twenty-five permits were issued gratis to the Armed Forces for the movement of heavy equipment, each movement being escorted by State Police.

In connection with the issuance of permits for overloaded or oversized vehicles, special credit is due to the Delaware State Police for their cooperation and to the mem-

bers of the Bridge Division who assisted in the routing where bridges crossing problems were encountered.

Accident Reports

The arrangement by which the Traffic and Planning Division is provided a copy of each accident report by the State Police has been continued. A spot map recording the location of each accident and a cross index locator file were invaluable in our analysis work. At the end of each calendar year, color slides are prepared of the spot maps for future comparative purposes. This historical record has proved very useful in design work.

Wilmington Transportation Study

In February, 1948, the State Highway Department, in conjunction with the U. S. Bureau of Public Roads, and with the cooperation of the Mayor and Council of Wilmington, the Levy Court of New Castle County, and various lay leaders within this area, conducted a comprehensive transportation study of the Wilmington Metropolitan Area. Following the compilation of the basic information collected from the Wilmington Transportation Study, reports were issued in 1949 and 1950 showing the results.

To supplement these reports, the State Highway Department engaged the firm of Parsons, Brinckerhoff, Hall, and MacDonald of New York City to prepare an Arterial Route Analysis and General Plan for Route A as proposed in the State Highway Department reports. The report was completed by the consulting engineers and presented to the Department in December, 1950, at which time it was approved in principle.

Inasmuch as a major portion of the route, as proposed by the consulting engineers and as approved in principle by the Department, would extend through the incorporated City of Wilmington, it is necessary under the Laws of Delaware for the Mayor and Council of Wilmington to approve the route as suggested and to cooperate in making it a reality. Considerable opposition to the proposed route developed after the General Plan was announced and the continuation of the work necessary to construct this highway has been deferred.

Connecting Highways Between the Delaware Memorial Bridge and the Maryland Line Near Warwick

During the fiscal year 1950-1951, a report was prepared for the State Highway Department by the Knappen, Tip-

petts, Abbett Engineering Company of New York City to survey conditions in New Castle County in the vicinity of the Delaware Memorial Bridge and to investigate and report on the following items:

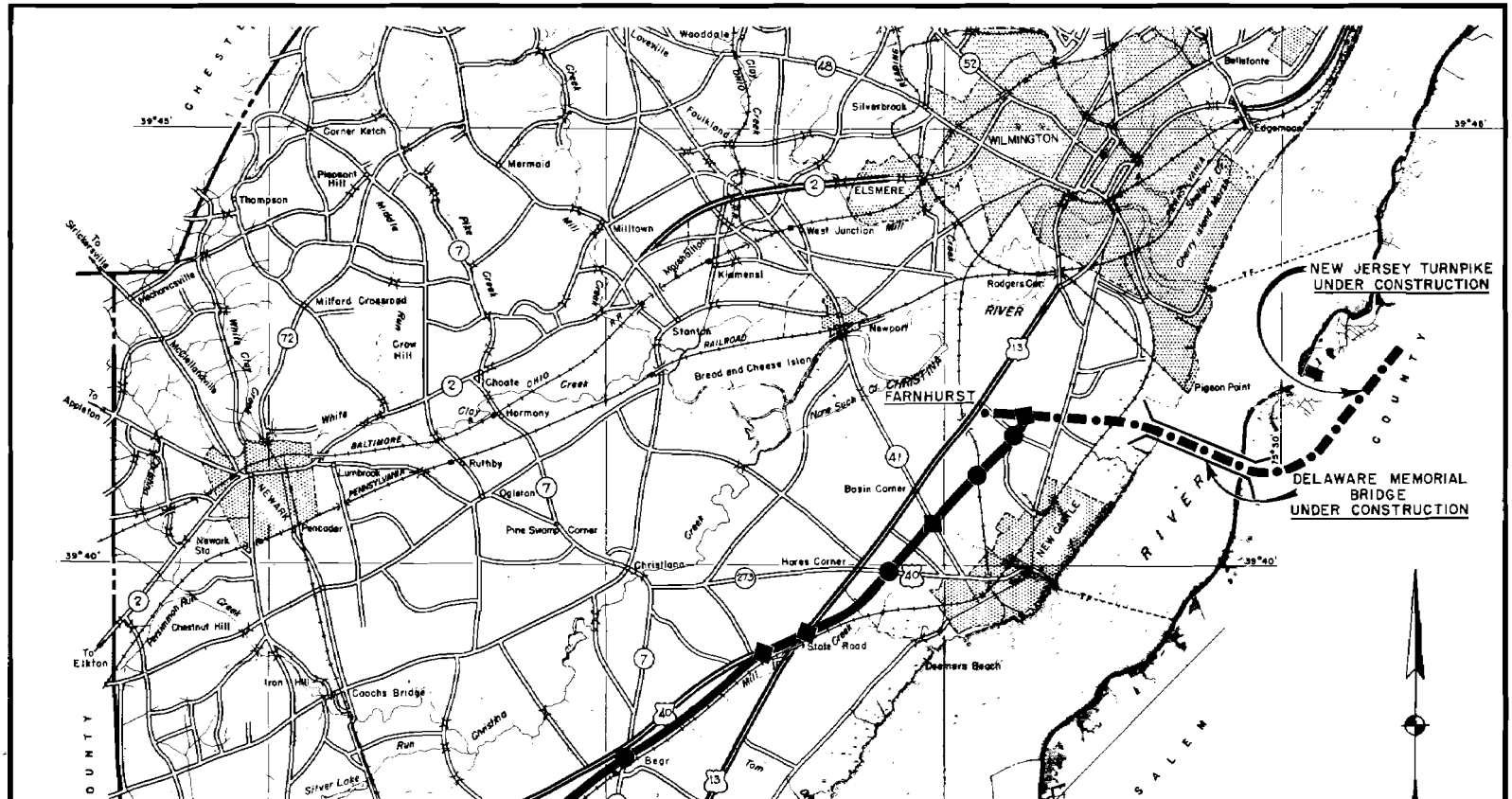
1. Probable traffic volumes expected to use a facility between the Delaware Memorial Bridge and the Maryland Line near Warwick,
2. The best location for a route to handle this expected volume,
3. Any alternate locations for this route,
4. The geometrics of design necessary for this route,
5. The type of right-of-way control considered necessary, and
6. The estimated costs of the recommended and alternate routes.

