

Wilmington newspapers published excerpts from the recently-released 1961 Annual Report of the Department. Headlines referred the Director's recommendation that the merit system be instituted on a State-wide basis rather than one peculiar to the Department.

### *Publicity*

It is important that the public be kept informed not only of the regular activities of the Department but also of any activity necessary in case of emergency situations. This is done by the following means:

1. Daily papers: regular news releases are furnished to 4 papers on the peninsula and special reports are sent to 4 others in nearby metropolitan areas.

2. Weekly papers: news releases are provided to 10 papers published in Delaware. Information contained in these releases pertains to projects and activities within the general distribution area of the papers.

3. Radio and television: all news copy is furnished to 10 radio stations and one television station. These stations are most cooperative during emergencies.

4. Magazines: information is sent to 6 magazines of national circulation pertaining to engineering and highways.

During the year 341 news stories of general interest were released and 71 stories of special interest. When photographs are available they are circulated with releases and stories for illustration purposes.

## **II. ACTIVITIES OF THE ENGINEERING SECTION**

### **PLANNING AND DESIGN DIVISION**

The function of the Plans and Design Division is to coordinate the activities of the Road Design Section, the Bridge Section, the Right-of-Way Section, the Planning Section, and the Utilities Section with other sections of the Department which are concerned with any aspect of contract plan preparation.

All roadway and bridge plans which are prepared by consultants are reviewed and approved by the office of Plans and Design. This Division participates in the preparation of material to be used at public hearings as required by the Federal Aid Highway Act. This year public hearings were held regarding :

- Limestone Road, Route 2 to Mill Creek
- Washington Street Extension
- Kenton to Maryland line
- Frederica Bypass
- Lebanon Road, Route 13 to Dover Air Force Base
- Route 18, Milton to Gravel Hill
- Stein Highway Extension

Personnel from this Division cooperated with the U.S. Board of Natural Resource to have the Mason-Dixon Line resurveyed by the United States Coast and Geodetic Survey. Many of the original monuments have been replaced or repaired.

### **Road Design Section**

The Road Design Section designs, reviews, and approves all plans for road construction in the state. Design is performed by Department personnel and by consulting engineering firms who are engaged for specific projects.

Tables IV and V list the projects which have been formally approved for construction and those on which preliminary design was undertaken for future needs.

The Road Design Section performs the duties of the Department relative to the acceptance of suburban streets into the maintenance system. Under the laws of the state a developer must submit construction plans and performance bonds for approval by the Department before street construction is undertaken. If the streets have been constructed to Department standards they can be accepted into the maintenance system. During the past year this section approved 43 performance bonds covering 13.232 miles of streets with a construction value of \$1,053,578.41.

The Department is directed by law to improve and accept for maintenance all suburban streets which were built (or created) before July 1, 1951. During the past year 25.431 miles of suburban streets were accepted into the maintenance system. This brings the total of suburban streets maintained by the Department to 430.573 miles. Table VI shows in detail the mileage of streets accepted this year.

TABLE IV (Continued)

Contract Number	Location	Type	County	Mileage	Bid Price
1807	Lea Boulevard (Wilmington)	"	N.C.	0.566	60,539.50
1809	Road 549 (Rd. 20 to Rd. 553)	Resurfacing	S.	3.393	91,348.64
1811-1	Lebanon Road Borings	Borings	K.		10,900.00
1820	Claymont School Streets	Reconstruction	N.C.	0.598	79,651.25
1821	Poplar and Spruce Avenues (Elsmere)	"	N.C.	0.321	39,558.80
1827	Double Bridges to Redden	Widening and Resurfacing	S.	4.204	199,382.00
1850	Intersection Alteration at Loocker- man and Court Streets, Dover	Reconstruction	K.	0.0884	81,367.50
1861	Bridge Replacement	"	N.C.	0.311	116,703.50
1905	Kirkwood Highway Crossovers		N.C.		102,596.50
1925	Long Bridge and Approaches	Reconstruction	N.C.	0.262	83,385.10
1927	Bridge Replacements	"	K.		69,573.50
1981	Augustine Cutoff and Concord Pike Intersection		N.C.	0.199	34,942.00
1983	Red Lion to Bear Station	Resurfacing	N.C.	1.54	39,500.75
1984	Marydel to Pearson's Corner	"	K.	6.2	206,102.00
1985	Hartly to Kenton	"	K.	4.32	139,708.40
2035	Milton Street Repairs		S.		94,580.00
2043	Greenwood to Milford	"	S.	10.256	152,999.75
Dirt Roads	New Castle		N.C.	5.99	173,778.00
Dirt Roads	Kent		K.	22.34	618,100.89
Dirt Roads	Sussex		S.	40.69	921,811.52
TOTAL					\$11,132,241.81

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**TABLE V (Continued)**

<b>Contract</b>	<b>Location</b>	<b>Type of Const.</b>	<b>County</b>	<b>Mileage</b>	<b>Estimated Cost</b>
1846	Belvidere	"	N.C.	*	90,000.00
1857	Limestone Road (Mill Creek to Pennsylvania Line)	"	N.C.	4.657	1,000,000.00
1858-2	South Bowers Beach Causeway	Fill and Surfacing	K.	1.184	20,000.00
1920	Shipley Road (Wilson Road to Washington Street)	Reconstruction	N.C.	1.154	625,000.00
1930	Hares Corner Intersection to Churchman's Road	Reconstruction	N.C.	0.271	110,000.00
1953	Duncan Road (Kirkwood Hwy. to Road 276)	"	N.C.	1.632	290,000.00
1955	Route 300 (Md. Line to Kenton)	Widening and Resurfacing	K.	5.427	400,000.00
57 1959	Route 26 (Bethany Beach to Clarksville)	Widening and Resurfacing	S.	*	312,000.00
1961	U.S. 13 to 40 (Wilmington Manor)	Reconstruction	N.C.	0.278	55,000.00
1974	Route 41 (Basin Road) (Route 40 to I-95)	"	N.C.	*	450,000.00
1975	Union Street (Wilmington)	Widening and Resurfacing	N.C.	*	440,000.00
1977	B. & O. Railroad Bridge (DuPont Road, Elsmere)	New Construction	N.C.	*	800,000.00
1978-1	Broadkill River Bridge	"	S.	*	1,000,000.00
1990	Intersection Improvements Seaford, Delaware	"	S.	*	10,000.00
2045	Terminal Avenue	Reconstruction	N.C.	*	330,000.00

\*Mileage not determined as of this date.

