DELAWARE'S

Roadways 1630-1956

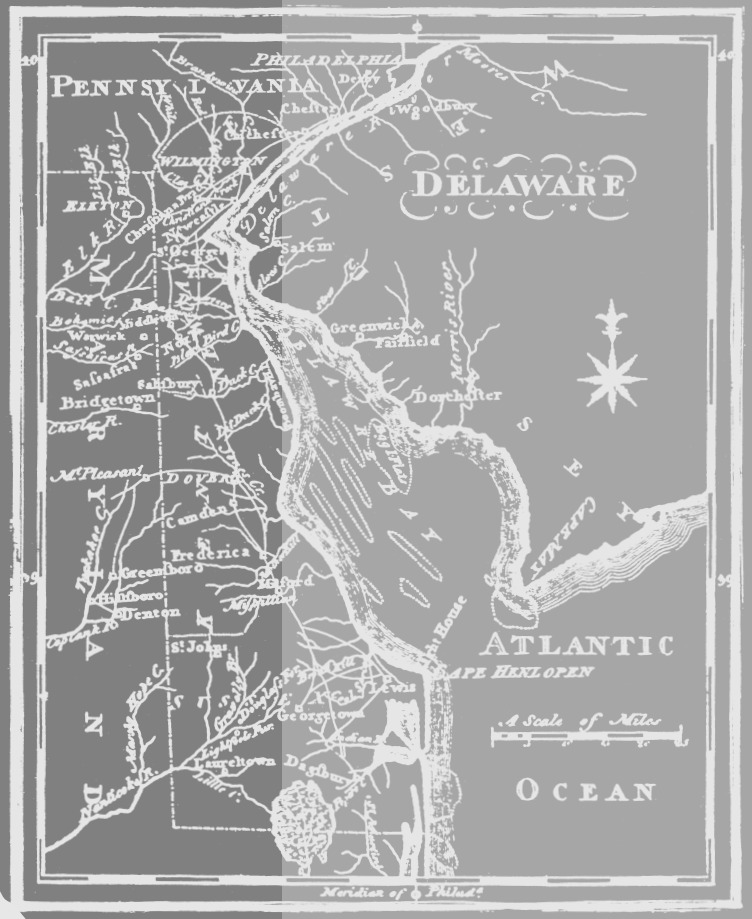
Delaware's bridges are part of a highway system that has developed over time from the colonial period to the present day. A cursory glance at a colonial road map and a modern highway map presents striking similarities in the pattern of the primary road network. Most of the population centers that are connected by roads today are the same as those that initially were connected by roads during the colonial period. Of course, what the maps do not show is that the character and quality of the roads and the landscape has changed dramatically over the course of more than three centuries. Once seasonally impassable Indian trails and horse paths are now state highways designed for high-speed, high-volume motor vehicular travel in all weather. Many highway bridges are third, fourth, or even fifth generation structures at stream crossings. An understanding of how Delaware's bridges fit into the pattern of roadway development is an important part of their historic context.

Apple wagons on a 1925 road, not yet improved by paving. Notice the mix of horse drawn and motorized vehicles. The Delaware State Highway Department used photos like this to illustrate the importance of funding for good roads.

Colonial Trails and Roads

Delaware's colonists arrived in the New World by sea, and through much of the colonial period their transportation orientation was east toward the Delaware bay and river. All of Delaware's earliest communities were established and grew to prominence at locations with access to navigable water. The few rudimentary land routes in existence at the time of European contact were established Indian paths traversing the interior. The Minquas Road, named after the resident Indian tribe, provided an overland connection between the Susquehanna and Christina rivers. Another important trail followed the Delaware River from a point north of the site of Philadelphia south to Christina River. Other trails traversed the Delmarva Peninsula from Odessa and Lewes to the Chesapeake Bay. Explorers, trappers, and traders followed the Indian paths, and over the course of the early colonial period they transformed the paths to horse trails and crude roads.

Delaware Roadways



The historic map of Delaware from 1800 (above) shows much the same pattern of primary roads as does the present day highway map (left). The pattern is similar but the quality of the roads and bridges and the character and volume of travel has changed dramatically in 200 years.

The English, who who took over Delaware from the Dutch in 1664, were the first colonial power to legislate improved roads. The government designated principal roads, sometimes called King's Highways, and ordered them cleared, grubbed, and maintained by statutory labor. In 1675, the colonial governor required every Delaware household to contribute one able-bodied man to work on the construction of a road from New Castle to Philadelphia. After 1679, the highway was extended south from New Castle to Red Lion, Lewes and Cape Henlopen. A branch ran from Milford to Seaford. In 1683, William Penn instituted a policy whereby county courts appointed local overseers for road construction. Around 1700, government surveyors began systematically recording road rights-of-way and maps in colonial record books. By the mid 18th century, Delaware had a distinct network of roads. The principal route was a north-south passage that follows roughly modern-day US 13.

Prior to the mid 18th century, most Delaware waterways were unbridged, re-

quiring travelers to ford or cross by boat. One such traveler, Jasper Danckaerts, arriving on the bank of the Christina River in 1679, found "... the water was so high that it was not advisable to ride through it with horses, and we would have to wait until the water had fallen sufficiently for that purpose. While we were waiting...an Indian came on the opposite side of the creek...He said that we should have to wait there too long; but if we would ride a little lower down, he had a canoe in which he would carry us over, and swim the horses across. We rode there at once, and found him and his canoe. We unsaddled the horses, and he swam them over one by one, being in the canoe and holding them by the bridle. When we were over, we quickly saddled them and rode them as fast as they could run, so that they might not be cold and benumbed."

The date of construction of most of Delaware's colonial bridges are undocumented, but travelers began noting bridges in their travel diaries toward the middle of the 18th century. In 1744, Dr. Alexander Hamilton reported "passing over a toll bridge in bad repair at a place called Brandywine." Forty years later, Johann David Schoepf observed "near to Wilmington the Brandywine is crossed, over a good stone bridge". The bridges often replaced ferries or fords that had been found inconvenient due to increased traffic and inclimate weather. In many instances, the colonial government granted toll bridge charters to private individuals who then raised the money necessary to build the bridges in exchange for the right to charge a toll. A bridge was located at the head of the Christina Creek near Christiana by the 1740s. Wilmington was served by bridges in the vicinity of the present North Market Street and Church Street crossings of the Brandywine River as early as the 1760s.

Delaware's Turnpikes, 1783– 1919

By the end of the colonial period, Delaware and neighboring states had in place an established network of roads serving both local and regional travel. The roads were really not much more than wide dirt paths worn by time and repeated travel. By modern standards, travel was slow and difficult, but Delaware's rural population at the end of the 18th century did not expect to travel long distances quickly. They prepared for winter when roads would be closed by snow or mud. They measured travel time of more than a very local nature in days rather than hours. The state's citizens maintained roads using the farming tools and draft animals at hand. As long as travel by a particular road remained mostly local in nature and limited to the pace of a draft animal or a man's walk, there was very little reason to do otherwise. This would remain the case throughout much of Delaware during the entire 19th century.

The primary units of government responsible for roads and bridges were the county Levy Courts, established in the 17th century. The courts levied taxes and appropriated funds, appointed overseers to construct and repair the roads and bridges, and reviewed petitions for new roads and bridges. In New Castle County, the hundreds, a local unit of government akin to a

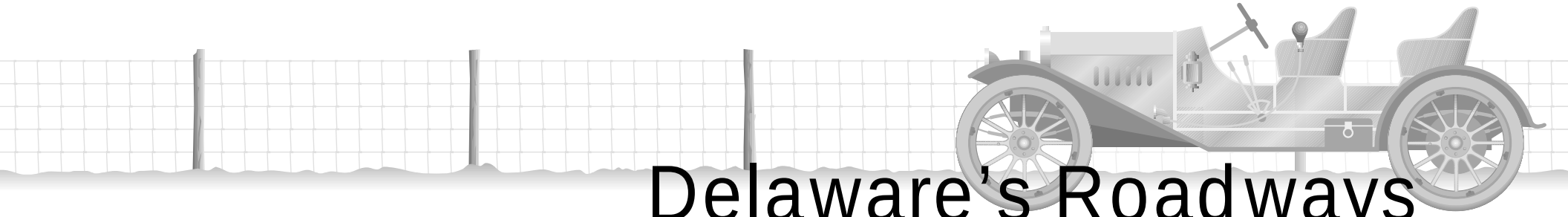
Tollgate on the old Kennett Pike. The Wilmington & Kennett Turnpike opened in 1813. It was Delaware's longest operating turnpike when the gates were removed in 1919 and the road turned over to the county as a free road.

township, were given the authority to elect road commissioners for the better repair and maintenance of local roads beginning in 1832.