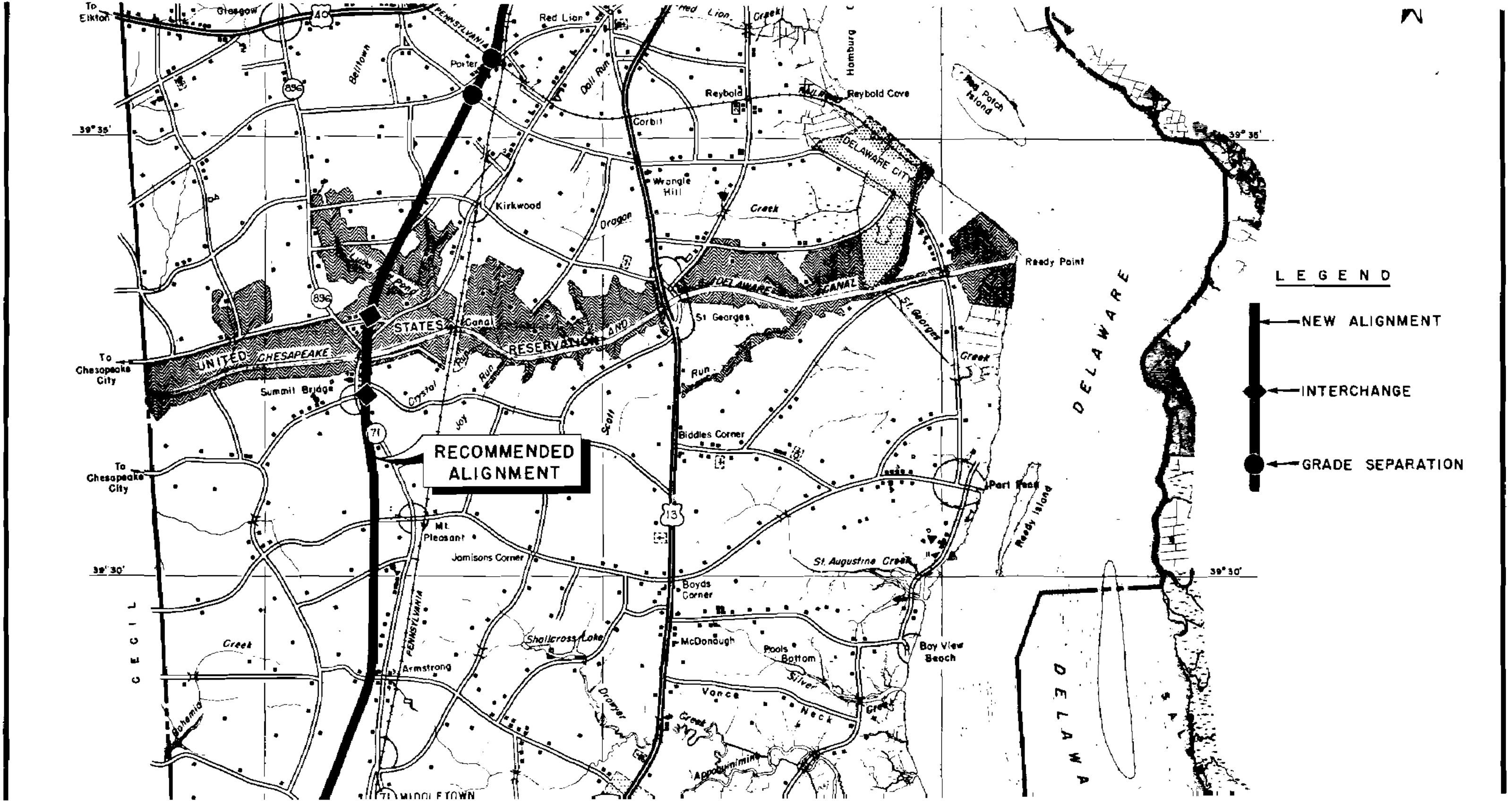
In December, 1950, a very comprehensive report was submitted to the Department by the consultants. The report includes an extensive traffic analysis of the whole area, the value of access control for new highways, factors to be considered in the location of highway routes, studies of various alignments which could connect the Delaware Memorial Bridge and the Maryland Line near Warwick, economic justification for the routes studied, and finally, recommendations for a proposed connection. Plate I shows the line which was recommended to the Department.

After a thorough study of the report the Department approved in principle its contents. For the purpose of continuing this project to a reality special legislation was requested of the 1951 General Assembly. This legislation was not approved.