## Bridge Section

During the past year this section designed 24 of the 29 bridges now under contract for construction; the others were done by consultants.

With the establishment of the Delaware Turnpike the Bridge Section has been relieved of considerable detail work for that portion of the Interstate System from the Maryland state line to Basin Road known as the toll road.

However, prior to this, when the project was part of the freeways system, all the bridges had been designed and checked by this section; as a result, only minor changes were needed to adapt them to meet the design requirements of the toll road.

On the Interstate Route 95, north of the Christina Interchange, the bridges over the Christina River, the Pennsylvania Railroad, and the Little Mill Creek have been completed. Plans are well advanced on the South Wilmington viaduct, approximately 5,600 feet in length, crossing over the tracks of the Baltimore and Ohio Railroad, the Pennsylvania Railroad Company and the Reading Company. Formal agreements must be prepared by the section which must be approved by the Department's Attorney, the Pennsylvania RR, the B&O RR, the Reading RR, and the U.S. Bureau of Public Roads.

To reduce future maintenance costs existing small timber bridges are being replaced by various types of concrete and corrugated metal pipe on roads being improved under the Dirt Road Program.

These installations have resulted in more efficient structures which will allow the maintenance forces to give more time to other activities.

Tax Ditch work by the Soil Conservation Service to benefit marginal agricultural lands requires the lowering of ditch and stream beds. This necessitates alterations to existing bridges in order that they do not fail. Plans and specifications have been prepared for bridges over the White Marsh, East Nanticoke, and Beaverdam tax ditches. The White Marsh project has been advertised for bids.

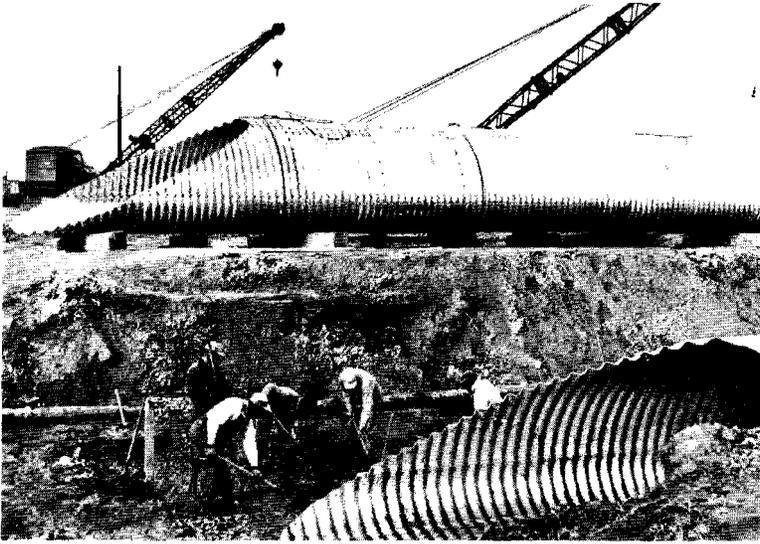
Beach erosion projects are under the direction and supervision of the Bridge Section. After the March storm the section worked with the Corps of Engineers of the United States Army. Details of the storm and the damage which it wrought are covered elsewhere in this report.

## PROJECTS WORKED (Continued)

I-2 (42)	Substructure and Wing Wall
I-2 (43)	Superstructure
	<b>Kent County</b>
1740-1	Haven Lake Bridges
1757	Carpenter's Bridge (Bridge 35A on Road 35)
1860	Bridge 360A on Road 360
1906	Bridge Replacement (Bridge 100A on Road 100)
1927	Bridge Replacement (Bridge 158A on Road 158, Bridge 162B on Road 162, and Bridge 203A on Road 203)
1955	Route 300 (Maryland Line to Kenton)
2000	Raising Spillway (Coursey's Pond)
2023	Rodney Village Sewer Outfall Extension
2038	Widening and Opening Bridge 3B
2042	Repairs to North Pier, Barker's Landing Bridge
2065	White Marsh Tax Ditch Bridge Protection (Bridge 62C on Road 62, Bridge 441A on Road 441) (See also Contract 2065 in Sussex County)
2080	Beaverdam Tax Ditch
2095	Emergency Repairs to Bridge 10A (Woodland Beach Causeway over Duck Creek)
	<b>Sussex County</b>
1777	Bridge Replacement (Bridge 438 and Road 382, over Dirickson Creek)
1795	Route 404 and Route 18 (U.S. Route 13 to Cokesbury Church)
1854	Bridge 357 on Road 451
1880	New Indian River Inlet Bridge
1889	Broadkill River Drawbridge
1890	Bridge 679 on Road 317
1978	Broadkill River Bridge
1986	Bridge Construction (Bridge 555 on Road 60)
1989	Bridge Construction (Bridge 460 on Road 381, over Dirickson Creek)
2020	Slaughter Beach and Broadkill Beach Fill
2026	Indian River Inlet Bridge (Temporary Repairs)
2037	Rehoboth Beach Groins
2050	Lewes Beach Maintenance Fill
2065	White Marsh Tax Ditch Protection (Bridge 102 on Road 612), and East Nanticoke River Tax Ditch Bridge Protection (Bridge 130 on Road 40, Bridge 132 on Road 591, and Bridge 133 on Road 594) (See also Contract 2065 in Kent County)
2078	Automatic Gates (Lewes Bridge)
	<b>Flood Maintenance Contracts</b>
9011	Lewes Bridge
9012	Canary Creek Bridge
9013	Charles W. Cullen Bridge at Indian River Inlet
9019	Cedar Creek Bridge

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The Computer Section under the supervision of the Assistant Bridge Engineer is assisting other sections of the Department. Details of this are dealt with on page 71.