By 1800, some primary roads were serving a growing volume of traffic, especially stage coaches, grain wagons, animal drovers, and other types of commercial travel of more than a local nature. In Delaware, these roads were located in the northern part of the state. One principal route crossed the state's northern neck as part of a post road between Philadelphia and Baltimore. The other roads radiated out from Wilmington, Newport, and New Castle to the increasingly prosperous agricultural regions of southeastern Pennsylvania. Wilmington, in particular, by virtue of the waterpowered mills of the Brandywine River and its port, was a growing center of the flour trade, dependent on grain from farms in southeastern Pennsylvania.

Northern Delaware's commercial interests promoted the improvement of the existing roads through the creation of turnpike companies patterned after Pennsylvania's Philadelphia and Lancaster Turnpike, America's first turnpike established in 1793. It proved to be such a success – to the prosperity of Philadelphia's merchants and Lancaster's farmers – that it was soon imitated across the northeastern United States. Private corporations built, operated, and maintained the turnpikes. The state governments authorized the corporations to take over existing roads and to sell stock that generated the necessary funds for improvements, usually consisting of straightened and widened roadways paved with Macadam, a mixture of crushed stone and water that created a hard, smooth surface. Tolls compensated the investors and paid the operating expenses.

The Delaware General Assembly chartered the state's first turnpike, the Newport & Gap Turnpike in 1808. Sometimes called the Lancaster Pike (State Route 41), it provided a maintained and direct route between the farms of Lancaster County,



Delaware's Roadways

Pennsylvania, and the port of Newport. In 1811, an extension was built to Wilmington. Specifications for the construction called for "an artificial road bedded with road-stone, gravel, clay...compacted...to make a solid foundation, and faced with clay, gravel, or stone, in such a manner as to secure a firm or even surface, rising toward the middle by a gradual arch."

In 1811, the Delaware General Assembly chartered the New Castle & Frenchtown Turnpike Company to construct a road from New Castle to the Maryland-Delaware border. At the same time, the company also received a charter from Maryland to complete the route from the state line to Frenchtown on the Elk River with access to the Chesapeake Bay. Construction was delayed until 1814. This turnpike provided an important transportation link for the region. Passenger ships docked at New Castle, where travelers caught a stagecoach to Frenchtown and then boarded ships to Baltimore and points south, thus bypassing the long water journey around the Delmarva peninsula. In 1830, the turnpike company opened Delaware's first railroad parallel to the earlier turnpike.

Wilmington was the greatest beneficiary of Delaware's turnpikes. The growing city became a common termination point of many turnpikes because of its port and flour mills. In 1812, the Wilmington & Kennett Turnpike Company received a charter to build from the Pennsylvania boundary (north of Centreville) to Wilmington. Opened in 1813, this turnpike was particularly advantageous since it provided a good, reliable road between Wilmington and the rich farmlands of Chester County, Pennsylvania. Additional turnpikes helped assure the success of Wilmington as a commercial center. The New Castle & Wilmington Turnpike, chartered in 1812, ran between Hare's Corner and Wilmington. The Wilmington & Great Valley Turnpike, chartered in 1811 and completed in 1818, provided an important connection between Wilmington and West Chester, Pennsylvania, along the route of the present day Concord Pike (US 202). The Wilmington & Philadelphia Turnpike, chartered in 1813 and completed in 1823, extended from Market Street, Wilmington, north to the state line just east of Naaman's Creek to connect with Pennsylvania's Philadelphia & Chester Turnpike. The Christiana & Wilmington Turnpike Company, chartered in 1821, built the last of northern Delaware's turnpikes.

Turnpikes flourished for a brief period but soon faced competition from other transportation improvements, particularly the railroads after 1830. The turnpikes continued to operate through the middle of the 19th century, but profits were rare. Tolls often did not meet the operating and maintenance expenses. One by one the turnpike companies closed and the roads reverted to free public roads. The Wilmington & Kennet Turnpike was the longest operating turnpike in the state. The last toll was collected on April 30, 1919, prior to its sale to Pierre S. duPont. The road was in a poor state of repair, the company was financially troubled, and the county was reluctant to

(Above) The Chesapeake & Delaware Canal (ca. 1880) with the swing span bridge of the Delaware RR in the background.

(Right) The Chesapeake & Delaware Canal forms a barrier dividing northern and southern Delaware. In 1942, the St. Georges Bridge opened to traffic and provided the first high-level crossing of the canal. The previous bridge at St. Georges had been a movable vertical lift bridge, which collapsed into the canal when it was hit by a freighter.

The Chesapeake & Delaware Canal

A singular transportation project in Delaware history was the construction of the Delaware & Chesapeake Canal. Delaware's earliest colonists recognized the importance of linking the Chesapeake Bay and the Delaware River. Both the Indian paths and the colonial roads provided a connection between these two great waterways. Concepts for a canal were entertained as early as 1654 by the Swedes. Land surveys to determine a possible course for the Chesapeake & Delaware Canal began over a century later in 1786. Incorporated in 1803, the Chesapeake & Delaware Canal Company chose a route and began construction the following year. The company encountered financial difficulties and malaria epidemics, delaying the canal's completion until 1828. The final cost of the waterway totaled $2,250,000. The canal originally consisted of three locks, each 100 feet long and 22 feet wide with a depth of 10 feet. The canal has been enlarged twice in its history, once in 1855

and again in 1935. Its usefulness to shipping has been proven throughout the years, and it is one of the nation's only canals originally built in the 19th century and still in operation today.

The canal has been the site of numerous impressive bridges from its earliest period. A provision of the canal company charter was that the company would build sufficient highway bridges over the canal in order to maintain connections between northern and southern Delaware. In 1833, Henry Tudor wrote that "across the [Chesapeake and Delaware] Canal, at the greatest elevation of its embankment, is thrown a bridge of singular appearance and ingenious construction, rising to the height of nearly ninety feet above the surface of the water." The tradition of bridge construction over the canal has continued for over 150 years, with all of the present-day bridges dating to after the canal was last widened in 1935. Among the impressive structures are the St. George steel thru arch bridge (1942), the Summit cantilever truss bridge (1960), and the cable stay, Route 1 bridge (1996). ■

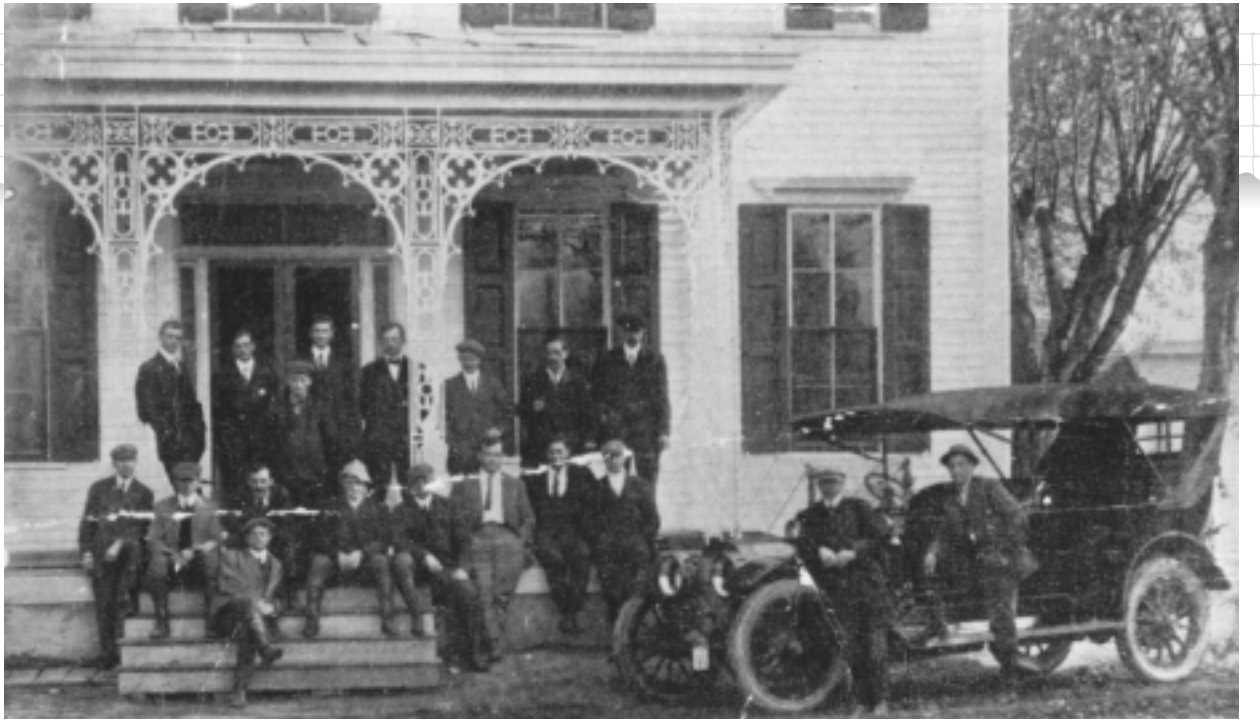
assume responsibility for the road. DuPont rebuilt the road, declared free access to it, and then gave it to New Castle County.

