THE IMPORTANCE OF USING CONTEXT TO DETERMINE THE SIGNIFICANCE OF DUALIZED HIGHWAYS

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Today, the most common type of dualized highway is the standardized limited access interstate highway familiar to all. The interstate highway system was established by the 1956 Federal-Aid Highway Act, but the concept of dualization and its development for safely handling dense levels of high-speed motorized traffic dates in concept to at least 1908 in the United States. Federal, state and local highway engineers developed dualization to maturity from about 1920 to 1941. It was a well understood highway design concept by the time engineers applied it to most American metropolitan areas after the end of World War II in 1945.

A dualized highway has opposing directions of traffic separated by a median. Dualized highways can be designed with two or more lanes, but four lanes is the most common built. Medians separating traffic flows can be strips of concrete, asphalt, or grass or they can be vertical barriers like the safety shape "Jersey" type. The primary advantage of a dualized highway is that it reduces the risk of head-on collisions and side swiping. It permits traffic to proceed quickly and efficiently with the faster vehicles more safely overtaking slower vehicles traveling in the same direction. A limited access dualized highway does not allow access to and from property abutting the highway; vehicles may enter and leave only at selected points, generally located at important cross streets or highways. Dualized highways usually have higher construction and maintenance costs than non-dualized highways, but in other respects they are built using the same materials and construction technology.

A Context for Understanding the Historical and Technological Significance of Dualized Highways

Dualized highways are found in every state. As physical features on the American landscape, they show remarkable standardization and uniformity. They are pointed to as the products of the nation's obsession with the automobile, arguably the defining technology of our culture. Dualized highways ubiquitously stripe the landscape, subdivide cities and demarcate locations of economic activities. For better or worse, they are a pervasive influence on our daily lives. But now that many of these highways are reaching 50 years of age, does that make all of them historically significant? How does one evaluate the significance of dualized highways that are seemingly remarkably like thousands of miles of nearly identical highway throughout the nation?

The significant question for historians of mid-20th century highways is the one that asks "how did these roads develop and reach such an unprecedented level of standardization?" Answering this question offers the most benefit in helping to distinguish historically significant dualized

highways from ones that are not. The best explanation for the form and appearance of dualized highways is not that they merely are a credit to the place of the automobile in our society, or that they stimulated the growth of suburbs, but that they are the efforts of government engineers that emerged as the key actors in the development of America's 20th century highways.

The idea for America's earliest dualized highway is believed to have been put forth in about 1908 by T. Coleman du Pont, a wealthy industrialist, avid automobile enthusiast, MIT-trained engineer, and scion of the famous Delaware family. Du Pont offered to construct with his private fortune a 100-mile long dualized highway the length of Delaware. The highway as envisioned by du Pont was a multi-modal design with opposing traffic lanes separated by grass medians that would be wider at certain intervals to accommodate airplane runways. Each direction of traffic was to have separate lanes for motorized automobiles and trucks, and other lanes for streetcars, horse-drawn vehicles and pedestrians. Du Pont reasoned that the highway could be self-supporting based on income obtained from rental of the adjacent roadside to farmers and franchises to utility companies that could also use the right-of-way. Another innovation promoted by du Pont was that the highway would bypass the smaller towns along its route thus alleviating general congestion, dangerous and congested intersections, and the taking of in-town properties for the right-of-way.

Du Pont's proposal was a grand vision unlike any other of its time. He claimed that part of its inspiration was the Parisian boulevard, but there was far more to it than that, as it combined concepts of double-tracking and freight by-passes long used by the railroads, and a democratic concept of building a highway that everybody, no matter their wealth or vehicle, could use. Du Pont had traveled Europe and the United States surveying road design and construction technology, and he had given highway technology a lot of thought; his proposal was more than a crackpot idea. Du Pont's genius for organization and management as president of the DuPont Company, and his family's domination of politics in a small state, made his highway seem entirely feasible.

Du Pont's project was approved by the State of Delaware in 1911. He created a corporation, named the Coleman du Pont Road, Inc., and hired a staff of young college-trained civil engineers, many of whom would later remain in Delaware for the rest of their careers as the senior engineers of the Delaware State Highway Department, established in 1917. Du Pont surveyed a nearly straight-as-an arrow route and began to purchase between 100 ft. and 200 ft.-wide rights-of-way, a width unheard of in the years leading up to World War I. It was the huge expense of construction and delays caused by a few suspicious farmers reluctant to sell out, however, that finally caused du Pont to scale back his plans and drop the multi-modal concept. He reasoned that he could begin small to prove the worth of an all-weather highway, and then expand it into a dualized road in later years. Actual construction was limited to a two lane, non-dualized concrete-paved highway. The road was completed in 1917 except for some short lengths in northern Delaware around Wilmington. It was subsequently donated to the state, which had established a state highway department to begin developing a state highway system using the DuPont Highway as its arterial spine. The Delaware State Highway Department with du Pont's son, Francis V. du Pont, as chairman, dualized the DuPont Highway from two to four lanes with grass medians beginning in the early 1920s, a task greatly simplified by the previously purchased, wide right-of-way. The DuPont Highway, designated US 13 in 1926, is considered

the first dualized US-numbered highway of significant length in the United States. In the 1920s and 1930s, the dualized road was hailed as one of the finest highways in America.