Corrugated metal pipe being installed to replace old type structure on Road 158, west of Dover.

### Right-of-Way Section

The largest property procurement program ever undertaken by the Department is gradually approaching conclusion. The FAI-2 (Interstate Route 95) alignment through Wilmington is nearly complete, and all land requirements for the Delaware Turnpike (between Maryland line and Basin Road) have been met either through negotiation or through court right of entry. The interchange areas and small but important connecting areas between the Turnpike and the Freeway were acquired early to permit construction to start sooner. All these special projects, added to the considerable amount of right-of-way work which is normal throughout the state, have caused the modification of some policies and procedures.

been raised in amounts varying from 300 percent to 500 percent. The normal market uptrend in such a case has been only about 25 percent. However, if in the time between the *announcement* of the Department's *intention to construct* and the *date* the Department *actually assumes the title*, the market should decline, then the Department still must pay the higher price.

The Department gave blanket authority to the Right-of-Way Section to post condemnation cases in court subject to later concurrence. Time restriction to avoid interest payments to the bonding syndicate for failure to meet the completion deadline resulted in the establishment of these emergency procedures. Appraisals were completed in unusually fast time, and invoicing methods were revised in order to post bond for entry rights for the contractor so work would not be delayed in this respect.

Commercial and industrial developers are in constant search for desirable sites and buyer interest is active. Available land, however, is being held by present owners who are awaiting completion of turnpike work.

It must be noted, however, that increased land values are not limited to the areas of the Turnpike and the Freeway. This is a statewide trend and as such it appears to be quite normal to the times.

The dirt-road program, parts of which had been delayed because certain property-owners would not make right-of-way available, received support when the Department approved the limited processing of condemnation.

Possibly the most unusual assignment given any right-of-way section came as a result of the storm which struck the Delaware coast in March. Many of the protective dunes had to be rebuilt, mostly along new alignment because of the destruction of the beaches. The sand displaced from the dunes and beaches was spread landward by the winds and tides, much of it being deposited in the landlocked bays and swamps; but much of it remained on the land and could be reclaimed. While maintenance crews were clearing the roads, streets, and other public areas under the jurisdiction of the Department and salvaging considerable quantities of sand for the reconstruction of the dunes, the Right-of-Way Section approached hundreds of unknown property owners, many of them absentees who lived at great distances from Delaware, to get easements allowing the Department to enter their property and remove the salvag-

governmental agencies, to commercial interests, and to the general public concerning topics which influence highway engineering.

In order to augment the services of this section a new subsection was created this year to assist in the study of advanced planning throughout the state; however, most of its efforts will be in the highly-developed urban and suburban areas which are the result of this population growth, and the change of land use. Thus, the Department will participate in future overall planning with state and county planning commissions.

Many facts must be presented, including such items as motor fuel consumption, State Highway income and motor vehicle registration. This year 18 major comprehensive statistical tables were prepared for the Federal Government.

The Department must maintain a road inventory which lists the roads and streets for which it is responsible. This must be continually revised to show total mileage, surface type and width, roadside culture, and other pertinent information used for mapping purposes.

Past records are used to complete the "Road Life Study." This report supplies information about the cost of operating the highway system and, from construction records, the average life of a pavement is determined.

The Department must be aware of trends occurring in weights of commercial vehicles over the roads. An annual Loadometer Study is prepared showing this trend which is important to design criteria, equitable tax rates, and to the regulation of vehicle operation.

One of the major functions of the Planning Section is counting and classifying the various vehicles using the highways. Today 54 portable hourly recording counters are used. In 1961 there were 16 major, 28 minor, 17 weekday control stations, and 402 single-count stations in operation. To record information covering all 4,210 miles in the highway system requires a schedule of three years.

There are 9 strategically located permanent automatic counter stations which operate continuously throughout the year. These stations make it possible to develop seasonal variation and hourly volumes, and to forecast trends. At stations on multilane highways, directional split information is obtained.

palties for their use in street maintenance, traffic signals and signs, police regulation, and other similar items. An annual inventory of streets in each municipality is prepared listing those eligible with accompanying maps. An annual fiscal study is made of the receipts and expenditures relating to the construction, maintenance and administration of roads, streets, alleys, and their public ways; traffic police, debt service, the status of bonds and other financial obligations related to the highway user; and the use of any surplus road and street funds for nonhighway purposes.

One means of placing information before the Department and the general public is by maps, graphs, sketches, special layouts, and exhibits.

Work was started in 1961 to produce an entirely new series of County General Highway Maps of Delaware which will include many cultural and other features not shown on present maps. There will be a Dover area supplementary map published at scale of 2 inches to 1 mile.

Work also has been started on new traffic-flow maps showing the 24-hour annual average traffic for 1961 on the primary and secondary roads. In addition to the usual notation of traffic figures another innovation will be the indication of traffic flow in multicolored bands.

A new State Maintenance Map was completed late in 1961. These maps were designed primarily for use by the road maintenance planners but many other state and private agencies find them extremely helpful.

### **Utilities Section**

The increased activity discussed in other portions of this report is reflected in the Utilities Section as well. It is inevitable that new construction, most reconstruction, and some maintenance work affects the locations of public utility installations.

Before work starts on any project meetings are held with representatives of the utilities and the contractor. Usually a schedule is arranged which will allow all concerned to pursue their work with a minimum of interruption. Thereafter, monthly meetings are held to keep abreast of the situation and to resolve any difficulties which may have arisen.

of this law have amounted to \$136,217.14, to cover adjustments of manhole covers, sanitary sewer locations, and water line adjustment or relocations.