The Good Roads Movement

The last half of the 19th century was the age of the railroad (see next chapter), which was superior to post roads, turnpikes and canals for most types of long distance passenger and freight transportation. The public and their government representatives had little interest or motivation to improve roads between 1850 and 1890, and the period generally is considered a one of stagnation in American road development. Due to a number of factors, interest in better roads reawakened in the 1890s and a good roads reform movement began sweeping the nation.

Proponents of improved farm transportation and a growing num-

"1907 Maude Killen and Jim George out for a ride in Geroge [sic] Cohee's car in Woodside, Del." Touring was a pastime for those who could afford early motor vehicles. By the 1910s, however, the automobile had proven a practical conveyance and the mass production techniques of Henry Ford were making moderately priced cars available to a wider segment of American society. Better roads and bridges were necessary to take advantage of the speed and freedom of travel afforded by improved motor vehicles.



A 1913 postcard shows the engineers, surveyors, and staff of the Coleman DuPont Road Company. The DuPont Highway set the standard for road design and construction in Delaware.

ber of bicycle enthusiasts initiated the Good Roads Movement. As the automobile began to gain widespread acceptance around the turn-of-the-century, the cause was taken up by automobile clubs and motor vehicle dealers. Good roads reformers delivered lectures, published promotional articles, and engaged in lobbying for improved roads. The movement won the notice of such leaders as William Jennings Bryan and President Theodore Roosevelt, both of whom attended the National Good Roads Convention at St. Louis in 1903. Delegates to this convention endorsed state and federal aid for road and highway maintenance and construction. Among Delaware's most vocal good roads reformers was T. Coleman duPont, soon to be chairman of the National Highway Association. DuPont had a significant influence on the development of Delaware's highways.

The Delaware General Assembly responded to the Good Roads Movement by enacting rudimentary vehicle regulation and registration acts in 1903 and 1905. A total of 313 cars were registered in the state in 1907, the number approached 1,000 by 1910, and 7,000 by 1916. The 1903 State Aid Road Law provided $30,000 for roads in matching funds divided equally between the three counties. To oversee the state aid program, a state highway commission was established, but the funds proved insufficient to have a great impact on the condition of roads. The commission was short lived and dissolved by the state legislature two years later. It would take another decade of lobbying and good roads activism before Delaware's lawmakers would become convinced of the need for a state highway commission with a permanent professional staff to direct a statewide program of road improvements.

From 1905 to 1916, the counties carried on their own good roads programs. New Castle County set standards for hard-surfaced roads and built nearly 73 miles of improved roads by 1908, at a cost of approximately $537,000. Improved road mileage in the county increased to 110 miles in 1910, 138 miles in 1912, and 220 miles in 1916. The southern counties lagged far behind the more commercial and industrial northern county. In 1917, Sussex County had 35 miles of surfaced roads and Kent County had a mere 19 miles of improved roads.

The DuPont Highway

In 1908, in an effort to demonstrate the value of an improved highway system, T. Coleman duPont offered to construct a visionary superhighway the length of the state. DuPont, an 1885 graduate of M.I.T. and a member of one of Delaware's leading industrialist families, was an automobile enthusiast, a leader in the national Good Roads Movement, and serious student of roadways who had traveled throughout Europe and the United States surveying road design and construction technology. He envisioned a highway of grand scale for Delaware, "the straightest, widest, and best road in the country." He planned a multi-modal highway design unlike anything that had ever been built. It would have had central lanes for high-speed automobiles, and flanking lanes for trolleys, heavy motor freight, horses and horse-drawn vehicles, and pedestrians. Airfields would be located at intervals within the median strip, agricultural experiment stations would be spaced along the way, and electrical conduits were to run underground. Unused land within the broad 200-foot right-of-way was to be leased to utilities and other enterprises, including farmers, to enable the highway to be self-supporting. DuPont would bear all costs of construction, and turn the road over to the state upon completion, an unprecedented individual philanthropic gesture in the annals of American highway history.

The DuPont Highway north of St. Georges, September 1923.

The Boulevard Corporation Act, as passed by the Delaware General Assembly in 1911, authorized a corporation, known as Coleman duPont Road, Inc., to construct the highway the length of the state. As each section of ten miles was completed, it was to be conveyed to the state free of charge. DuPont hired two consulting engineers of international renown, Thomas Aitken of Scotland and Ernest Storms of Belgium, and duPont himself was chief engineer, until he gave that responsibility to Frank Williams, former Chief Engineer of the New York Highway Department. Construction began with the southernmost section, in Sussex

Delawareans greeted good roads with enthusiasm. By the 1920s, the state highway department's road and bridge program had a wide base of public support, including these volunteer firemen who demonstrated their support for improved roads with a parade banner in 1924.

County in September 1911. Litigation concerning condemnation and right-of-way purchase interrupted construction from 1912 to 1915, but the first 20 miles of the road, from the Maryland Line near Selbyville to six miles south of Milford, was completed and presented to the state on May 24, 1917.

Although built to a much smaller scale than originally invisioned by duPont, the 2-lane concrete highway was still an example of one of the most modern highways in the nation at that time. One of the primary insights which duPont had and which saw execution in the completed highway was the concept of a bypass. The highway bypassed towns and was connected to them through spur roads. The public thought the idea ridiculous, and worried that it would hurt business. After its execution, the bypass idea took root in the highway department, which said in a 1920 report that "in many instances it is better to have the trunk roads laid out near the towns rather than through the towns" because of concerns for safety and traffic congestion. DuPont's vision was true; his highway was so successful as a trunk line for the rapidly increasing motor traffic, that it became overburdened. Widenings were reported as early as three years following its completion.

Establishing a State Highway Department and System, 1917– 1934

Compared to many of its neighboring states, Delaware saw slow progress in road improvements in the years before America's entry into World War I in 1917. The end of the period saw no complete, hard surfaced, inter-county roads, and only the beginning of a privately financed improved through-road in the state. Lacking state support, county roads were primarily financed by local real estate taxes. With control at the local level, it was difficult to plan or maintain roads which were useful to the whole state. That would not be possible until the roads were under the control of a statewide agency.

The passage of the Federal Aid Highway Act in 1916 set in motion a series of changes which would greatly accelerate the

The DuPont Highway (US 13) in New Castle County, 1930. The highway was one of the earliest dualized roads in the nation.

pace of road improvement in Delaware and lead to the establishment of a state highway department. The act provided $75 million in matching funds to the states for road construction, and it required that each state that had not yet done so set up a highway department with a professional staff. In order to cash in on the federal windfall, the Delaware General Assembly passed the Highway Act of 1917, creating the Delaware State Highway Department. The department was given the authority to build and maintain a permanent highway system, and to issue bonds for financing construction. It was determined that the department would take over and maintain only the roads it improved and the newly built DuPont Highway. The Highway Act gave supervisory power to five commissioners, consisting of the Governor and four appointees.