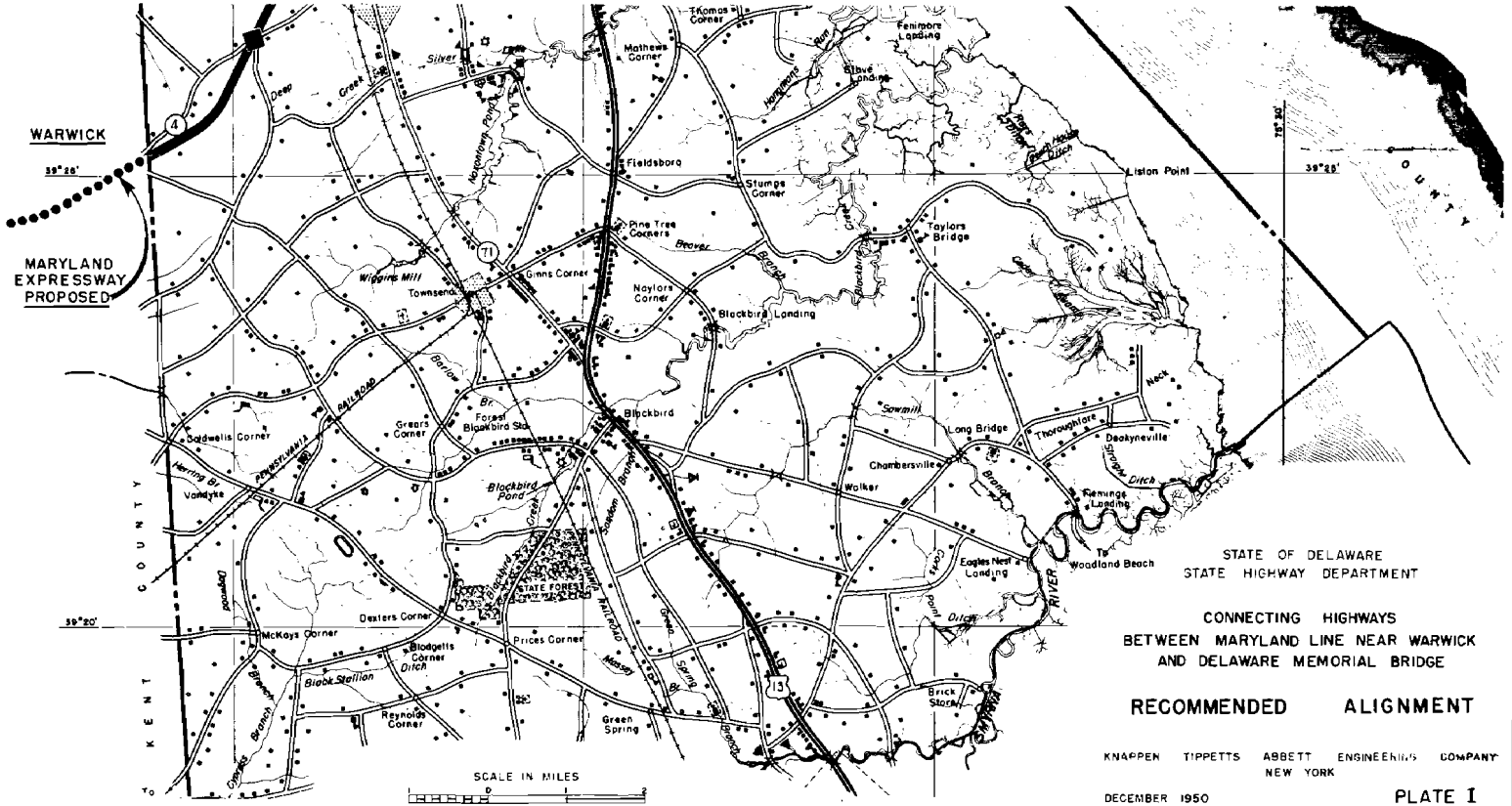
Traffic Engineering Studies

The ever-increasing traffic volumes on our highways which were mentioned earlier in this report and often discussed in previous reports continue to emphasize the need for more traffic engineering studies. There is no doubt that good results are being obtained throughout the State as a result of the continuous effort to assist in moving motorists and commodities safely on our streets and highways. Among the towns which were assisted during the past fiscal year were Wilmington, Elsmere, Camden, Magnolia, Kenton,


NEW JERSEY TURNPIKE
UNDER CONSTRUCTION
DELAWARE MEMORIAL
BRIDGE
UNDER CONSTRUCTION
WILMINGTON
ELSMERE
NEWARK
FARNHURST
Corner Ketch
Pleasant Hill
Thompson
Mermaid
Milltown
West Junction
Kirkwood
Stanton
Newport
Rodgers Cor.
Edgemoor
Bellefonte
Silverbrook
Loveville
Woodside
Milford Crossroad
Crow Hill
Choate
Hormony
Ruthby
Lumbrook
Pencader
Newark Sta.
Oglesby
Pine Swamp Corner
Christiana
Hares Corner
Basin Corner
Bread and Cheese Island
Pigeon Point
Chestnut Hill
Iron Hill
Coochs Bridge
Silver Lake
Bear
State Road
Deemers Beach
Odessa
To Stricklersville
To Appleton
To Elkton
CHESTER COUNTY
NEW CASTLE COUNTY
SALEM
RIVER
39°45'
39°40'
39°48'
25°30'



To Elkton
Glasgow
40
Pennsylvania
Red Lion
Red Lion Creek
Hamburg
Porter
Belltown
896
Dall Run
Reybold
Reybold Cove
Pea Patch Island
Corbit
39° 35'
Delaware City
Wrangle Hill
Kirkwood
Dragon Creek
Reedy Point
United States Chesapeake and Delaware Canal Reservation
Canal
St. Georges
St. Georges Creek
To Chesapeake City
Summit Bridge
Crystal Run
Joy Run
Scott Run
Biddles Corner
71
RECOMMENDED ALIGNMENT
Port Penn
Reedy Island
13
Mt. Pleasant
Jamisons Corner
St. Augustine Creek
39° 30'
Boyds Corner
McDonough
Pools Bottom
Silver
Bay View Beach
Shallcross Lake
Creek
Armstrong
Vance Neck
Drawyer Creek
Bohemia
CECIL
Appoquinimink
MIDDLETOWN
DELAWARE
LEGEND
NEW ALIGNMENT
INTERCHANGE
GRADE SEPARATION



STATE OF DELAWARE
STATE HIGHWAY DEPARTMENT

CONNECTING HIGHWAYS
BETWEEN MARYLAND LINE NEAR WARWICK
AND DELAWARE MEMORIAL BRIDGE

RECOMMENDED ALIGNMENT

KNAPPEN TIPPETTS ABBETT ENGINEERING COMPANY
NEW YORK

DECEMBER 1950

PLATE I

PLATE I

Wyoming, Newark, Milton, Rehoboth Beach, Newport, Bridgeville, Delmar, Greenwood, Smyrna, and New Castle. In addition to the incorporated towns, many unincorporated areas, particularly in New Castle County, have had traffic engineering assistance.

The traffic engineering work included accident analysis, detour routings, traffic signalizations, and studies of speed zoning, highway lighting, parking, channelization, school crossings, crossover relocations and pavement markings.

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 Bulletins, Annual State Mileage Tables, Annual Report for the Delaware Safety Council, Annual Tables on Highway Department Income and Expenditures, Traffic Paint Testing Reports, and other types of statistical information.

RIGHT OF WAY DIVISION

H. Fleming Hart, Right of Way Engineer

The principal function of the Right of Way Division is the acquisition of land for highway purposes. This involves the examination of land titles and the preparation, execution, and recording of documents. The Division is also responsible for maintaining up-to-date records of the lands and buildings in the custody of the Department by reason of right of way purchases, and initiating recommendations for the sale of excess properties.

For this fiscal period, Right of Way costs made very heavy demands on the funds of the Department. These demands were more related to the excessive value placed upon the lands involved than to the number of parcels acquired. These excessive values can be directly attributed to several large condemnation awards in New Castle and Kent Counties, the affects of which exerted an ultra-inflationary influence on right of way costs throughout the State.

Certain condemnation awards against the State were very high and in some instances apparently biased, the awards being granted in complete disregard of the expert testimony submitted. It is presumed that the condemna-

tion laws, revised and amended by the 1951 General Assembly will assure fairer and more equitable settlements in future condemnation hearings.

The activities of the Right of Way Division are indicated by the following tabulation:

Options obtained	318
Trespass Agreements executed	57
Drainage Agreements executed	76
Slope Easements	56
Deeds executed	366
Mortgage Releases executed	130
Judgment Releases executed	16
Descriptions written	354
Condemnations heard	18
Condemnation appeals	8
Plats prepared	29
Parcels State land sold	9
Auction Sale Buildings	13
Borrow Pits purchased	8
Total Expenditures	$605,330

SUBURBAN DEVELOPMENTS DIVISION

Chauncey O. Simpson, Suburban Development Engineer

The Suburban Development Division is charged with the entire supervision and direction of the duties and responsibilities imposed upon the State Highway Department by the Laws of Delaware relating to the acceptance for maintenance of certain streets and roads within unincorporated suburban communities that have been dedicated for public use.

The following is a tabulation of the street and road mileages which were incorporated into the State highway system during the fiscal year.