The Utilities Section is responsible for the processing of all franchise requests from utility organizations after Division Office review and prior to final Department approval. The extent of franchise permission granted, in miles, during the past fiscal year by the Department for utility use of highway right-of-way, is reflected below:

	New Castle	Kent	Sussex	Total
Water .....	16.5	.1	—	16.6
Gas .....	17.0	1.2	—	18.2
Sanitary sewer .....	3.0	1.1	—	4.1
Buried cable .....	11.5	96.5	86.3	194.3
Poles .....	7.0	4.8	5.2	17.0
Underground conduit ...	.5	—	—	.5
Total Miles .....	55.5	103.7	91.5	250.7

### Electronic Computer Services

The science of electronics in recent years has provided engineers with a new machine, the electronic digital computer, which has become the accepted tool in every phase of science and engineering. Unfortunately the civil engineering profession, of which highway engineering is one of the major subdivisions, has been somewhat slower than other branches of engineering to adopt this new facility.

The electronic computer is a complex piece of equipment. However, it is not a magic brain but depends on the will of the operator. When a complicated problem is presented to the computer in logical mathematical steps, known as programming, and numerical data is supplied, these computers can calculate at a speed of 10,000 to 100,000 times as fast as the human calculator, man. The machine merely follows instructions given to it by our engineers who have been specially trained in this field of operation.

Many of the former time-consuming problems, which are repetitious in nature, being solved by the Department's computer are:

1. Computations of quantities removed from borrow pits.
2. Computations of road profiles.
3. Computations of horizontal curves including spiral transitions.

## **OPERATIONS DIVISION**

The Operations Division has the responsibility of supervising the construction and maintenance of highways. This is accomplished by coordinating the activities of the Construction Section, the Traffic Section, the Materials and Research Section, and the Maintenance and Equipment Section. These sections are closely aligned with the county divisions whose primary functions are the supervision of contract construction and maintenance.

### **Traffic Section**

Between 1950 and 1962 the number of vehicles registered in Delaware increased 94.06 percent (95,685). During the 12-year period, 1950 through 1961, motor vehicle registration in the United States increased from 49,161,691 to an estimated 76,007,000, an increase of 26,845,309 (54.6 percent). Many vehicles registered in other states use the road system of Delaware as evidenced by the traffic over the Delaware Memorial Bridge and the number of out-of-state registrations noted at the Dover Air Force Base. In 1950 the annual average daily traffic count over the New Castle ferry was 8,613 vehicles; in 1961 the annual average daily traffic count over the Delaware Memorial Bridge was 30,508, an increase of 254.09 percent. All these figures reflect the increase in the annual vehicular miles of travel over our highways which in 1950 was 1,090 million and in 1961 was 1,996 million.

The State Police reported in 1950 “. . . pertinent data reveals that in the total of 2,729 accidents, there were 62 which resulted in 71 persons being killed; 772 in which 1,133 persons were injured; and 1,895 which resulted in property damage only.” In the State Police report for 1961 it shows that of 7,234 accidents there were 51 which resulted in 57 persons being killed; 1,377 in which 2,127 persons were injured, and 5,806 which resulted in property damage. The increase in total accidents bears a relationship to the increase in motor vehicle registration and the increase in vehicular miles traveled per year.

In the construction of new roads the Department incorporates into the design features which will allow safe travel if the motorist will obey the visual directives and aids installed for his benefit. On existing roads and streets traffic conditions must be continually studied and corrective measures applied to reduce accidents. The Traffic Section of the Department undertakes this work.



Overhead signs at Concord Pike and Murphy Road.



Interior of new sign shop.

## Construction Section

The Construction Section is a staff group with field engineering and auditing duties. Its principal function is to review and check all construction project procedures within the Department. With few exceptions, the full responsibility for proper execution of contract construction lies in the hands of the four district divisions, New Castle, Kent, Sussex, and Freeways.

In its constant review of contract administration, this section attempts to unify and generally assist in improving operations. The auditing group check out and approve supporting documents for progressive and final payments to contractors. These estimates are audited for accuracy of sketches, measurements, and calculations; vouchers covering the performance of the work for which payments are requested are then prepared.

The field engineering group attends preconstruction meetings with contractors and utility companies held by the district divisions to resolve problems before commencing work. The presence of Construction Section representatives is to promote uniformity and completeness of meeting agenda and to note items of importance for the chief engineer and his staff. Subsequent to these meetings, all pertinent data, such as formal construction schedules, submission of lists of proposed subcontractors, etc., are reviewed prior to a recommendation being made for the "Notice to Proceed" which allows the contractor to commence work.

Unscheduled field trips are continually made to all construction sites in the state. Operations, inspection procedures, and records are then reviewed and discussed with those in charge at the project. Records of all visits and actions are maintained, studied, and reviewed for trend patterns and outstanding items are brought to the attention of the chief engineer. Other records are maintained and are available to all who have need of them. They indicate the current status and progress of all construction contracts.

The section is charged with several other responsibilities, including:

1. The execution of supplemental agreements when occasional unit prices are required.
2. Contract change orders are reviewed and submitted for approval by the Department.

3. Liaison with the Bureau of Public Roads in reference to contract changes in federal-aid projects.

4. Make final field inspection of each construction contract and prepare formal recommendations for its acceptance or rejection.

5. Collect and systematically file all permanent records which document the performance of construction contracts. This includes correspondence, test reports, construction diaries, and estimate books.

6. Assist field personnel by acting as construction consultants whenever help is requested, or referring requests to appropriate sources of information.

7. Perform liaison for the district division in various meetings which are called between the Department, engineering consultants, contractors, and others in matters relating to construction.

8. Represent the state as a member of the American Association of State Highway Officials Committee on construction.

Construction contracts within the scope of the Department include highways, bridges, retaining walls, drainage structures, buildings, beach facilities, beach erosion restoration, and involve supplementary work such as marsh stabilization.