In its first year of operation, the department made great progress in planning a system of state highways. Engineers mapped and surveyed existing roads and plotted improvements to their alignment. They conducted traffic counts to assess the present and future needs for highways throughout the state. After analyzing this information, the department recommended to the governor that first priority should be granted to the establishment of a north-south trunk route through Delaware, linking the county seats and larger towns, and providing road access to rail terminals. The specific route ran north from Delmar to Dover parallel to the path of the Delaware Railroad. Another recommended road began at Selbyville to link the railroad towns in the east and to connect with the Delmar-to-Dover road about a mile south of the capital. A third spur was proposed beginning in the vicinity of Rehoboth and running near Lewes and Milton to Milford where it would join the Selbyville route. These three roads correspond approximately to present routes US 13, US 113, and SR 1, respectively.

A trunk route was recommended between Dover and the northern part of the state. The first segment of this road would run north from Dover to Blackbird, about six miles north of Smyrna. At that point, the department recommended two northerly

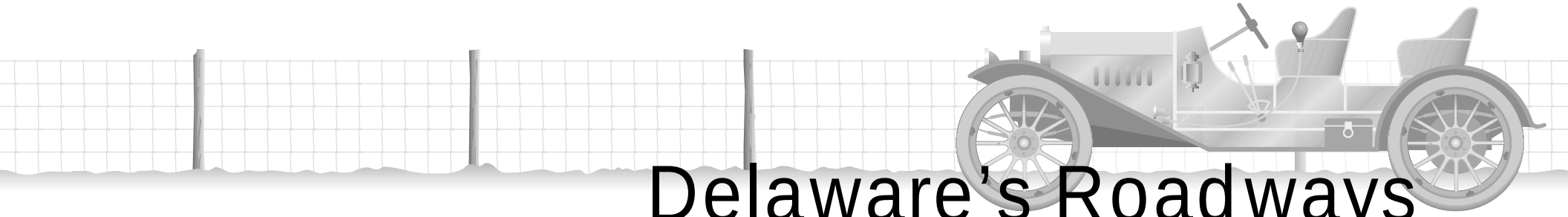
routes to link population centers in the eastern and western areas of the state. One was proposed to pass through Odessa, St. George's, and Red Lion to Wilmington. Sixty-nine miles of this route were to be constructed with private funds under T. Coleman duPont's agreement with the Department for the completion of the DuPont Highway. The other branch was to go to Newark via Middletown and Summit Bridge. East-west roads in the area were recognized as desirable but afforded second priority. Wilmington was to become the nucleus of a "radial system" by utilizing many of the existing alignments of turnpikes laid out in the 19th century.

The network thus described was presented to the governor as the "rudimentary requirements of a State Highway System." Planning incorporated many ideas which represented the state-of-the-art at the time. For example, the trunk routes were generally laid out to pass near established towns, rather than directly through them. To achieve reduced travel time and increased safety a sixty-foot right of way for rural areas was proposed to provide for emergency needs (this recommendation, based on observations of military operations on French roads, reflected the wartime preoccupation with defense). Within towns and villages, a right-of-way of eighty feet was suggested to allow for future improvements.

While the state planned the new network, Coleman duPont continued privately to construct the DuPont Highway. In September, 1917, duPont, having been appointed to the commission that supervised the newly formed State Highway Department, saw a possible conflict of interest in continued involvement in acquisition and planning the rest of the highway. He turned over control for the completion of the road to the state highway department, but continued to underwrite the costs of finishing it, up to $44,000 per mile. The completion of the DuPont Highway was marked by a celebration in Dover on September 2, 1924. A total of $3,917,004 in private funds was expended toward the realization of this visionary project.

The state gave a further boost to public road improvements in 1919 when the State Aid Road Law enabled counties to issue bonds to match state funds. The 1919 law significantly increased the annual state assistance for county roads from $10,000 per county, as established in 1903, to $250,000. Sussex County was the first to take full advantage of this program, accepting $250,000, matched with a bond issue, to construct 58 miles of road. The effect of federal and state initiatives was rapidly and widely felt. By the mid 1920s, every major town in Delaware was connected to the main highway system by a paved road. This profound change in Delaware's transportation landscape was described in an article published in 1926 by the State Agriculture Department Bureau of Markets. The description has special relevance to rural agricultural regions, which had lagged behind the urbanized northern part of the state in road improvements:

> *"In 1916 it was a common sight to see a Delaware farmer driving to market through deep mud. Sometimes he was driving a double team. But in his wagon there was little better than half a load.*



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When the roads were seas of mud he hauled half a load, either because he was afraid of getting stuck or because it was physically impossible for his team to pull any more. Half a load, like half a loaf, was of course better than none.

In the space of ten years a striking change has taken place in Delaware. Where once there were hundreds of miles of roads that were by turns mud and dust, to say nothing of the in between period when they were scarred with deep ruts and hard ridges, there now are hundreds of miles of smooth permanent highways that are open to traffic the year round. That this condition promotes not only the prosperity of Delaware but that of adjoining states is quite apparent. No longer do [protracted] wet seasons see huge quantities of perishable produce wasting in the fields."

Paved highways and modern bridges accommodated not only farming but also automobile tourism and the motor freight industry. Trucking companies had burgeoned during World War I when railroads failed to meet the increased demand for shipping and soon assumed a dominant role in freight transportation. The number of trucks on American roads increased more than tenfold from 85,600 before the war to 326,000 by 1917, and over 1,000,000 by 1920. Improvements in pneumatic tires in the early 1920s stimulated further expansion of the industry, permitting higher speeds and heavier loads while reducing the wear to highway surfaces caused by solid-tired vehicles.

In 1923, Delaware enacted a motor vehicle fuel tax, which became the primary source of highway revenues. The period 1926-1935 was marked by the consolidation and improvement of the primary road system and the development of the secondary system. Roads were widened to accommodate increasing traffic, and the first dual, or divided highways were constructed.

Road and bridge improvements were also directed toward accommodating the needs of tourists destined for the growing resorts on the Delaware seashore. As the Delaware shore resorts began to benefit from increased visits by motor tourists, highway improvements were planned to provide easier access, and structures were upgraded to handle the anticipated traffic. For example, as the improvements to the road over the Broadkill River at Milton were planned in 1925, the existing bridge was deemed "quite unsuitable for the motor traffic the new highway leading to and from it will carry." A modern movable structure was constructed to replace it. In 1928, plans were made for a bascule bridge over the Mispillion River near Milford, part of a major project to allow Rehoboth Beach traffic to bypass the Milford business district.

Efforts during this period were also directed toward improving road safety. Grade crossings posed a dangerous junction between railroad and highway traffic, accounting for thousands of fatalities in the United States in the first quarter of the twentieth century. In 1926, the Delaware State Highway Department began a systematic program of eliminating these hazardous crossings. The railroad companies acted in cooperation with the department to replace

The "Grade Crossing Problem" as illustrated in the 1926 Annual Report. *The increased size and speed of both motor vehicles and locomotives led to a growing number of fatal accidents. Beginning in the 1920s, state highway departments across the nation worked with railroad companies to eliminate dangerous crossings.*

grade intersections with separated crossings. In some cases, grade crossings could be eliminated by relocating the road or the railroad tracks, or both, but this program generally involved the construction of overpasses or underpasses.

As the state highway department developed and extended the road network over Delaware, the counties continued to pursue road construction and maintenance both independently and in cooperation with the state. In 1931, for example, New Castle County's road program included about 19 miles of new roads, in which the Levy Court had appropriated $150,000. These were secondary roads to be built 9 to 12 feet wide and paved with water-bound macadam on a stone substrate. Additionally, many roads were being reconstructed and resurfaced. A maintenance crew of approximately 100 men was at work on county roads. Nine bridges were also under construction in that year in New Castle County; many county bridges during that period were designed by Charles Dannenberg, who had left his consulting practice to join the county engineer's office. Kent and Sussex counties did little in those years, but New Castle completed 200 miles of additional hard-surfaced roads from 1917 to 1934.