As automobiles and trucks increased in weight and speed, the wisdom of du Pont's plan became apparent. During the 1920s, highway engineers generally accepted that narrow roadway widths contributed to head-on collisions and side swiping, and that the number of accidents could be reduced by wider roadways and traffic flow separated by medians. The benefits of wide rights-of-way, controlled access and elimination of grade crossings were all proven prior to 1926. As one pavement advertiser in *Roads and Streets*, a periodical aimed at highway engineers and contractors, put it, "Power plus room in which to use it – that's the formula for speed with safety." Most, including the federal Bureau of Public Roads (BPR) that controlled highway construction policy because it controlled the purse strings, considered them special roads for special circumstances related to local problems, like traffic congestion in urban areas. BPR argued in the 1920s that a network of high-speed through roads like du Pont envisioned was not necessary. Dualized roads were expensive, and that since urban congestion and accidents were local problems, they should be solved by locals.

While dualized roads stayed more vision than reality in most places until the late 1930s, a few other states like New Jersey, New York and Massachusetts were building them in urban areas. New Jersey in particular was ahead of other state highway departments in recognizing the need to develop limited access highways in order to segregate local and through traffic. Between 1926 and 1932, when the Pulaski Skyway was finished, the New Jersey Highway Department planned and built what is considered by many America's first super highway. The 13-mile long approach to the Holland Tunnel recognized the severe economic impact of traffic congestion and developed an effective highway to "unscramble" through and local traffic in fully developed urban areas and stands as testament to the ability of local solutions. With no precedent, the New Jersey State Highway Department came up with a design that accommodated separation of not only different classifications of vehicular traffic but also accommodated train and marine traffic, as well as access to a major river crossing. Enjoying a remarkably complete state of preservation, this urban expressway is without parallel in historic significance in this country.

But the more typical projects were the short, 2- 3-mile long limited access roadways like Chicago's 1933 Lake Shore Drive, Manhattan's 1931 start to the Henry Hudson Parkway on its west side, and Detroit's 1936 Woodward Avenue. All were aimed at relieving urban congestion by eliminating grade crossings and controlling access. Cities with large, and even modest, dualized highway construction plans invariably ran into financial and political problems, and prior to the late 1930s there was precious little financial help from the state or federal governments. The federal aid program, and indeed most state aid programs that had originated as getting the farmer-out-of-the-mud programs, were designed to pay for rural roads and did not fund road improvements in larger towns or cities. Urban expressways were by default locally financed and designed projects that often proved well beyond a single community's ability to fund or see to completion.

Clearly among the outstanding examples of 1920s and 1930s dualized highways in an urban setting were the parkways in greater New York City. The popularity of the 1921-1924 Bronx River Parkway quickly transformed it from a s scenic pleasure way into what many considered a

speedway. The first commuter parkways, the Saw Mill River and Hutchinson River parkways were begun by Westchester County in 1925-26. They combined dualized roadways and limited access with park atmosphere. The story of Robert Moses and the Long Island parkway system is well known by highway, automotive and urban planning historians. The first limited-access, high-speed parkway, the Meadowbrook Causeway, opened in 1934, and 85 miles of parkway in Long Island were completed from 1933 to 1938, largely with assistance from New Deal-work relief funds and labor. The cost of this parkway system was staggering but justifiable, or so it seemed at that time, only in the context of America's largest metropolis.

Not even the vision of Robert Moses incorporated all of the characteristics of what today is thought of as a limited-access, dualized highway. As historian Bruce Seely has so brilliantly analyzed, the technical expertise and influence over public policy required to carry out the transforming vision of a system of modern dualized highways was gathering in a triumvirate of increasingly powerful institutions—the federal Bureau of Public Roads (BPR, now known as the Federal Highway Administration), the American Association of State Highway Officials (AASHO, now known as AASHTO), and the state highway departments. These institutions and their engineers are the most important actors for understanding the relative significance of dualized highways designed and built starting in the late 1930s. In fact, their influence on standardized highway geometrics predates significantly the whole dualized movement. To address the disparity in design practices among the states, BPR worked to the formation of AASHO in 1914, and in 1928, "standards of practice," which include the 12'-wide travel lanes with 8'-wide shoulders and at least 6' wide shoulders across bridges that are still standard design policy, were adopted.