**CONTRACTS ACCEPTED**  
**July 1, 1961 — June 30, 1962**

<b>Contract</b>	<b>County</b>	<b>CONTRACT DESCRIPTION</b>
1994	K	Emergency Road Repairs
1996	K	Emergency Road Repairs
1998	S	Emergency Road Repairs
FAI-1 (10)	NC	Bridge Approaches (Relocations)
1665	NC	Roads 483, 471, 481, 480, 475, 473, and 472
1873	S	Roads 213, 596, 597, and 611
1881	S	Roads 326 and 317
1842	K	Beach Fill (Kitts Hummock and South Bowers Beach)
1885	S	Roads 616, 594, and 624.
1991	NC	Emergency Road Repairs
1993	NC	Emergency Road Repairs
1995	K	Emergency Road Repairs
1997	S	Emergency Road Repairs
1999	S	Emergency Road Repairs

*Continued*

2. At the end of this fiscal year there are 45 contracts affecting a total of 131.073 miles.

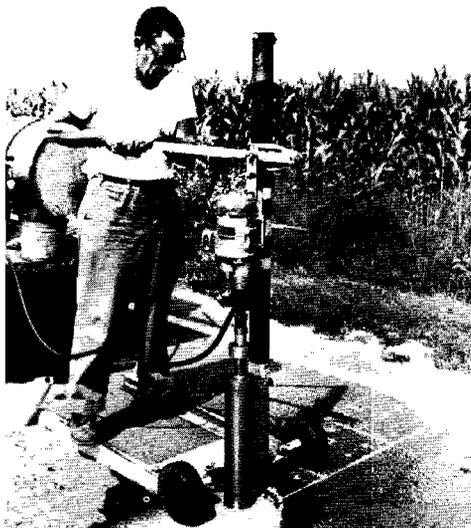
3. There were 61 contracts accepted, totaling 109.364 miles as shown in tabulation.

### Materials and Research Section

The primary function of this section is to inspect and test all materials used in construction and maintenance of roads and bridges and to insure that these materials meet the requirements of the specifications applicable to the various projects.

To improve upon past procedures on Federal-Aid projects the Bureau of Public Roads has changed their requirements and the Department is cooperating to increase job control of sampling and testing, random progress sampling and testing, and final record samples. The successful fulfillment of these revised requirements is resulting in better completed projects.

To comply with these changes in procedures and to keep abreast of the increased work necessitated by the construction of the Freeway required additional training and reassignment of personnel.



Laboratory technician obtaining samples of pavement.

strength, wearing ability, and life of the product. The Department through the Materials and Research Section must continue to systematically study and investigate the composition of these products in order to improve the use of the materials available. This year studies were made to determine the effective maximum size of coarse aggregate in portland cement concrete and also improve methods for determining the moisture content in asphalt stabilization.

With the enormous amount of background technical knowledge and the know-how, private companies are turning out new chemicals and products unheard of and many of the older products are being improved. Where it is possible to use these products on highway construction, future maintenance and life of the project may be affected. However it is necessary for the Department to test these products prior to including them in the specifications in order to insure their suitability for highway purposes. This year the Materials and Research Section investigated the use of epoxy resin compounds, chemicals, and fabricated materials to prevent soil erosion, poly sulfide epoxy for sealing joints, and conducted exposure tests on paints. These are a few examples of the work being done.

#### **Maintenance and Equipment Section**

The objectives of the Maintenance and Equipment Section are:

1. To improve and unify maintenance practices on a statewide basis.
2. To assist in the selection and procurement of proper maintenance equipment.
3. To consolidate requirements for and administer the procurement of maintenance materials for the fiscal year.

The section works with the Division Engineers of New Castle, Kent, and Sussex Counties in planning for the future by assembling information relative to the material requirements for the ensuing year. The requests from the division engineers are analyzed, budgeted, consolidated; then contract proposals are prepared for specific items. This year 60 proposal were prepared for bidding purposes.

This section continually seeks out and investigates new equipment to replace worn out or inefficient machinery and tools, thus releasing many man-hours of labor which can be used to better advantage.

year. Construction contracts started during this year had a bid value of \$3,313,749; contracts completed during the same period amounted to \$1,534,105. Among the maintenance contracts, resurfacing work amounted to \$147,019 and hot-mix projects totaled \$99,919.35.

### *Maintenance*

With the increase in the volume of traffic more maintenance is required to extend the life of pavements and existing structures, to keep the parkways and roadsides clean, to keep equipment in good repair, to keep drainage facilities functioning, to preserve the rideability of the paved surface, and, most important, to keep the roads open to traffic on all occasions.

During July and August extreme heat causes expansion which develops tremendous pressures within concrete pavement, resulting in a buckling or disintegration of the pavement. The blowups occur without warning and require immediate repair to eliminate an unexpected hazard to the motorist and to preserve the rideability of the road. Striking one of these blowup areas could cause a driver to lose control of his car with possible disastrous results. In spite of this, there has been criticism of the size of the maintenance crews making these repairs; but the urgency of the situation requires that an adequate number of men and pieces of equipment be on hand to do the work as quickly as possible. Sometimes blowups are temporarily patched so traffic will not be interrupted and later filled with concrete when time permits.

During the vacation months all divisions are involved in the litter problem. Clearing the parkway and roadsides of debris is necessary every week to maintain an attractive appearance. Every year the collection of garbage in resort areas presents a problem. Trash receptacles are placed along the roads where traffic is heaviest and special care is taken to keep the picnic sites clean, but even these measures are not sufficient to prevent the accumulation of trash.

During the summer months continual mowing is necessary on the main roads to preserve a neat appearance and control nuisances. The area to be mowed on a dual highway the length of the state approaches 1,200 acres; mowed 10 times per season, this is nearly 19 square miles, which in turn is almost double the land area of Wilmington. When all the highways in Delaware are considered some idea of the mowing problem may be grasped.