Contract	Development	Mileage
Owner	Alapocas	1.939
SD-32	Delaview Avenue	0.397
Owner	Cooper Farm	0.990
Owner	Claymont Heights	0.235
Owner	Fairfax Farms	0.106
Owner	Gordy Estates	1.702
Owner	Kynlyn Apartments	0.920
Owner	Leedom Estates	0.686
SD-22	McDaniel Crest	0.217
Owner	McDaniel Crest	0.918
Owner	Manor Park Apartments	0.714
Owner	Monroe Park Apartments	1.028
Residents	North Seaford Heights	0.148
Owner	Wilmington Manor Gardens	3.367
Developer	Wilmington Manor	0.105
SD-28	Woodcrest	0.169
SD-29	Woodcrest	0.160
	Total Mileage Accepted	13.801

5.687 miles of streets in 4 suburban developments were rejected for the reason they failed to meet Department specifications.

42.128 miles of streets in 66 suburban communities or developments were under investigation and inspection at the close of this fiscal period. It is expected that these streets will be ready for acceptance within the next fiscal year.

Since the close of World War II, 41 miles of suburban streets have been accepted for maintenance by the Department, and of this mileage more than half were accepted during the biennium ending with this report period.

Considering the number of suburban projects active at the end of this period and the many new developments under construction and in the planning stage, it seems safe to anticipate that an additional 60 miles or more will be added during the next fiscal year to our already extended maintenance repsonsibilities.

Legislation passed by the 1951 General Assembly authorizes the Department to require a bond of the developer thereby insuring closer adherence to the Highway Department specifications.

MOSQUITO CONTROL DIVISION

Frank D. Cannon, Mosquito Control Engineer

Although the control of mosquitoes can be termed as successful this fiscal year, it is believed that an even greater success would have resulted if the air spraying schedule had been extended until later in the Fall.

A decided advantage is gained in any year if spraying is continued into the late Fall, thereby destroying the adult mosquitoes present, and thus eliminating the eggs they would lay during the first warm days of early Spring.

During the year this Division was contacted by representatives of the Fish and Wildlife Service for information on the number of times various marshes are sprayed and the amount of spray material used. The purpose of this inquiry was to check possible harm to fish, crabs and other marine life. Their findings will probably be known and reported on in the next fiscal year. It is the feeling of this Division that our rate of spray, .2 pounds of DDT per acre, will in no way injure or otherwise affect the marine life which inhabits the bays and rivers around which we spray. With regard to this problem many men have been consulted who fished and crabbed long before spraying was instituted and they state that they have not noted any greater number of dead wildlife now than before. Incorrect assumptions have been made that spraying is harmful to marine life in the Rehoboth Bay section. At the time these complaints were received that location had not been sprayed at all.

Complaints similar to that mentioned above are very few and offer no problem as the majority of the people realize the advantages gained by a pest-free vacation area. However, the complaints regarding muskrats fall into a different class. This year two marsh owners prohibited us from spraying their marshes, therefore small acreages of marshland that actually needed treating remained untouched. Even though the acreage is small it should be pointed out that these marshes can breed enough mosquitoes to become a problem in the nearby populated areas.

Recent studies in cooperation with the University of Delaware disproved these complaints which because of widespread publicity have been difficult to combat.

The funds available for this fiscal year amounted to $107,120.00 which included the regular appropriation of

$75,000.00 plus $3,620 representing unspent funds of the previous fiscal year and $28,500 allocated from the Emergency Fund for the purchase of urgently needed new equipment and supplies.

Of the total funds available $105,757.97 was expended, details of which are tabulated below:

	Expenditures	%
Salaries and Wages	$ 44,433.69	42.00
Office Expense	678.21	.64
Travel	498.65	.47
Operations	43,346.14	41.00
Repairs & Replacements	3,567.81	3.40
Equipment	10,904.57	10.29
Permanent Improvement	2,328.90	2.20
Total	$105,757.97	100.00

Operational expenses include airspraying, fuel oil, DDT and other normal operating expenses and also includes the amount allocated to the University of Delaware for research in connection with the Mosquito Control program.

The purchase of new equipment was made possible by the additional funds received from the Emergency Fund. This extra money assured better results and a more efficient program for the latter part of this fiscal year. The equipment that was purchased included:

One 1-ton jeep pickup with four-wheel drive. This vehicle has made possible the inspection of marshes that heretofore could only be reached on foot or by tractor. It is also equipped with hitch and vacuum brakes for pulling the new tilt-top trailer.

One 1500-gallon tank equipped with pump and meter for delivery of spray oil to the planes.

One 10-ton tilt-top trailer. Before this purchase the Division had only a homemade four-wheel trailer without brakes, which could be pulled only with difficulty through some of the marsh roads when loaded with heavy equipment.

One Ware loader and bucket. This was attached to the Oliver HG 68 cletrac already on hand.

On order for delivery next year is a scavel plow for attachment to the Ware loader. This requires one tractor and one operator and will replace our present homemade ditch cleaner. The homemade ditch cleaner requires two tractors to pull it and four men to operate it. With the new one there will be a saving in manpower and it will do more ditching in a much shorter period of time.

Under permanent improvements, materials and equipment have been purchased for a 30′ x 32′ building to accommodate a car lift for greasing. This building is being constructed by Division forces and will replace the old outside grease rack that we have had for maintenance of our mobile equipment.

A normal year's work can be divided into two phases: Summer and Winter. We have a hand ditching crew which operates the year round, but the machine crew and construction crew are used on these jobs only during the winter months. During the summer these men are used in various summer operations connected with the spray program.

The hand cleaning crew this fiscal year cleaned 567,262 linear feet of ditches. The following records the cost and the number of manhours to do the above footage.

Month	Man-Hours	Total Cost	Linear Feet	Cost Per Foot
July	1,752	$ 1,404.30	56,170	.024
August	1,799	1,846.72	77,235	.025
September	1,394	1,448.62	49,220	.033
October	1,533	1,612.33	31,589	.051
November	1,399	1,454.08	55,150	.026
December	1,127	1,276.36	23,808	.054
January	1,491	1,556.36	38,010	.040
February	1,307	1,351.12	53,525	.025
March	1,409	1,457.65	44,050	.033
April	1,333	1,369.81	44,525	.030
May	1,246	1,282.25	38,100	.033
June	1,542	1,577.20	55,883	.029
Totals	17,332	$17,636.80	567,262	.032

The machine cleaning was done entirely with the previously mentioned homemade cleaner. This crew worked

certain months and a breakdown of the amount of ditch cleaning done in this way is as follows:

Month	Man-Hours	Total Cost	Linear Feet	Cost Per Foot
October	152	$ 168.48	26,680	.006
November	265	293.24	23,830	.018
December	49	54.52	5,400	.010
February	32	34.25	7,700	.004
March	50	54.76	5,500	.009
April	404	444.40	70,420	.006
Totals	952	$1,049.64	141,530	.007

This year we were not able to do much work with our machine ditcher because of its obsolescence. Repair parts were practically non-obtainable and almost everything had to be improvised in our own shop. It is for this reason that we are anxious to put our new ditch cleaner in operation in the coming year.