1935–1945: Consolidating and Extending the System

In 1935, the Delaware State Highway Department took over all roads formerly maintained by the counties. The department assumed responsibility for road and bridge construction, and maintenance for an additional 2,600 miles of state roads. The gas tax was increased in that year an additional penny to four cents per gallon, to cover the increased cost of maintaining the expanded system.

Between 1935 and 1942, many miles of narrow roads were widened, and progressive improvements were planned for 2,200 miles of dirt roads. The department emphasized the improvement of these rural dirt roads by using local materials. The dirt road improvement program was ongoing, and produced a network of all-weather roads for local area use. Over 450 miles of those roads were treated with a bituminous covering, and over 250 bridges were built during that period as part of the secondary highway system. A large part of those bridges

included an increasing number of small creosoted timber spans in low-lying areas in the southern part of the state. To facilitate construction, the Department established a wood treatment plant in Newport to produce material for these utilitarian structures. An emergency program of bridge replacement following disastrous flooding in September 1935 confirmed the utility of this bridge type. About 100 small bridges had been destroyed or seriously damaged, and many were quickly replaced with simple timber spans. Efforts were also increasingly directed to construction and improvements within towns and cities.

In the late 1930s and early 1940s, the bridge division of the Delaware State Highway Department under the leadership of State Bridge Engineer Arthur G. Livingston experimented with several uncommon bridge types. In 1936, construction began for two multiple-span, composite timber and concrete bridges; a third was constructed shortly thereafter (Bridges K-9A, S-445, and S-707, respectively). The department's Annual Report for 1936 touted the bridges as examples of "unusual construction," a "new and very economical design [whose] serviceability will be watched with interest by the Department's engineers." In 1940, the department designed its first concrete through arch, or "rainbow" arch bridge, which was completed two years later (Bridge NC-246). Other structures designed during this period derive their stylistic inspiration from visions of the future: embellished with up-to-date Moderne-style design elements, these bridges reflect the architectural aesthetic of the second quarter of the 20th century.

At the same time, the design of many bridges continued with allusions to historic traditions, especially stone veneers applied to modern bridge types such as reinforced concrete slab and steel stringer bridges. Livingston favored these stone-faced bridges in wooded, often park-like settings of New Castle County. Livingston's notes indicate his feeling that a structure's surroundings should influence its appearance, and that the stone masonry was an appropriate response to the landscape of northern New

Typical county roads on June 21, 1935. All of the state's remaining county roads were taken over by the state highway department on July 1, 1935 with the goal of improving them for all-weather use.

Warren W. Mack (2nd from left) and Francis V. duPont (right) were chief architects of Delaware's highway program from the 1920s to the late 1940s. Here they are shown at the opening of the St. Georges bridge in 1942. With them are Governor Bacon (left) and Colonel Vaughan of the U.S. Army Corps of Engineers (2nd from right).

Castle County. Drawings for Bridge NC-543, a stone-faced steel girder bridge constructed in 1934, provide insight into the inspiration for this treatment: "the site shows exposed rock thickly located around the entire vicinity; construction should conform as closely as possible to the surrounding country."

By 1940, the state road system comprised a total of 3,930 miles. About 44% of these roads were hard-surfaced, rated "dustless or better." The remainder were still essentially unimproved, surfaced with slag, gravel, or dirt. New Castle County continued its established pattern of the state's most modern infrastructure, while the two lower counties together accounted for 90% of the unimproved road mileage in Delaware. Although Sussex had nearly twice the total road mileage of New Castle (1,863 miles vs. 995 miles), it did not equal the northern county's total for hard-surfaced road, with only 648 miles to New Castle's 699. Bridge construction in the early 1940s was seriously hampered by shortages of critical materials, especially steel, related to the war effort. Important projects, such as federally assisted grade crossing elimination structures, were awarded priority ratings by the Public Roads Administration to prevent problems in receipt of materials, but these ratings often proved difficult to obtain, and the application process itself introduced delays. In its Annual Report for 1943, the State Highway Department observed that "...the bascule bridge over the Rehoboth Canal at Rehoboth begun in 1941, is still incomplete, and will probably remain so until critical materials are released." From 1943-1945, the Department did not award any major bridge contracts as "both manpower and materials were withheld for the war effort." However, the staff completed plans for 19 bridges for future construction after the war.

Delaware Roads and Bridges, 1946–1956

The immediate post-World War II years were a period of transition for Delaware's roads and bridges. Founded in 1917, the Delaware State Highway Department had focused its early efforts on the completion and improvement of the state highway system. By the early 1930s, Delaware had what was considered one of the finest state high-

way systems in the nation with US 13 north of Dover, the state's first dualized, four-lane, median divided highway as its centerpiece. In 1935, the department's responsibilities were greatly expanded when all county roads and bridges were transferred to its jurisdiction, but World War II intervened before the secondary road system could be significantly improved. In the postwar years, the department's job of managing all of the state's highways and bridges was made all that much greater by the five years of deferred maintenance during the war. Additionally, Delaware's highway officials, like those of most every other state, had difficulty adjusting to the unexpectedly rapid increase in the number of automobiles and trucks. They found themselves in the unenviable position of redesigning and rebuilding highways and bridges in an effort to catch up with the automobile society while simultaneously struggling to maintain what was already built.

With the singular exception of the opening of the Delaware Memorial Bridge in 1952, there were few historically outstanding accomplishments in the field of highway and bridge engineering in the decade following World War II. The department primarily worked reconditioning existing roads and bridges by widening highways and improving traffic control to meet the increased demands of motor vehicles. Bridge design was centralized at the Delaware State Highway Department's bridge division, with a majority of the routine work completed in-house by department engineers. In general, the department's bridge division continued using the standard steel and reinforced concrete bridge technologies of the immediate prewar years to replace structures that no longer met traffic demands or were worn out, inadequate, and unsafe.

From the 1940s to the mid 1950s, the department's engineers found that their efforts to plan ahead for the expansion of the state highway system were frustrated by the lack of a statewide political consensus on the future of Delaware's roads. Powerful rural downstate interests blocked efforts that would have shifted highway funds from the maintenance and improvement of existing roads to the construction of a new system of expressways to serve Wilmington and the Northeast Corridor where traffic was heaviest. The political stalemate over Delaware's future highways was not broken until late 1956 when events at the national level overtook Delaware and the U.S. Congress passed the Federal-Aid Highway Act creating an integrated system of limited-access interstate highways. The act, which marked a major redirection of federal highway policy, broke opposition in Delaware to the upstate expressways by providing 90 percent federal funding for such highways. The interstate highway program marked a new era of highway construction, including new post-1956 developments in the field of bridge technology.

The Automobile Age Comes of Age:

The Economic and Social Context of Delaware's Roads and Bridges, 1946-1956

The lack of a strong postwar highway planning policy was characteristic of the largely uncontrolled development of Delaware in the

Traffic jam on US 13 south of Wilmington, 1954. The state's highway engineers began planning for a system of limited access expressways to eliminate congestion around Wilmington in the late 1940s, but it was not until the late 1950s that the state government authorized the work with huge infusions of federal aid.

late 1940s and 1950s. The state had never experienced such sprawling growth, and the government initially lacked the means to plan for, or even keep up with, the expanding suburban landscape. The most dramatic changes were in New Castle County, where the middle class abandoned downtown Wilmington for the suburbs with their new residential subdivisions and shopping centers. Growth also accelerated downstate as farmers successfully adjusted to agri-business, building poultry houses and growing truck crops on ever larger individual farms. Meanwhile, the resort towns of Rehoboth and Bethany Beach experienced increased popularity. Whether upstate or downstate, driving postwar growth were numerous and interlinked social and economic forces, but perhaps the most influential force was the automobile.

In the 1920s and 1930s, the motor vehicle had been a potent yet adolescent transportation technology promoting suburbanization, industrial development, agricultural diversification, and tourism. One of the factors limiting the impact of the automobile was that the price of a new car remained beyond the income of most working class Americans until mid-century. Although Henry Ford's mass production techniques had made automobiles widely available, fewer than 50 percent of all families owned a car as late as 1940. After 1945, postwar prosperity and pent-up consumer demand boosted automobile sales to record highs and accelerated prewar social

and economic trends. Nationally, car registrations soared from 25 million in 1945 to 52 million in 1955. Truck registrations also boomed, growing from 10 million to 26 million trucks, and interstate trucking cut into the railroad's freight business. Trends in Delaware mirrored the nation. State vehicle registrations increased almost 250 percent from 72,000 in 1946 to 178,000 in 1959. Delawareans took to their cars as never before and the landscape rapidly was reshaped to accommodate the automobile.