A major complaint from the public, especially in Sussex County, concerns the dust from nonsurfaced roads, untreated shoulders, and nearby construction projects. This situation may be alleviated by the application of calcium chloride but no permanent remedy is feasible economically.

Maintenance crews begin erecting snow fence in October at strategic locations throughout the state to prevent snow from drifting over various sections of the highway. More snow fence is now being erected than ever before, as experience has taught how to use this very effective means of reducing snow-drift on roads. Materials for sanding and deicing are stockpiled at many locations to be available when emergencies occur. All equipment to be used for snow removal is subject to continued inspection and repair so it can be placed in operation without delay. Snow removal schedules are modified, available contractors' equipment is listed, individual employee assignments are made, and attempts are made to anticipate the unexpected problems which occur every winter.

Snow was not a big problem this year. The New Castle County Division reported no extra help was required to remove snow. The Kent County Division reported its forces were called out in December and January to correct some dangerous ice accumulations. In February three minor snows occurred, and snow removal was also necessary in the early part of the March 6-8 storm. The Sussex County Division reported that snow and ice control activities were relatively light this year, being limited to about 5 days' extra work resulting from two medium snow storms.

After snow fences are erected, and whenever weather permits, maintenance crews are engaged in sealing cracks which have developed in the pavements. This is preventive maintenance which prolongs the life of the pavement and its rideability. Unless this is done water seeps down to the subgrade and forms a soggy mass which will not support the pavement and making it subject to easy breakage.

Older road surfaces must be continually repaired where potholes develop. This occurs at all seasons of the year because traffic ravels out weak spots which are the result of natural deterioration. Each month, in Kent County, enough cold patch material is placed to cover 25,000 square feet. A similar amount of patching occurs in the other counties. New materials have been tried for the repair of pavements. Placing one of these new materials by trucks

purchasing the material on a contract basis.

For Kent County alone, approximately 8,000 cubic yards of borrow is hauled and placed each month to maintain the 291 miles of dirt roads. Sussex County reports that only two select borrow pits were available during the past year.

The following table shows the amount of some of the materials used in maintenance operations.

Patching material .....	19,700 tons
Sand .....	17,000 tons
Coarse aggregate .....	38,000 tons
Slag .....	9,000 tons
Crack filler .....	46,000 tons
Concrete pipe .....	20,520 linear feet
Corrugated metal pipe .....	1,875 linear feet
Grader and snowplow blades .....	309,310 pounds
Calcium and sodium chlorides .....	2,500 tons
Diesel oil .....	270,000 gallons
Gasoline .....	1,349,000 gallons

Considering that the average driver would get 15 miles per gallon and drive his car 12,000 miles per year, the gasoline used by the Department would last him 1,686 years, or 84 generations; or he could drive around the earth 809 times.

New Castle County has the greatest number of bridges which open for vessels using the rivers. The following table lists the bridges and the number of times they were opened for river traffic during the year.

South Market Street Bridge .....	1,107
Newport Bridge .....	2
Flemings Landing Bridge .....	31
Third Street Bridge .....	2,208
Seventh Street Bridge .....	51
Pine Street Bridge .....	0
Walnut Street Bridge .....	1,470

Since mechanical and electrical equipment is used to operate these bridges, special maintenance procedures are required to keep them in service. This equipment is subject to the same ills as the homeowner's mechanical and electrical appliances. Mechanical parts which wear out must be replaced. Aged wiring which has become defective must be removed. Burned-out motors must be serviced. The safety barriers and light standards are often damaged by vehicles, these must be replaced. The steel decks and framework supporting riding surfaces' and steel traffic plates are subject to weather and impact and vibration from the movement of

vehicles. Rusted and broken supports must be continually replaced. Frequent rebolting or rewelding is necessary throughout the structure to keep it in a safe condition and to protect the steel members from the weather.

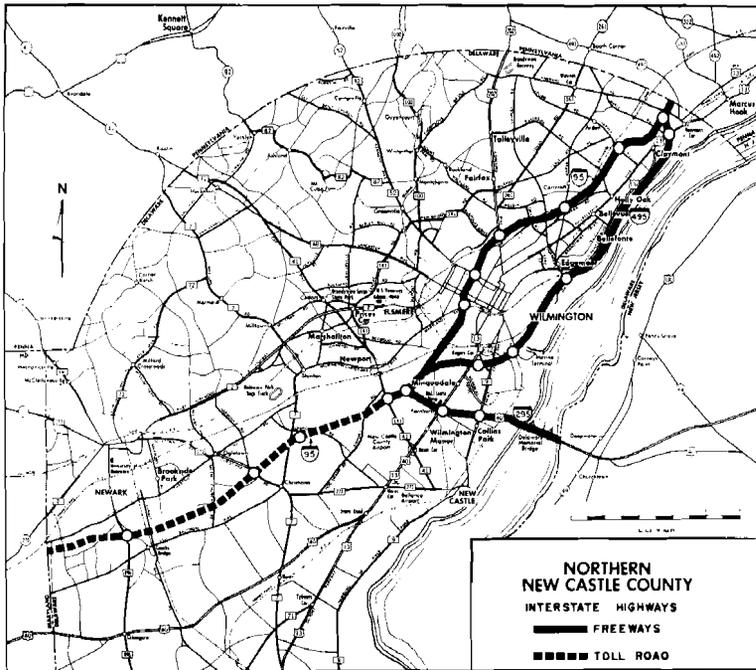
### *Repair and Maintenance Facilities*

Constant work on equipment is performed at the maintenance garages of the three counties so the Division Engineers will be able to perform their missions. Mechanics, electricians, painters, and other specialists are employed in preventive maintenance and repair work on machinery varying from a lawn mower to a 10-ton wrecker. During the course of ordinary events the shops are busy places, but during emergency periods the men perform yeoman service which is not often realized by the general public.