Our final winter operation is done by the carpenter or construction crew. Under this classification we list work such as repairs or construction of outlet boxes and culverts, repairs in camp, grading, filling of holes, etc.

This year the following work was accomplished:

Month	Man-Hours	Project
Aug.-Sept.	178	Filling in holes between Rehoboth and Fort Miles caused by ocean breaking through.
Nov.	266	Repair outlet box at Oak Orchard and Dewey Beach. Install culvert at Long Neck. Repair camp garage.
Dec.	28	Repair camp buildings.
Mar.	52	Install culvert at Russell's.
May	388	Install new outlet box and culvert at Cripple Creek. Install new outlet box at Dewey Beach. Put in foundation for new building at camp.

Our main summer operation is airspraying. The most important items that affect the breeding of mosquitoes are

the amount of rainfall and the temperatures that are encountered during the summer months. Of equal importance is the role played by tides during that season of the year. Even though rainfall can be below normal some freak of nature can cause abnormal high tides during the summer which keep the marshes flooded and in an ideal condition for breeding. During the breeding months of this year our average rainfall and temperature was as follows:

Month	Rainfall	Temperature
July 1950	3.18 inches	75°
August	2.94 "	69°
September	5.12 "	64°
October	.82 "	58°
May 1951	3.41 "	62°
June	5.11 "	69°

For our aerial spraying program the division has approximately 18,000 acres mapped out with 15,000 acres being in Sussex County and 3,000 acres in New Castle County around the Governor Bacon Health Center. During this fiscal year a total of 100,818 acres were sprayed as follows: July to September 1950, 76,818 acres and during June 1951, 24,000 acres. The cost per acre was 19¢ in 1950 and 17¾¢ in 1951.

The greatest benefit from the aerial spraying in Sussex County is received by Rehoboth, Lewes, Bethany Beach and those communities that are on the Rehoboth and Indian River Bays. In New Castle County the work is centered in and around Delaware City.

This year marked the first full year that the Mosquito Control Division had the advantage of an entomologist working with it on a full-time basis. Dr. R. F. Darsie accepted this position and the benefits derived from the agreement cannot be overemphasized. The Entomology Department of the University of Delaware carries on research by way of experiments, provides advice, and counts and identifies all mosquitoes caught in our mosquito traps.

The chief experiment finished this year was designed to find new insecticides that could possibly replace DDT if immunity is found here. The full results of this test can be found in Publication 236 and Scientific Article 158 of the

Department of Entomology, February 15, 1951. The overall results were as follows: (1) Q-137 (0.1 pound per acre) and dieldrin (0.05 pound per acre) appear to be effective against Aedes sollicitans larvae, when applied to salt-marsh area by airplane. (2) Considering all known factors, Q-137 and dieldrin, at the stated rates, gave about the same control as DDT at 0.2 pound per acre. It would seem therefore, that Q-137 is twice and dieldrin four times as toxic as DDT. (3) Second and third instar larvae are killed more readily by Q-137 and dieldrin than those in the fourth instar.

In the early part of the fiscal year there were in operation thirteen of the New Jersey type light traps. These traps were located throughout the State and were watched by private individuals who consented to give their time. The most prevalent species of mosquitoes caught were Culex salinarius at Delaware City, Aedes sollicitans in the Rehoboth-Lewes area, and Mansonia perturbans around Cedar Swamp.

In the latter part of this fiscal year, dredging of the Indian River and Indian River Bay was well under way. Mud and water from this operation are being piped into marshes bordering these bodies of water and when the mud dries and cracks begin to appear we will be confronted with a serious mosquito-breeding situation.

MAINTENANCE

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

The state highway system has to be maintained and operated as well as built. These duties must be performed from the time a road or structure is completed and opened to traffic, and they must continue as long as the facilities are in use.

At this time the Department is responsible for nearly 4,000 miles of primary and secondary roads. Exclusive of street maintenance crews in Wilmington and other incorporated towns, the State Highway Department is the only public road construction and maintenance organization in the State. In addition to the rural portions of the highway system, the Department is responsible for the maintenance of all city streets on our primary systems and numerous other streets which form urban extensions of the secondary system.

The cost of maintaining the highways has always been a prime consideration of the Department. Attention has been more sharply focused on this item in recent years because of:

(1) A substantial increase in labor, equipment and material costs,

(2) Funds provided have not kept pace with needs,

(3) The public has demanded better highway maintenance due to rapidly increasing usage of and dependence upon all types of motor transportation, and

(4) Failure of new construction to keep pace with obsolescence resulting in an increased maintenance burden on an inadequate highway system which must in some manner take care of present day needs.

Road maintenance operations are carried on throughout the State according to specifications laid down by the Department and under the direction of the Chief Engineer. These operations are given general supervision by the Division Engineers of New Castle, Kent, and Sussex Counties. The maintenance of riding surfaces continues to be the major item of work in the field divisions.

The appropriated funds for maintenance are allocated by the Chief Engineer and each Division Engineer is charged with the responsibility of budgeting his allocated funds to cover the operations in his respective county.

One of the most complex problems that has burdened the Division Engineer this fiscal year was that of stretching the allocated maintenance funds equitably throughout his county. Economic conditions necessitated this step and to stay within the Division budget, it had to be done.

On a state-wide basis the situation was ably met and although some deficiencies existed at the end of the period, no section of the State was left without maintenance services.

In this stretching of funds the farmers' roads were not forgotten. Good rural roads have widened the horizons of farm families and increased their opportunities. The Department has recognized this fact and, notwithstanding the limited funds, has reached into every rural community

and by surface treatment, blading, grading and ditch cleaning, has endeavored to keep these roads in an all-year-round serviceable condition.

The increase in maintenance expenditures is partly a consequence of rising costs. It is also accounted for by other reasons, principally the deterioration of highways during the war, the inability to replace wornout highways as rapidly as would be desirable, and the tremendous increase in the number of heavy vehicles.

Under these conditions the top problem of the Department has been the holding of the maintenance line. In the main, our counterattack has taken two directions. First, we are seeking to improve methods of making repairs and reduce labor costs by the more effective use of machinery. Second, through better coordination of location, design and construction practices, we have sought to build highways that will cost less to maintain in the years to come, even though this might involve somewhat greater initial expense.

It is pointed out that many miles of streets and roads of suburban communities have been accepted into the highway system since 1945, without provision being made in the biennium appropriations for maintaining them.

By the end of the next fiscal year, it is expected that the streets accepted for maintenance since the War will total over 100 miles. This is a considerable additional responsibility, one that should be considered for special attention when submitting the budget for the next biennium.

For the reason that a number of these streets are of light construction and that they have since become thoroughfares, it is not economical to maintain them; they should be entirely reconstructed.

New and adequate specifications and regulations governing the future acceptance of suburban streets for maintenance are being prepared and will become effective at the beginning of the next fiscal period. These revised specifications and regulations will insure the Department against the acceptance of suburban streets or roads that are too lightly constructed to stand up under the traffic that can be expected to use them.