After 1946, the automobile placed ever increasing demands on the state's roads and bridges. The Concord Pike (US 202) was reconstructed, and the Kirkwood Highway (SR 2) and Dover Bypass (US 13) were built on new alignments for greater traffic capacity and grew into commercial strips while the surrounding farmland was carved into residential subdivisions. As a smaller size city, Wilmington's traffic jams were hardly comparable to those of Philadelphia or New York, but the routine five-to-fifteen minute delays and downtown parking shortages were considered inconvenient, and businesses chose to forsake the inner city for more convenient suburban locations. As downstate farmers increasingly trucked their goods to the metropolitan markets, heavier and larger trucks took their toll on roadway surfaces and bridges. Each summer automobile vacationers clogged US 13 and US 113 on the annual pilgrimage to the beach.

Despite the sometimes annoying problems of automobile travel and its accompanying sprawl and congestion, the postwar decade was in general a time of optimism and the state's attitude toward growth and the benefits of the automobile were overwhelmingly positive. In 1949, the state highway department's chief highway engineer, M. Allan Wilson, noted that conditions in Delaware had changed much since the early 1910s when highways lacked funding and strong institutions. In contrast to earlier days, Delaware motorists strongly supported the well-equipped and staffed highway department, even if they often disagreed over which particular projects should be given priority. Although the department often found itself embroiled in political controversy and unable to undertake all of the work it desired, the department remained the largest and best funded of all the state's agencies.

Delaware and the Federal Aid Program, 1916-1956:

Influence on Delaware's Postwar Road Programs

A key ingredient to the growth of the Delaware State Highway Department was its cooperative relationship with the federal highway administration. Much of the postwar-era road and bridge construction was funded with the assistance of federal aid administered by the Bureau of Public Roads (BPR, renamed the Federal Highway Administration (FHWA) in 1967), the agency responsible for managing national highway policy. Since the 1910s, the BPR had worked in association with the American Association of State Highway Officials (AASHO) and the American

The intersection of Kirkwood Highway and Ohio Avenue, 1957. Commercial strip development followed Delaware's road improvements leading to sprawl and traffic congestion.

Society for Testing Materials (ASTM) establishing national standards for highway design and construction. Most states, including Delaware, sent their state highway officials to national conferences where committees prepared and reviewed specifications to be used as minimum standards for all roadways and bridges. Although federal aid usually amounted to less than one-fifth of the Delaware State Highway Department's annual budget, it had a proportionately greater impact because any project using the funds had to meet AASHO and ASTM guidelines, as well as the approval of BPR engineers. Under the growing influence of the federal aid system and ever growing federal appropriations, the nation's and Delaware's postwar roads and bridges reached an unprecedented level of standardization of design.

Historically, the demand for federal support for good roads had begun with requests by bicyclists for routes into the countryside. In 1893, Congress approved the formation of the Office of Road Inquiry (ORI) within the Department of Agriculture. The small bureau, originally created to gather information on the nation's roads for bicyclists, formed the nucleus of what eventually became the BPR. Early automobile enthusiasts and Progressive reformers added their voices to the good roads movement, the former desiring roads for long-distance touring and the latter demanding good roads and bridges to improve the quality of rural life through easier access to towns and markets. BPR engineers guided federal legislation, and in 1916 achieved the passage of the first federal aid act that required states to create professionally staffed highway departments in order to qualify for the federal dollars. Those states that did not yet have departments, including Delaware, immediately created departments in order to cash in on the federal windfall. In 1917, the Delaware General Assembly created the Delaware State Highway Department headed by a five-member commission.

In the 1920s and 1930s, the BPR worked in cooperation with state highway departments creating roads to serve motor vehicles. The federal funding formula required states to expend a large portion of the aid on new construction of primary US highways. Engineering experts, led by the BPR's Chief Thomas MacDonald, encouraged states to match federal funds through dedi-

cated funding sources such as fuel taxes. In 1923, Delaware adopted a dedicated fuel tax, and with the infusion of funds, became the first state to complete its primary highway system to BPR standards. The rapid completion was made possible in part because of the state's relatively small size and the head start given by the privately built DuPont Highway (US 13/US 113).

In the 1920s, the Delaware State Highway Department used its federal aid to help pay for the conversion of the northern section of the DuPont Highway (US 13 north of Dover) and the Philadelphia Pike (US 13 from north of Wilmington to the Pennsylvania state line) to four-lane highways. The DuPont Highway was among the earliest median-divided highways in the nation and was looked at as a model by many other states. In the 1930s, the federal government turned road construction into the largest of the New Deal public works programs. Delaware's state government used work relief programs and funding to widen existing state and local roads and to build new bridges. The department undertook an expanded program to improve safety at dangerous at-grade railroad crossings, including the addition of new signals and the construction of a limited number of overpasses. In 1935, the state legislature transferred all county roads and bridges to the state highway department, thus relieving the financially strapped county governments and taking advantage of increased federal aid to secondary highways. Much of the additional federal aid was used to improve rural dirt roads with asphalt pavements and short-span wood multi girder bridges.

By the 1930s, Delaware had what many considered one of the finest hard-surfaced primary highway systems in the United States. However, the federal aid system that had helped fund the roads and bridges was not without its shortcomings. Close political alliances to rural interests at the federal level had largely limited highway improvements to the countryside. In fact, until the Depression, no federal aid was allowed inside of urban areas defined as towns with populations greater than 2,000 people. As a consequence, US 13 (DuPont Highway to the south and Philadelphia Pike to the north) stopped at the Wilmington city line leaving motorists to pick their way through congested city streets. After 1936, BPR engineers worked to shift attention to urban highways, but progress was slow. By the late 1930s, the need for improved urban highways was pressing, but the BPR's traditional rural backers resisted expanded federal aid to cities.

The urban-versus-rural highways issue that nagged at federal highway policy translated directly to Delaware state politics where rural downstate interests traditionally clashed with urban upstate interests. As state highway engineers began to promote plans to extend expressways in and around Wilmington in order to improve highway connections along the Northeast Corridor and to relieve New Castle County roads serving suburban communities, downstate interests balked at the proposals increasing the gas tax and debt to pay for those improvements. In 1939, the legislature passed the Single Fund Act over the opposition of the highway department. The act diverted

Construction of the Elsmere Viaduct over the B&O Railroad in 1948. The bridge eliminated a dangerous railroad crossing and was an early example of a continuous-span steel multi girder bridge designed by the state highway department's bridge division.

highway-dedicated gas tax revenues to the general fund rather than it being dedicated to highways. The Single Fund Act limited the department's ability to plan construction projects because the department could no longer estimate schedules based on the steadily increasing gas tax revenues but on what state funds were made available within the state government's two year budget cycle. Every two years the department's funding and construction schedule was thrown into question. Highway financing for the desperately needed upstate urban and suburban roads became mired in state house politics where downstate politicians controlled appropriations.

Another problem for highway planning from 1947 to 1955 was that federal politicians failed to agree on the funding formula to provide for a system of long-distance, limited-access interstate highways. The need for interstate roads was particularly acute in the urban northeast, but it lacked support in other regions of the country. The engineering community was divided over the best means to pay for the roads. BPR's Chief MacDonald strongly opposed toll roads like the Pennsylvania Turnpike (opened in 1940) on the grounds that politicians would use such self-liquidating toll roads as a justification to cut back the BPR's traditional “free road” funding formula based on gasoline taxes and user fees such as registrations. After 1947, many eastern states including New Jersey, Massachusetts, Maine, and New Hampshire built toll roads despite the objections of the BPR. The popularity of the turnpike roads created problems for states like Delaware when automobiles were dumped from the turnpike exits on to old, unlimited-access, two- and four-lane US highways at the state line.