The Department, in carrying out road maintenance operations, salvages all usable material such as culvert pipe, stone, lumber, and structures in the right-of-way. Unserviceable material removed from one location sometimes can be used at other locations. Scrap material which is unusable may be dumped; however, if it is in demand for purposes other than highway work it is placed on public sale. The purpose of such salvage operations is to clear the path for new construction. The Kent County Division this year on the Milford Bypass project salvaged all usable material from an old woolen mill, as well as the usual items such as culvert pipe.

A good example of the implied or directed responsibilities of the Department is the maintenance and control of public dumps. Keeping the dumps from becoming hazards to the public is as big a problem as finding a place suitable to use as a dump. In Kent County two long-used dumps have been closed and cleaned up through use of pest controls and covering the trash with fill to present a neat appearance. The dump on the Danner Farm was closed and sanitized and the site is now being used by the Traffic Section for storage and office facilities. The dump at Barkers Landing was closed at the request of the Board of Health.

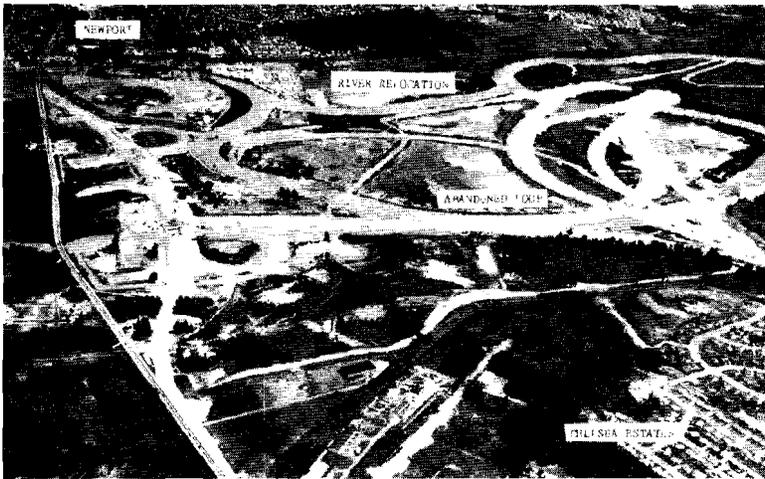
The Department, by legislative assignment, has maintained the public land along the Atlantic Ocean. During the past year, and before the storm of March 1962, the Sussex Division enlarged and improved tenting and recreational areas on the public lands. Excellent weather nearly doubled the use of the Key Box Road tenting facilities and the



### Freeways Division

The Freeways Division entered the 1962 Fiscal Year with only one active contract, the Combined Contract FAI-1 (21)-1 and (24), which provides for the construction of a northbound Basin Road and the preliminary phases of the Christiana River Interchange. This interchange, just west of the Farnhurst Interchange, will connect Interstate Routes 95, 295, and 495 with the new Delaware Turnpike, the most important link between the Delaware Memorial Bridge and the State of Maryland.

The first six months of the contract was characterized by the slow pace of the work. However, the contractor increased his effort with the employment of 350 men and working two or three shifts. The outlines of the Christiana River Interchange are developing in Conrad Marsh. To accomplish this huge project the contractor has been permitted to work around the clock, seven days a week, on the



**Christina Interchange under construction. Note the abandoned river loop and the relocated channel.**



**Aerial view of borrow pit where 3,500,000 cubic yards of material has been removed.**

roadways will consist of two 12-foot concrete lanes in each direction. A median varying from 74 feet to 124 feet in width will permit the construction of an additional 12-foot traffic lane in each direction at a later date. The maximum grade planned for the Turnpike is 2.84 percent; other grades are 1.7 percent or less. Bituminous paved shoulders will be 10 feet wide on the right and 4 feet wide on the left. In one place the median will be 600 feet wide, where a million-dollar restaurant and service area will be built.

Seventeen bridges will be constructed along the route. Vertical clearance to overhead bridges will be 16 feet 4 inches. A minimum of 14 feet horizontal clearance will be provided between the edge of the roadway pavement and the adjacent bridge piers. On bridges carrying the Turnpike over crossroads and rivers the full shoulder width, right and left, will be carried across the bridges for maximum safety and driving comfort.

One of the stipulations in the Traffic and Revenue Study upon which the feasibility of the bond issue was based is that the Turnpike and the Maryland section must both be complete and open to toll-paying traffic by December 31, 1963. Therefore, one of the keynotes of construction is speed.

The Delaware project is being financed by a \$28 million bond issue. The total cost, including construction, right-of-way acquisition, traffic and revenue studies, legal expenses, and estimated contingencies, is \$24 million. The additional \$4 million is required to capitalize the interest on bonds to January 1, 1965, for bond discounts, and to provide an additional reserve for contingencies. No state tax funds will be required, nor is the credit of the State pledged in connection with the financing of the Turnpike. Only those using the Turnpike will pay tolls to finance the construction and maintenance costs, but they will save both time and money in doing so. It is estimated that by the use of this proposed two-state toll road through traffic between the Delaware Memorial Bridge and the Baltimore Harbor Tunnel, a 62-mile trip, nearly a half-hour's travel time will be saved compared with taking the same trip over U.S. Route 40. Also, the traffic diverted from U.S. Route 40 to the Delaware Turnpike will bypass 49 traffic signals, 124 intersections at grade, and approximately 1,300 private entrances.

Toll rates for passenger cars on the Delaware Turnpike will be 30 cents per vehicle and for the Maryland section \$1.00. Truck rates will vary with the number of axles.

Department (these are described on page 12) ; and still and movie photography for the Department. Photographic records have proved to be very valuable in comparing the present with the past, in illustrating activities of the Department, and in presenting material to be used in court cases.