Storm Damage

New Castle County

On November 24 and 25, 1950, a heavy storm accompanied with abnormal tides caused considerable damage to highway facilities throughout the State.

The heaviest damage occurred in New Castle and Sussex Counties. In New Castle County the three most important bridges in the Wilmington Area were closed to traffic for over eight hours. The South Market Street Bridge was ordered out of service when water flooded the main motor room and the counterweight pits. This bridge was closed until the next receding tide by which time the pits were pumped out and emergency repairs made to the motor room machinery.

The counterweight pits of the Third Street Bridge were also flooded by this high tide. The prompt assistance of the Wilmington Fire Department in pumping the water from the pits enabled the restoration of the north leaf in the evening of November 25. The south leaf was restored to service at noon of the following day.

In like manner the Newport Bridge was affected by this abnormal tide. The water flooded the counterweight pit and covered all leaf operating machinery including the two 10 HP electric drive motors and the 3 HP sump pump motor. The span remained out of commission until one of the 10 HP motors could be dismounted and baked out. The bridge was temporarily restored to service the next day, operating on one motor only. The second 10 HP motor was not restored until December 18, 1950. The services of the Minquas Fire Company of Newport are gratefully acknowledged for their assistance in pumping the flood waters from the counterweight pits of this bridge.

Other damages in New Castle County included the destruction of large sections of the River Road and the sluiceways and tide gates between Port Penn and Delaware City; the destruction of the sluiceway at Augustine Beach, and the washing out of the dyke and sluiceway at Dobbinsville.

A number of other roads in New Castle County received damage extending from shoulder washouts to the upheaval of entire slab sections.

Sections of River Road and the tide gates and sluiceways along the Delaware River in New Castle County were practically destroyed, the damage being so extensive that repair by the maintenance forces was impossible.

For reason that all available construction funds were previously obligated for other essential highway projects, the reconstruction of these destroyed facilities will be delayed until the next fiscal year, the cost of which will be defrayed from special appropriations. Plans and specifica-

tions were started in March and were about 90% complete at the end of this fiscal year. All other damages to the highway system in this County were repaired by the maintenance forces.

Kent County

The most extensive highway damage in Kent County was experienced at Mahon's Road. Large sections of the surface treatment were lifted off the subbase and washed into nearby marshes. By Monday, November 27, the entire road had been graveled and opened to traffic.

The causeways at Leipsic, Woodland Beach, and Flemings Landing were under water until Sunday, November 26, when the tide receded, allowing repairs and resumption of traffic.

The settlements of Kitts Hummock, Bowers, and South Bowers were completely isolated. During the height of the storm, much assistance was rendered by Department employees in evacuating residents from inundated farm properties. The roads serving these sections were not too severely damaged but the slow recession of the waters delayed the repairs for several days.

Most of the roads in the shore areas received some damage but taken as a whole, the damage in Kent County did not approach that suffered in the other two Counties.

Preventive measures taken during the height of the storm, such as the prompt assignment of men and equipment to remove fallen trees and other debris and the cutting of road hips to allow free passage of the flood waters, had much to do with keeping the damage to a minimum.

Sussex County

The violence of this storm was felt along the entire coast line of Sussex County, from Slaughter Beach to Fenwick Island. The natural sand dune barriers were breached in many places and north of Indian River Inlet heavy seas washed out nearly one-quarter mile of the Rehoboth-Fenwick Island highway.

Near Henlopen Acres there were three break-throughs totaling 1,100 feet. The force of the winds and waves dispersed the sand dunes over a wide area, extending inland across and beyond the ocean road north of Rehoboth Beach.

Only a relatively small portion of this dispersed sand was salvageable.

In the Indian River area a section of dunes of approximately 500 feet was washed out. It was in this section that the Rehoboth-Fenwick Island road was damaged.

In addition to the damage to shoreline installations, a number of roads in other sections of the County sustained shoulder and surface treatment washouts. Although time consuming, these repairs did not present too great a problem.

Within thirty days all repairs were completed without recourse to outside assistance with the exception of the renting of several pieces of equipment used in the replacement of the protective shoreline sand dunes.

Snow Removal and Ice Control

The Winter season of this report period compared favorably with that of the previous period, in that we were not confronted with the removal of blizzard-type snows. We did have, however. a number of sleet storms which, although of short duration, required the usual sanding operations throughout the State. In most cases these storms occurred after normal working hours. This partly accounts for the increase in this operation over that of the previous period.

The following tabulation indicates the snow removal and ice control expenditures for the last ten fiscal periods:

Fiscal Yr.	New Castle	Kent	Sussex	Total
1941-1942	$ 11,011.16	$ 6,787.65	$ 5,298.91	$ 23,097.72
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
Totals	$331,450.23	$77,673.49	$84,517.29	$493,641.01

Traffic Service

The highway maintenance forces have a wide range of responsibilities pertaining to the manufacture, installa-

tion and upkeep of signs, signals, and pavement markings. Each succeeding year places greater emphasis on these responsibilities and this year has been no exception. As the traffic on our highways continues to increase so does the need for more signals, signs, and pavement markings.

The increase in costs for the performance of this function is paralleled by the increased importance in expediting traffic over the state highway system in an orderly and safe manner.

The installation of traffic-actuated lights at important intersections continues to be an item of major expense.

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

Fiscal Yr.	New Castle	Kent	Sussex	Total
1941-1942	$ 39,887.41	$ 12,009.78	$ 6,377.53	$ 58,274.72
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	53,510.88
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
Totals	$512,598.49	$191,432.93	$163,384.76	$867,416.18

Roadside Maintenance

Keeping the entire right-of-way neat and trim is a very important duty of the maintenance forces. This is not merely a matter of aesthetics although a sightly, pleasant setting for the road is one of the objectives of this work. Cleaning the ditches improves drainage of the road. Mowing the grass and eradicating weeds guards against danger from fire and smoke. The care and trimming and removal of trees protects traffic from storm damage, removes obstructions to safe sight distances and in some places creates a natural snow fence.

Although there are State laws prohibiting the throwing of paper and refuse on the rights-of-way of our highways, this continues to be a nuisance that requires the constant attention of cleanup crews. This is so noticeable along the

parkways that regular schedules are maintained for the removal of this debris.

Another irksome violation of the law is that of motorists crossing the grassed sections of the parkways. Ample crossovers are provided but a number of motorists persist in ignoring them. During this period the cost of repairing the damage caused by these unauthorized crossings approached nearly 10 thousand dollars. This is an expense that is entirely unnecessary and one that the law enforcement authorities are helping eradicate.

* * * * * *

Maintenance costs for this fiscal year are detailed in the report of the Secretary.