A vital area of influence for federal engineers was their leadership in research and planning, which they used to justify the need for improved roads in urban areas. H. S. Fairbank, a civil engineer who joined the BPR in 1910, literally wrote the book on "origin and destination" studies that identified the volume and nature of traffic, and prepared rigid guidelines for uniform data collection. The BPR wanted to base highway construction on need, so the use of Fairbank's data, which showed that most traffic was in and out of, not through, cities, was interpreted by federal and state engineers to determine which roads required modernization or dualization. The studies also illustrated to BPR that dualized arterial roads penetrating the central business districts of cities should be the funding priority. After 1936, BPR steadily shifted its focus to urban highways, and while the process to completion was tortured and slow, the model of the standardized-design dualized highway that was to flourish after World War II was developed and perfected by war's end in 1945.

Federal and state highway engineers were increasingly aware of the many different characteristics of highway geometrics and construction that had an impact on safety and capacity of high-speed roads. These characteristics included shallower, banked curves, fewer blind spots, longer sight distances, elimination of steep grades, truck climbing lanes, and controlled access. Additionally, they included the advantages of roadway surfaces that offered greater skid resistance and durability, and wide improved shoulders for emergency stopping and recovery.

Joseph Barnett (1897-1973), a civil engineer who cut his teeth on the Westchester County parkways, had as much as any individual to do with standardized highway geometrics in this

country. He joined the BPR as senior design engineer in 1933, and he quickly rose through the Bureau to become the federal government's urban expressway specialist responsible for the design of many post-World War II urban expressways. Barnett retired from FHWA in 1966. He was a pioneer in the standardization of geometric design. His philosophy was of "balanced design," which means that every element of design, from curve radius, sight distance, superelevation and gradients, should be determined by speed so that drivers would not encounter surprises. This was a crucial step in the development of safe, high-speed highways. In 1937, to facilitate implementation of this concept, Barnett developed a table for transition curves. Between 1938 and 1944, in his capacity as secretary to the AASHO Committee on Planning and Design Policies, Barnett worked to develop and have adopted by AASHO seven policies on geometric design ranging from highway classification of intersections and sight distances. The policies were reinforced by federal aid programs that strongly encouraged state highway departments to spend federal funds on highway projects that met the technical policies. The same policies formed the nucleus for later ASSHO policies for rural highways adopted in 1954 and arterial highways adopted in 1957.

Barnett's and the federal government's role in standardizing dualized highway design is enormous. Even though the policies, which were used as design standards in most states, were released through AASHO, the federal involvement is as unmistakable as it was profound and ubiquitous. While they were not the only highway designers of urban expressways they were the primary source of approaches and geometric design policy.

Ironically, the dualized highway that turned out to be the prototype of the modern high-speed highway, the 1938-1940 Pennsylvania Turnpike, was built against the wishes or involvement of the federal BPR and the Pennsylvania Department of Highways. The limited access, grade separated, dualized highway through a challenging mountainous terrain had all the most advanced practices—a 200 ft.-wide right-of-way, 12 ft. wide travel lanes, a 10 ft. wide median, shallow, banked curves, grade separated intersections, long acceleration lanes, and grades greater than 3%. It was built by a private commission that promised to use the toll revenue to pay back a federal loan from a New Deal agency. The BPR and state highway department vigorously opposed the project, not on technical grounds, but on the grounds that tolls threatened their hard won fight to fund a system of free state highways through dedicated fuel taxes. In perhaps one of their greatest miscalculations, the engineers of the BPR claimed that their data proved that the Pennsylvania Turnpike would never pay for itself. The turnpike's success, however, proved them wrong, and it led to the establishment and construction of about a dozen turnpikes, especially in the Northeast and Midwest, in the years after World War II.

Despite the increasing maturity of the dualized highway technology, construction of dualized highways was not common in most states until after 1945. Indeed, the most important factor limiting the construction of new dualized highways was their cost and disagreements about how to finance them. The difference between a dualized highway and a non-dualized highway was for the most part a matter of expense, since construction technology was the same for both. Dualized highways were much wider and thus had much greater right-of-way acquisition costs. Similarly, clearing, drainage, grading and surfacing costs increased with a dualized road.