#### **Federal-Aid Section**

The primary function of this section is to maintain liaison with the U.S. Bureau of Public Roads, especially insofar as fiscal matters are concerned. As federal monies are apportioned to the state, programs showing the projects proposed for each class of funds are submitted for Bureau approval. The programs describe in detail all phases of the proposed projects to justify the Department's application for financial assistance. Needless to say, all design, engineering, right-of-way acquisition, and other elements in the preparation of plans for the project were done with federal-aid application in view.

After all calculations have been prepared, this section cooperates with the engineers in preparing an estimate of the total cost of the proposed project and a tentative sharing of the costs between the state and federal monies. Conferences between representatives of the state and federal agencies result in an agreement relative to governmental participation in the proposed project.

Another important function of this section is the preparation of advertisements and contract forms, and the verification of applicants' qualifications before issuing them forms to bid on projects. This work is done for all construction projects whether they are federal-aid or state-financed.

#### **Permit Section**

One of the economic factors involved in the design of highways is the thickness of the pavement. Pavement thickness, in turn is based on the total volume of traffic and the loads to be carried. Speed limits are one way of regulating the impact of loads on the pavement; other methods include regulating the size and weight of the vehicles.

Statutory enactments define quite clearly the size-weight-axle combination which will be allowed to be used on the roads. However, when oversize and overweight vehicles need to use the roads, permits will be issued which

which specifies the number, size, and color of signs which may be erected at any development.

During the fiscal year 2,334 permits were issued. The annual permit fee was increased to \$2.00 effective July 1, 1962 in order to make the advertisers responsible for a reasonable portion of the cost of administering the section.

Continued cooperation of the various divisions of the State Highway Department in advertising control will result in our highways remaining attractive.

## **MOSQUITO CONTROL DIVISION**

### **General**

The Fiscal Year 1962 was noteworthy for the Mosquito Control Division because of very favorable weather conditions which minimized the amount of mosquito breeding. Consequently, the airspray program encompassed only 148,000 acres, the lowest figure in six years. Moreover, for the first time since 1959 there was available an effective insecticide for larval control, which contributed to the facility of abatement efforts.

### **Spray Treatment**

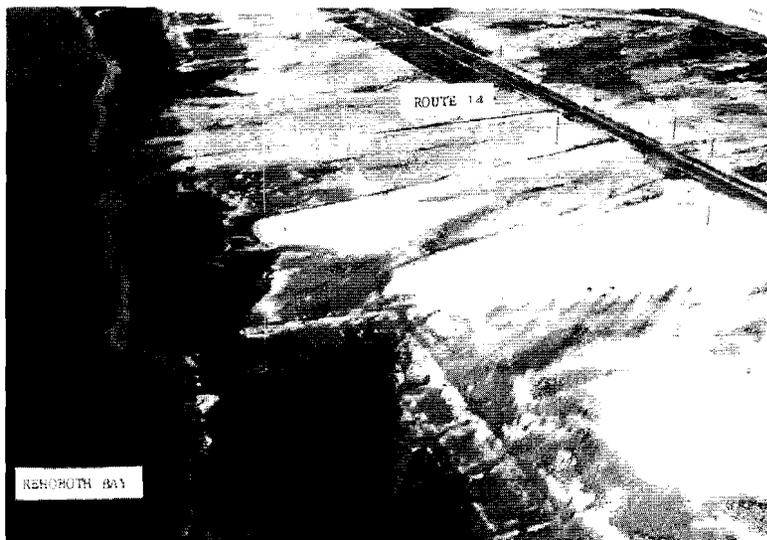
As in the past Kent and Sussex Counties benefited almost equally from the spray operations, with each having some 69,000 acres treated. The remaining 10,000 acres sprayed were in New Castle County. Three insecticides were utilized in this program; namely, DDT, malathion and Baytex. DDT was used in the treatment of 80,000 acres, 47,500 acres were treated with malathion, and 21,000 acres with Baytex, the newly developed larvicide. DDT was employed almost exclusively over marshland in combating adult mosquitos; malathion was sprayed over upland and urban areas. Baytex was, of course, directed solely against larvae on the marsh breeding spots, but it was not employed until late in August 1961, when the principal brood of this period developed.

### **Fog Treatment**

Supplementing the aerial operations was fogging with the Tifa machine. Total expenditures amounted to 910 gallons of material dispersed in 40½ hours of operational time. The formulation used was 3 percent each by weight of malathion and Lethan-384 in a fuel oil base. The places



Cleaning mosquito control ditches. Note the wide tracks on the specially-designed equipment.



Aerial view of storm-damaged mosquito control ditches south of Dewey Beach.

detectors and traffic lights, intercommunication and paging systems, tape recorders, and many other associated devices.

Two technicians are assigned to each county for maintenance purposes and two steeplejacks, who double as installers, comprise the work force of the Division to install and maintain approximately 700 mobile units and 25 base stations used by the following state agencies:

1. Department of Civil Defense
2. Highway Department
3. State Police
4. Forestry Department
5. Game and Fish Commission
6. Shell Fisheries Commission
7. Soil Conservation Commission
8. Water Pollution Commission

In addition to these state agencies, all but a few volunteer fire companies in the state are serviced by the Division.

The March storm is a prime example of the importance of this Division. An untold number of lives were saved at Bowers Beach alone as the result of a timely alarm and call for help sent over the fire network. In a matter of 20 minutes the routine "all O.K." report was changed to a flood alert.

The importance of communications was evident in the Rehoboth area also, when emergency facilities were installed whereby the National Guard and the State Police were able to coordinate activities. The same was true for the other communication network throughout the state.

In other areas, the equipment became run-down from the long hours of use during the emergency operation of the Department; in some cases radios were drenched by the storm. All this required many extra hours of work to keep communications in operation.

### **III. CONCLUSIONS AND RECOMMENDATIONS**

The inclusion of recommendations in the Annual Report is traditional and affords the Director the opportunity of delineating the main problems which confront the Department. In many instances the same recommendations, or similar ones, have been made for many, many years. The passage of time does not lessen their importance; rather, in some cases, the lack of implementation of the requests