CONSTRUCTION

As long as increased vehicle mileage, registrations, weights and widths continue to impose added burdens on our highways, so will the construction and reconstruction needs of the system continue to accumulate. It is now evident that these needs so far exceed the financial resources of the Department as to make it very difficult to organize orderly programs to meet them, and doubly hard to follow such programming. This was the case during this period when it was frequently necessary to select projects on the basis of urgent need.

The Department's construction activities during the fiscal period were shaped by three basic conditions. The first and most important was the condition of the highway system in relation to the requirements of deterioration and growing traffic volumes. The second was that the construction funds, even though supplemented by a $9,000,000 bond issue, were still insufficient to carry out the program scheduled for the biennium. The third was that the backlog of plans which had been made ready during the preceding years were largely depleted by successive contract lettings in the 1950 fiscal year.

With the exception of steel, the supply of basically essential materials continued fair mainly because of the close proximity of Delaware to the sources of supply in Pennsylvania and Maryland. Labor shortages, particularly as to cement finishers and equipment operators, greatly affected the contractors and for this reason slowed the progress on a number of projects. Bid prices continued high this fiscal year and it is expected that the competition for skilled con-

struction labor will be reflected in subsequent contract awards.

In spite of these and other handicapping factors, a creditable construction effort was accomplished during this period. We should not gauge our construction performance by the number of contracts let, as a truer picture of our activities is reflected in the number of projects active during the period.

Thirty-three contracts with an unfinished value of $5,015,311 were carried over from the previous year and 12 construction contracts with a bid value of $4,118,178 were awarded during the year, making a total of 45 construction contracts active during the year with a value of $9,133,489.

The overall construction performance for the period amounted to $5,163,266. Of the 45 contracts active during the period, 25 contracts were completed and 20 contracts with an unfinished value of $3,970,223 were carried over for completion in the next fiscal year.

A detailed analysis of the construction activities for the period appears below; the status of each contract being indicated in dollars and by percentages.

TABULATION OF ACTIVE CONSTRUCTION CONTRACTS

July 1, 1950 - July 1, 1951

Contract Number	Fed. Aid %	Location	Active Beginning 1951 F/Y Remaining $ Value	%	Awarded During 1951 F/Y Award Amount	Month	Constructed During 1951 F/Y $ Value	%	Active End 1951 F/Y $ Value	%
425	40	Leipsic Bridge	.....	..	222,120	July 1950	83,929	38	138,191	62
765	100	Elsmere Overhead	119,665	11	.....	.....	119,665	11	.....	..
791	40	Wilmington Avenue	45,004	29	.....	.....	45,004	29	.....	..
815	40	Seaford to Atlanta	157,691	100	.....	.....	157,691	100	.....	..
816	40	Blackiston to Clayton	154,662	100	.....	.....	53,487	35	101,175	65
880	40	Phila. Pike (30th St.)	.....	..	428,556	Sept. 1950	64,947	16	363,609	84
913	47	Dover By-Pass	.....	..	1,198,169	Nov. 1950	309,553	26	888,616	74
924	St	Brown's Church-Jacob's	.....	..	283,224	June 1951	.....	..	283,224	100
962	40	Cranston Hgts-Basin Cor.	29,977	15	.....	.....	29,977	15	.....	..
983	St	Incidental Construction	.....	..	14,638	June 1951	.....	..	14,638	100
987	40	Camp Mt.-Silver Lake	72,146	33	.....	.....	72,146	33	.....	..
993	40	Brandywine Boulevard	522,072	100	.....	.....	203,821	40	318,251	60
1000	40	Newark-Limestone II	149,746	36	.....	.....	149,746	36	.....	..
1001	40	Laurel-Mission	394,497	70	.....	.....	394,497	70	.....	..
1005	40	Mastens-Felton	54,182	42	.....	.....	54,182	42	.....	..
1007	47	Jacobs Sch-S. Greenwood	.....	..	833,703	Dec. 1950	277,285	40	556,418	60
1009	40	Phila. Pike (US 13)	355,864	81	.....	.....	355,864	81	.....	..
1016	40	Milton-Overbank	39,242	61	.....	.....	39,242	61	.....	..
1030	40	Chas. Cullen Bridge	430,605	100	.....	.....	416,919	97	13,686	03
1032	St	3rd Street Bridge	.....	..	133,045	June 1951	.....	..	133,045	100
1034	St	Hay Road Extension	4,658	03	.....	.....	4,658	03	.....	..
1035	St	McCaulley's Dam	13,810	29	.....	.....	13,810	29	.....	..
1039	40	Farmington-Harrington	91,346	74	.....	.....	91,346	74	.....	..
1040	40	Hardscrabble-Laurel	78,021	29	.....	.....	78,021	29	.....	..
1043	40	Laurel-Seaford	322,786	100	.....	.....	322,786	100	.....	..
1043A	40	Seaford Bridge	17,970	100	.....	.....	14,548	81	3,422	19

Contract Number	Fed. Aid %	Location	Active Beginning 1951 F/Y Remaining $ Value	%	Awarded During 1951 F/Y Award Amount	Month	Constructed During 1951 F/Y $ Value	%	Active End 1951 F/Y $ Value	%
1045	40	Del Mem Bridge Approach	209,215	100	.....	.....	176,472	84	32,743	16
1050	40	Kenton-Pleasanton	.....	..	180,703	Aug. 1950	146,115	81	34,588	29
1057	40	New Castle Ave Overpass	429,489	100	.....	.....	225,475	52	204,014	48
1059	St	Trooper Station No. 2	43,289	36	.....	.....	43,289	36	.....	..
1060	40	Barley Mill Br. Approach	26,589	61	.....	.....	26,589	61	.....	..
1066	40	Hardscrabble-Concord	146,768	86	.....	.....	146.768	86	.....	..
1067	40	Susan's Beach Road	.....	..	159,499	Aug. 1950	151,058	95	8,441	05
1070	40	Farnhurst Interchange	712,349	100	.....	.....	488,901	68	223,448	32
1072	40	Middletown-Odessa	258,080	100	.....	.....	207,564	80	50,516	20
1074	40	Appleby Road	24,330	92	.....	.....	24,330	92	.....	..
1079	40	Silver Lake Road	29,818	100	.....	.....	29,818	100	.....	..
1082	St	Brandywine Riv Crossing	.....	..	600,703	Feb. 1951	31,083	05	569,620	95
1091	St	Slaughter Beach Protectn	6,480	100	.....	.....	6,480	100	.....	..
1093	St	Broadkill Beach Protectn	19,400	100	.....	.....	19,400	100	.....	..
1095	St	Lewes Beach Protectn	19,400	100	.....	.....	19,400	100	.....	..
1096	St	Rehoboth Beach Groins	16,560	100	.....	.....	3,582	12	12,978	78
1097	St	Bethany Beach Protectn	19,600	100	.....	.....	.....	..	19,600	100
1118	MC	Smyrna-St. Rd. (US 13)	.....	..	23,128	Sept. 1950	23,128	100	.....	..
1119	MC	Md. Line-St. Rd. (US 40)	.....	..	40,690	Sept. 1950	40,690	100	.....	..
			5,015,311	..	4,118,178	.....	5,163,266	57	3,970,223	43

EQUIPMENT

William B. Markland, Equipment Supervisor

The emphasis on maximum use of equipment has already paid dividends in the expanding maintenance operations of the Department. Proper equipment for the job at hand is today's best bargain. Rising costs and frequent shortages of skilled labor make it economically wise to further emphasize the advantages of increased mechanization.