From 1948 to 1954, Congress passed federal-aid highway bills that provided states with ever increasing amounts of aid collected from the federal fuel tax. However, the federal aid was given within the bounds of the old funding formulas that largely

limited expenditures outside of urban areas to the preexisting US highways and rural roads. While some states went ahead and passed laws providing for limited access expressways, most like Delaware continued to work within the existing federal guidelines. In 1954, Vice President Richard Nixon, speaking for President Eisenhower, outlined a massive $50 billion dollar highway program to relieve highway congestion. The speech, which marked the shift of the initiative for highway policy from Congress to the White House, was the icebreaker in the rural-versus-urban and toll roads stalemates because it brought the debate from the back rooms of Congress into the highly politicized light of presidential politics. Eisenhower's backing of a first-class interstate highway system primed the public with high hopes for new highways, almost entirely paid for by federal dollars. In 1956, Congress passed the interstate highway bill that was the culmination of more than a half-century long effort of highway engineers to guide both the general goals and details of national highway policy. The bill's 90 percent federal funding formula to all intents and purposes eliminated local political opposition to the upstate freeways in Delaware.

Years of Transition:

The Delaware State Highway Department, 1946-56

As World War II concluded, Delaware's highway officials eagerly awaited a new era of road and bridge construction. At the top of the Delaware State Highway Department's agenda was planning expressways for Wilmington and pushing forward a bridge over the Delaware River to New Jersey. The department presented a long list of proposed projects specific to the state's bridges including improvements to structures on US 13, a new bridge over Red Clay Creek at Curtis Mill Road (Bridge NC-231), and an overhead bridge eliminating a dangerous crossing (Bridge NC-632) of the B&O Railroad at Elsmere, a suburb west of Wilmington. In addition to these plans, dozens of other bridges required immediate attention and were scheduled for repair or replacement due to deferred maintenance during the war.

The hopes of the department were dashed even as postwar automobile travel set new records. Inflation soared out of control, raising the price of materials and labor high above anticipated levels. By 1946, the state's chief engineer Warren W. Mack reported gloomily that due to economic conditions and the failure of the legislature to appropriate funds, no immediate prospect of a comprehensive, large-scale highway and bridge program existed. The chief engineer's annual reports became a plea to the legislature for funds and repeal of the Single Fund Act, so that the department could have the unrestricted use of the state's gasoline tax, and thus, plan construction in advance of the state budget. In 1949, a huge increase in federal aid helped boost highway and bridge construction to all time levels, but did little to end the confusion caused by the lack of an overall plan for the state's highways.

Adding to the department's responsibilities were the miles of privately built suburban

residential streets with varying pavements, different roadway widths, and sometimes complete lack of adequate drainage. The suburban street situation created serious problems, especially when new homeowners complained about potholes and flooded streets and basements. The Suburban Road Act of 1945 was meant to remedy the problem by providing homeowners the power to request the county courts to issue bonds and collect taxes to pay the cost of the state

ABOVE: After World War II, Wilmington's suburbs expanded rapidly. Families left traditional row houses in the city for outlying residential subdivisions along main roads such as the Concord Pike, Philadelphia Pike, and Kirkwood Highway. Here an advertising photo for the Allied Moving Company shows the H. deLong family on moving day, 1949. RIGHT: Garfield Park (1955) was typical of late 1940s and 1950s subdivisions offering yards, off street parking, and ranch-style homes with modern conveniences.

highway department's work to improve local streets, but the funding mechanism was awkward, time-consuming, and unpopular. Zoning regulations setting standards for streets in residential subdivisions were slow in coming. The regulations were only gradually strengthened by New Castle County's Regional Planning Commission in the late 1950s and early 1960s. The types of small culverts common in residential subdivisions were generally left to the design of local developers and contractors.

The premiere engineering accomplishment of the postwar decade was the construction of the first bridge of the Delaware Memorial Bridge, completed in 1951 and opened to traffic in 1952. The 3,650'-long suspension bridge ranked the sixth largest in the world and was entirely financed and built by the State of Delaware. Designed by Howard, Needles, Tammen, and Bergendoff of New York City, the bridge linked Delaware with New Jersey and replaced the old New Castle-Pennsville Ferry. The original bridge had two lanes of traffic in each direction. Funded by revenue bonds on the

Aerial view of the Delaware Memorial Bridge, looking west toward Delaware, ca. 1954. The newly complete New Jersey turnpike is shown at the bottom. The turnpike and bridge funneled thousands of cars daily onto Delaware's highways, adding to traffic volumes far surpassing the planners' projections.

income from the tolls, the bridge was constructed under the direction of a separate division of the state highway department. In 1963, the bridge was turned over to the Delaware River and Bay Authority. The authority directed the construction of the second of the twin bridges that opened to traffic in 1968.

Planners had greatly underestimated the impact the Delaware Memorial Bridge would have on local and regional traffic volumes and patterns. Ironically, during construction many officials had worried that tolls would be insufficient to pay off the debt, but the result was exactly the opposite. By 1955, eight million vehicles annually crossed the bridge, nearly double the original estimates and close to the limit of its capacity. The bridge was a magnet for traffic on the Northeast Corridor, and neighboring states soon started incorporating the bridge as part of their own highway planning. In 1949, New Jersey announced that the New Jersey Turnpike would terminate at the bridge's eastern approach. The last segment of the turnpike opened in 1953 shifting on to the bridge thousands of daily travelers between New York City and points south of Wilmington. In 1952, Maryland added more cause for concern by opening the Chesapeake Bay Bridge between Annapolis and the Eastern Shore and announcing plans to build an expressway from Baltimore to Delaware. Pennsylvania revealed it, too, had plans to build an expressway from Philadelphia to northern Delaware, also undoubtedly bringing even more traffic to the bridge, especially during the annual summer exodus to the Jersey Shore.

As the unanticipated and record-breaking number of automobiles flooded from the Delaware Memorial Bridge onto Delaware's US 13 and US 40, traffic congestion was becoming an increasingly visible and pressing problem, especially in northern New Castle County. State highway officials worked at building the political consensus necessary to secure funding for expressways servicing the bridge and preventing Delaware from becoming the Northeast Corridor's number one traffic snarl. Although the department hired outside consultants who prepared two independent reports on the need for an upstate expressway, downstate legislators were unwilling to divert tax revenues to a major highway building initiative in the northern part of the state at the expense of local road and bridge projects. Further complicating the picture were the objections of northern New Castle County businessmen who argued that limited-access highways would draw away shoppers from their stores.

Another problem was that the Delaware Memorial Bridge was simply making too much money. At the rate toll revenues were being generated, the bonds used to finance the bridge would be paid off too soon, at which time the bridge would become toll free. Controversy existed over whether the excess funds could legally be invested in additional facilities, such as expressways or additional bridge capacity. Delaware lawmakers were not willing to assume the maintenance and operating costs of the bridge once the bonds were paid off and the bridge became free, so they began to look for ways to restructure the bridge's funding and operation. After several years of debate and negotiations in the late 1950s, Delaware's officials unveiled a work-

able comprehensive plan proposing the creation of a bridge authority to take over the bridge and a turnpike authority to build what would become the I-95 and I-295 expressways linking with the bridge.

With the major exception of the Delaware Memorial Bridge, the immediate postwar years were marked by few major highway or bridge initiatives. The atmosphere of uncertainty coincided with the first major changes of the leadership of the Delaware State Highway Department since its inception. During the 1940s, many of the engineers that had worked on Delaware's roads and bridges from the time Coleman duPont had recruited them as young men in the 1910s to build the DuPont Highway reached retirement age. In 1946, Chief Highway Engineer Warren W. Mack retired after 30 years with the department. The following year State Bridge Engineer Arthur Livingston, another department veteran, retired from his post. In 1949, Francis V. duPont, son of Coleman duPont, stepped down after 27 years as probably the most effective and politically influential state highway commissioner in Delaware history. In contrast to the steady prewar leadership duPont provided, the postwar leadership was fluid with seven different chief highway engineers and four state bridge engineers between 1946 and 1955. The department also reported difficulty staffing its departments and recruiting young engineers, especially for field work and construction supervision. The constant leadership changes further hampered the development of a consistent postwar state highway policy.