Political factors were also influential in limiting the construction of dualized highways. Faced

with the huge task of improving and maintaining thousands of miles of highway, most state highway departments, with some exceptions in heavily urbanized states such as New Jersey, chose to allocate their funds for improving greater mileage of non-dualized highway across the state rather than concentrating funds on lesser mileage of dualized highway on a few heavily traveled roads. Political pressure from urban interests to do something about their growing traffic problems, however, brought about a change in federal highway policy beginning in the late 1930s. The first federal aid expenditures inside of towns and cities with populations of greater than 2,000 began in 1936 with some limited funding to improve the main arterial roads. The 1944 Federal-Aid Highway Act initiated the first large federal aid payments for urban expressways, and many of them, like the Penn-Lincoln Parkway in Pittsburgh and the Schuylkill Expressway in Philadelphia, were built as reactive solutions to regional traffic congestion problems. They reflected the BPR and ASSHO geometric design policies, and they penetrated the central business districts, just as the concept developed in the mid 1930s. They are uniform products produced in response to nationally established policies and design practices—common solutions to standard problems.

As is well known, the national highway-building program took a great leap forward with passage of the 1956 Federal-Aid Highway Act. This was the act that established today's system of limited access interstate highways, also known as the National System of Interstate and Defense Highways. With 90 percent federal funding, the interstate system was built with an unprecedented level of technical standardization that made obsolete or substandard many of the earlier 1940s and 1950s dualization efforts to the US-numbered highways. The federal funding formula gave BPR unprecedented control over policies and design standards. Most of the interstate highway system was built on new right-of-way bypassing the older US-numbered routes, although some sections of previously built urban expressway were incorporated into the interstate system like in Atlanta, Boston and many other cities all across America.

For anyone trying to understand the significance of dualized highways, must reading and understanding is Bruce Seely's *Building the American Highway System: Engineers as Policy Makers* (1987) and his article, "Urban Freeway Development and the Bureau of Public Roads, 1930-1950," in the *SCA Journal* (Spring 1997). What he identifies is a largely unwritten history of a small group of American highway engineers, who working rather quietly and obscurely to the public and using a mantle of apolitical technical expertise, carried out the role of shaping the American highway and ultimately had a great impact on the landscape. By the time this group of government engineers got around to building the interstate highway system, the era of experimenting with highway design was over and they had complete control over the basic uniformity and appearance of dualized highways.

In practical terms, what does this mean for evaluating the significance of dualized highways? Some dualized highways built before 1941 fall into the era of experiment and development on the path to a mature technical understanding of designs characteristics for safe, high-speed, high volume roads. Many of these early dualized roads were not successful because they lacked some critical component of design, like controlled access from adjacent property owners, adequate capacity, appropriate turning radii, or adequate acceleration and deceleration lanes.

In any study of a state's dualized highways, a critical area of understanding must be the role of

the state highway department and the influence of federal aid programs on it. It must be understood that except in a few instances, state highway departments were working in a national context in partnership with federal policy makers and federal engineers, and used established design standards that were modified at times often only slightly to accommodate special local conditions. Almost any plan set references AASHO standards for geometric design or a version of the AASHO standards modified for use in a particular state. They will also make reference to American Society of Testing Materials (ASTM) standards for the quality of materials, such as concrete, reinforcing bars and guide rails. Meaning that many post-World War II dualized highways do not meet National Register of Historic Places Criterion C. It also means that specific research is needed to support whether these roads, which were most often built as reaction to, not as stimulus for, development and traffic congestion, are significant under National Register Criterion A. Most were at or under capacity when they were opened.

Once significance has been evaluated, the same contextual considerations need to be tested against the aspects of integrity. Highways are physical entities consisting of travelway widths and numbers of lanes, foundations, pavements, grades, guide rails, signage, lighting, median design and material, bridges, etc.—all design elements that are or were and integral to and considered part of the highway, and thus elements that factor into determining if it meets the aspects of integrity. Most of the dualized highways that might have historic significance, like the Maine Turnpike of the Penn-Lincoln Parkway in Pittsburgh, are the ones that continue to service high volumes of traffic and have changed over the years to keep up with current safety and capacity considerations.

In order to achieve supportable justifications about significance, historians must look at the original plans including geometry, roadway profiles and paving materials, intersection designs and historic photographs to assess integrity. These elements are as important to the road as the resource, as elements are to a building. Their presence or lack thereof needs to be assessed and considered as part of the complete evaluation.

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The authors are indebted to the leading scholarship in federal highway policy provided by Dr. Bruce Seely of Michigan Technological University. His insightful thinking has done more to promote an understanding of the role and significance of federal engineers in our culture today than any other works available. His wisdom and guidance are invaluable.