To this end a comprehensive survey of the Department's equipment was made in the latter part of this report period. This survey was intended to determine the needs of the Department in regard to additional equipment and to list the equipment that was obsolete or needed extensive repairs for continuance in a usable condition.

In all three maintenance divisions many pieces of equipment were found to be obsolete and many others needed such extensive repairs that the most economical procedure was to replace them immediately.

In Sussex County the immediate needs are for heavy duty trucks, dump trucks, and graders. New Castle County requires replacement of much of its snow removal equipment and needs additional graders and mechanical mowers. The need for replacement in Kent County is not as great as the other maintenance divisions, but several heavy trucks are scheduled for early replacement.

The long out-of-service periods resulting from the need for extensive repairs to this equipment has seriously handicapped the maintenance operations throughout the State. Much of this equipment was acquired prior to World War II.

In addition to the maintenance equipment requirements, a number of supervisors' cars must be replaced early in the next fiscal year.

Upon approval of the Members of the Department and within budgetary limitations, bids for this necessary replacement of equipment will be requested early in the coming fiscal year.

PERSONNEL

John A. Joslin, Administrative Assistant

Calls to military service, high levels of employment, and rising wage scales in industry have made it very dif-

ficult during this fiscal period to maintain the number of trained engineers required to complete the construction and maintenance programs of the Department. This condition has particularly affected the recruitment of young engineers and was especially apparent in the latter part of this fiscal year when representatives of the Department personally visited and interviewed engineering students of the University of Delaware, Pennsylvania Military College, and other nearby engineering schools to acquaint them with the advantages of a highway career. Of the 45 students interviewed, we were successful in obtaining the services of only two young civil engineers. The higher starting salaries and future position security offered by private industry greatly outweighed, in the minds of these young engineers, the advantages offered by the Department.

The need for professional personnel cannot be overemphasized. If we are to retain and expand our place in the transportation field, as we must, it is essential that an effort be made to attract engineers in spite of the competition of industry. Two handicaps can be removed by the initiation of a competitive salary scale and a merit system of job retention.

During the fiscal year there was a sufficient number of untrained personnel available to the Department; however, the needs of the Department were for personnel trained in higher mathematics and other engineering techniques.

Within the next fiscal year it is planned to hold classes for our field personnel to acquaint them with the latest construction and maintenance practices. These classes will also assist new personnel in familiarizing themselves with various phases of highway work.

At the end of this report period there were 843 employees on the payroll of the Department. As compared with the previous fiscal period this represents a decrease of 12 employees.

During the fiscal period 27 employees entered the Armed Services, 9 were pensioned, and 3 were deceased.

TABULATION OF PERSONNEL

As of June 30, 1951

Division	Profes-sional	Sub-Profes-sional	Clerical-Steno-graphic	Maintenance Mon.	Maintenance Bwkly.	Total
Plans and Design	8	9	1			18
Testing	5	26	1	1		33
Traffic and Planning	4	12	3	1		20
Bridge	5					5
Suburban Communities	1	1	1			3
Right of Way	5		4			9
New Castle County	16	45	9	35	154	259
Kent County	6	18	9	22	137	192
Sussex County	11	26	9	41	186	273
Delaware River Crossing Division	1		1			2
Mosquito Control	2		1		15	18
Administration	2		8	1		11
	66	137	47	101	492	843

CONCLUSION

Throughout the biennium the State Highway Department was severely handicapped by the increasing pressure of conditions in its field and the unyielding character of factors which limit its operation.

Traffic has grown beyond the most optimistic predictions in the past. The highway system suffers from the inadequacies which this expansion creates and from the accumulation of inadequacies which are due to the age and obsolescence of a large proportion of its pavements and structures. The cost of rebuilding and maintaining the system's facilities were still rising at the end of this last year of the biennium.

Notwithstanding these adverse conditions, a considerable amount of work has been accomplished during the period. By means of construction on critical highway sections and by intensified maintenance operations on all parts of the system, highway transportation throughout the State has kept moving and in service.

The amount of funds that will be made available for the fiscal years 1951-1952 and 1952-1953 for construction purposes is not known at this time; consequently, it is impossible to include a construction program for these years in this report.

I am submitting the following list of projects from which I am confident a full and progressive construction program for the coming biennium may be selected by the Members of the Department.

New Castle County	
Contract 799	Concord Pike
Contract 798	Maryland Avenue
Contract 977	Carpenter's Bridge & Approaches
Contract 755	Lancaster Pike (Grading & Drainage)
Contract 1160	Middletown to Summit Bridge
Contract 1161	Summit Bridge to Tybout's Corner
Contract 1163	Boxwood Road through Newport
Contract 1154	Chrysler Plant to Ogletown
Contract 1176	43rd Street, Wilmington
Contract 1162	Lancaster Pike-DuPont Rd. to Center Rd.
Contract 1144	Silverside Rd.-Faulk Rd. to Talleyville
Contract 1165	State Hospital at Farnhurst
Contract 1167	New Castle Overhead Drainage
Contract 1168	Ridge Road and New Castle Avenue

Kent County	
Contract 1164	Glenwood Avenue, Smyrna
Contract 843	Canterbury to Camden
Contract 1037	Pearson's Corner to Marydel
Sussex County	
Contract 720	Georgetown to Hardscrabble
Contract 1087	Roxanna
Contract 1085	Oceanview to Bethany Beach
Contract 1063	Line Road East to Delmar
Contract 1148	Brown's Church to Laurel-Georgetown Rd.
Contract 1149	Laurel-Georgetown Rd. to Delmar
Contract 1123	Dagsboro Streets

In the latter months of this report period, emphasis was placed upon the creation of a backlog of plans for known urgent projects, in order that there will be no delay in the awards if and when the funds are forthcoming.

Recognizing the need for a complete revision of our Standard Specifications, and an up-to-date compilation of the laws affecting the State Highway Department, the revisions were ordered started in April of this period and these publications will be available for distribution early in the coming fiscal year. In addition a manual including personnel policies, and construction and maintenance practices of the Department is in preparation. This manual will include job specifications for every position in the Department and give detailed descriptions of modern construction and maintenance techniques.

It is confidently expected that publication of the revised Standard Specifications, Compilation of Laws, and the new manual of Standard Operating Procedures will aid materially in modernizing our methods and promote added efficiency throughout the Department.

Respectfully submitted,

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Chief Engineer.