The Delaware State Highway Department's more than 800 employees continued the ever-present work of maintaining and repairing the state's highway system throughout the sometimes tumultuous and troubling reorganizations of top level management. Postwar inflation and lack of materials, especially steel, delayed the award of construction contracts, but by mid 1948, the number of projects resumed a near normal prewar level and grew steadily each year thereafter with minor delays caused by materials shortages during the 1950-53 Korean conflict. Given the political situation, the department established as its priority bringing the highways up to standards before beginning a large number of new projects. Most of the projects were for the reconditioning and upgrading of existing highways including new signals and redesigned intersections for better traffic control.

An area of concern was the substandard width of the majority of the state's primary and secondary roads. Delaware was noteworthy for its large percentage of concrete-surfaced roadways, yet most of these roads had been paved in the days of lighter automobiles and trucks. Not only were heavier vehicles now taking their toll on the concrete surfaces, but the narrow 16' and 18' roadway widths were a safety hazard. Paving and widening occurred throughout the state with some notable projects including the dualization of US 13 in the vicinity of Laurel and Seaford. A large dualized highway project was the Kirkwood Highway (SR 2), begun in 1939-41 and resumed in 1949. The four-lane, approximately 12-mile long road between Newark and Wilmington had been planned in the mid-1930s at the insistence of an influential highway commission member from Newark. The highway was built on a mostly new

The Concord Pike (US 202) was one of many Delaware highways dualized for greater capacity in the 1950s.

alignment and replaced the Capital Trail, a winding two-lane road. The Kirkwood Highway was a significant factor promoting the 1950s suburban development west of Wilmington.

In 1951, the legislature passed a $22.5 million bond issue to match the increasing amounts of federal aid. The department began the 1951 fiscal year with the largest construction budget in its history and spread the money throughout the state on programs ranging from the asphalt surfacing of secondary county roads in Sussex and Kent counties to improvements to US 13 and US 40 in the vicinity of the Delaware Memorial Bridge. In 1953, the department began work on the Walnut Street Extension with a new bascule bridge over the Christina River and a new underpass of the Pennsylvania Railroad's Northeast Corridor in Wilmington. The extension was designed as an improved route connecting the city with the Delaware Memorial Bridge. In mid 1955, the department undertook a new $10 million initiative to hard-surface the state's remaining rural dirt roads, located mostly in Sussex County.

The Delaware State Highway Department's Bridge Division

The bridge division was created within the state highway department in the early 1920s. The division was responsible for the design and inspection of the state's highway bridges and employed a relatively small staff. In 1948, the division had a total of six engineers and draftsmen. Arthur G. Livingston, the first state bridge engineer, joined the department in 1918 and served until 1948. Succeeding Livingston were James M. Gordon (1948-49), Victor A. Jost (1949-50), and Joe S. Robinson (1950-58). As of 1946, the division had charge of

slightly less than 300 bridges (20' and greater clear span), some built and designed by the division over the previous 30 years and many more inherited from the counties and municipalities.

The bridge division's design philosophy differed little from other state highway departments throughout the nation; bridges were built to federal and state design standards with roadway width and load-carrying capacity determined by the class of road. From its inception, the bridge division used economy of material and design as the most important factors influencing the choice of materials and bridge technology. The division's engineers adjusted their designs based on the price and availability of materials and labor, and on local factors such as hydrological and foundation conditions. Staff attended national engineering conferences and kept abreast of new technological developments through professional journals and BPR bulletins.

Delaware's small size and few large rivers offered limited opportunities to build large or exceptionally challenging bridges. However, unlike larger states that repeatedly built nearly identical standard-design bridges on hundreds of miles of state highway, Delaware's bridge division did have the luxury of approaching each bridge as an individual design problem.

Engineers took the opportunity to apply aesthetic treatments, such as architectonic railings and stone facing, to small bridges that might not have received such individualistic treatments in larger states. Modernestyle detailing was used beginning in the 1930s and remained popular through the 1950s.

During the postwar decade, Delaware's bridge division introduced no major new bridge technologies or materials. Prewar technologies, especially the steel multi girder and the reinforced concrete slab and box culvert, remained popular but were adapted to higher standards to meet present and future traffic needs. There was a general trend toward the use of heavier loading design of bridges on all classes of highways. Full width bridge roadways with shoulders were advocated for greater traffic capacity and safety.

The bridge division reported anywhere from 10 to 20 bridge projects per year once construction schedules resumed a normal level in 1948. While most projects were routine replacements of short-span structures, a few were featured in the state highway department's annual reports as the division's most significant accomplishments of the year. In addition to bridges designed as part of larger projects such as the Du Pont and Kirkwood highways, structures singled out as deserving attention included the Curtis Mill Road Bridge NC-231 (1948-49), an innovative reinforced concrete rigid frame bridge; Elsmere Viaduct Bridge NC-632 (1948-49), a continuous steel multi girder bridge that eliminated a dangerous railroad crossing; SR 141 over Brandywine River Bridge NC-587 (1951-52), designed to improve access to the DuPont Company's experimental station; and the Walnut Street Bridge NC-687 (1954-57), a large double-leaf bascule bridge over the Christina River in Wilmington. Some of the bridges were notable as the largest projects of the year or for prominent locations, and others featured

Smith's Bridge, one of Delaware's last remaining covered bridges, was restored to its original appearance by the state highway department after a truck fell through the bridge in 1954. Unfortunately, arsonists burned the bridge in 1961.

innovative design or construction techniques.

In the early 1950s, the bridge division suffered manpower shortages caused by the quickening pace of construction schedules, the difficulty recruiting engineering staff, and the transfer of staff from the bridge division to the Delaware River Crossing Division (a special division created in 1945 to supervise construction of the Delaware Memorial Bridge). The bridge division met the problem by contracting with consulting engineers. In the past, the department had usually only turned to consultants for specific technical problems for which it did not have expertise, such as the design of movable bridges. In the early 1950s, consultants designed many bridges for which the department had in-house expertise but not the manpower to complete the work in a timely fashion. Most of these bridges, such as a series of steel multi girder bridges on the US 13 bypass of Seaford and Laurel, were standard technology. In several cases the bridges designed by consultants included innovative features such as Parson-Brinckerhoff's design of the hammerhead piers of the SR 141 Bridge NC-630 (Tyler McConnell Bridge), one of the first documented uses of hammerhead piers in the nation.

In the late 1940s, the bridge division expanded its inspection program as a result of a bridge failure in Sussex County that

caused the death of three motorists. On February 10, 1948, the approach spans of the SR 14 over Indian River Inlet bridge collapsed as a result of unusually high tides, easterly winds, and ice flows that caused excessive scour underneath several of the piers. An independent report concluded that the accident might have been prevented with more in-depth inspection even though bridge engineers had visited the bridge earlier in the day of the disaster. They failed to detect the problem. The bridge collapse prompted the division to step up regular inspections and, in particular, to update its standards to prevent and detect scour.

While the bridge division slated many old bridges for replacement, the 1950s were notable for the department's first significant historic preservation effort. By 1950, fewer than six of the approximately 26 covered bridges that once stood within New Castle County remained. Many were posted for restricted weights. In the historically conscious communities of north Wilmington, the bridges were increasingly seen as reminders of the region's disappearing rural past. In 1954, a truck, exceeding the three-ton loading, severely damaged Smith's Bridge, the last remaining covered wood truss over the Brandywine River. Public support rallied to save the Burr arch truss, and the department's chief engineer approved reinforcement of the structure while maintaining its historic appearance. The local community considered the preservation of Smith's Bridge an outstanding effort on the part of the highway department. Unfortunately in 1961, arsonists burned the bridge, and the covered span was not rebuilt.

The historic context of Delaware's roads and bridges from 1946 to 1956 places the bridges at a time when Delaware, and much of the nation, was coming to terms with the new automobile age. Leading the effort to build new roads and bridges was the Delaware State Highway Department staffed by professionally trained engineers. By 1946, the Delaware State Highway Department had grown to maturity; it was no longer a fledgling agency, but a powerful force in the Delaware political and economic scene with strong ties to the federal highway administration. Most new bridge designs originated in the department's bridge division where the state's bridge engineers chose from well-established, standardized bridge technologies of rolled steel beam and reinforced concrete materials. The engineers brought with them a scientific approach to bridge building that stressed theoretical and practical knowledge of structural behavior, strength of materials, and economy of design. When they viewed their plans for Delaware's roads and bridges, they adopted an essentially national outlook, but molded it to fit local conditions. ■