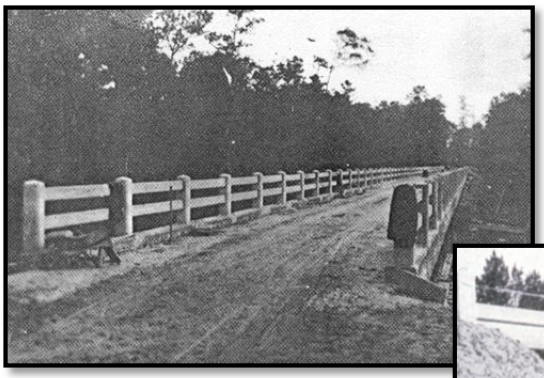
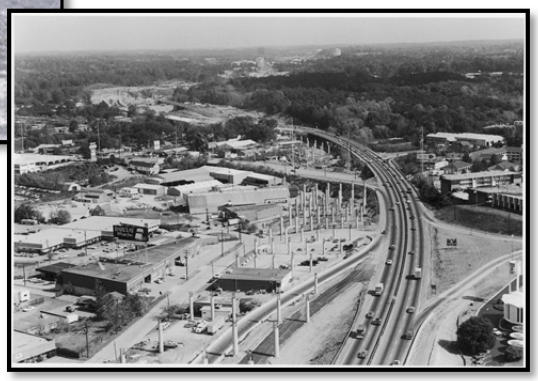
Transportation Contexts for Georgia, From Colonial Trails to Interstate Highways

- **Pre-1956 Transportation Networks & Bridge Technology, Including Tourist Trails (Part 1)**
- **Historic Context for Dualized Highways in Georgia Prior to 1956 (Part 2)**
- **Historic Transportation Context 1955-1965 (Part 3)**
- **Historic Context for Bridge Building Technology in Georgia 1955-1965 (Part 4)**
- **Historic Context for the Interstate Highway System in Georgia (Part 5)**





Office of Environmental Services
Georgia Department of Transportation

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Foreword by Dr. William R. Bowen, Ph.D.

Foreword: Georgia's Historic Bridge Context

North American bridges are as old as the first people who lived here—the Native Americans some twelve thousand years ago. In historic times, numerous Indian trails and paths are known to have run north and south, east and west across the southeastern United States connecting towns and villages with trading posts. These early transportation corridors crossed unavoidable bodies of water, primarily rivers and creeks. Rivers and large creeks required passage at areas of the stream where the water was shallow with a firm, rocky bottom. Smaller streams could be crossed by using a naturally occurring bridge such as a fallen tree or by placing an old log over the waterway. Who of us has not crossed a stream this way before?

Bridges are integral components and defining features of most terrestrial transportation facilities. Bridges provide the connections which make it possible for these facilities to be seamless, uninterrupted by fords, ferries, transfers and bypasses which require detours or breaks in the primary transportation mode. This is true whether the bridge is spanning a body of water (stream, river, lake or reservoir), a gorge, or some other transportation facility such as a roadway, a railroad, or walking and bike trails, and even airport runways. For an example of this last bridge, we have only to look at the recently completed "fifth" runway at Atlanta's Hartsville-Jackson International Airport. The proximity of the airport to Interstate 285 made it necessary to construct a facility that could span all ten lanes of the interstate at this location (approximately 900 feet). And since the facility carries a runway, a taxi facility, and a service road, it is a whopping 2000-plus feet wide.

The distinctive engineering and design features of bridges, though usually intertwined, often provide the identifying character for a transportation facility. When we think of U.S. Highway 17 in Savannah, the new Talmadge Memorial Bridge comes to mind as does the Sidney Lanier Bridge over the Altamaha River, also on U.S. 17, in Brunswick. These two structures are Georgia's only cable-stayed highway bridges. Numerous local roads are often named for bridges since everyone who lives in the county is familiar with the particular structure. Harden Bridge (a large steel truss) on Harden Bridge Road over the Etowah River in Bartow County, Concord Covered Bridge on Concord Road in Cobb County, Big Red Oak Creek Covered Bridge on Covered Bridge Road are a few examples. Obviously, using bridges as geographical identifiers indicates the importance of these structures to our transportation system and our local and state histories.

Bridges come in all shapes and sizes, materials, and designs. Some bridges are long and narrow while others are wider than they are long. Some carry only one lane of traffic while others carry multiple lanes divided by medians with on and off ramps for merging and exiting traffic. Some are made of wood, while others are constructed of

metal and others concrete and masonry. Some bridges are supported by ground mounted piers and abutments; others are suspended from cables while even others may float on pontoons on the water's surface. Many factors determine a bridge's engineering, including the geography, geology, topography and weather of the crossing location and the transportation need (what type of traffic is anticipated—pedestrians, bicycles, automobiles, large trucks, airplanes!). These factors help determine whether the bridge will be a simple concrete slab, a steel stringer, a cable-stayed, an arch, a wood or metal truss, or a combination of these, as well as special engineering features that may be required such as cantilevering. Also, let's not forget our bridge culverts, viaducts, and trestles which provide special transportation needs.

With the passage of the National Historic Preservation Act in 1966 and its implementing federal regulations (36CFR800) and the passage of the Federal Highway Act three years later, bridges became recognized as serious contributing components of America's historic engineering heritage. The legislation lays out the historic preservation process and requires that for all projects where federal funds, licenses and grants are to be used, the agency--or any entity in charge of the project--must take into account that project's effects on resources that are on or eligible for inclusion on the National Register of Historic Places (NRHP). As historic resources, bridges were to be evaluated for NRHP eligibility as well as the transportation facilities they connected.

In order to be considered for eligibility for the NRHP a resource must generally be at least 50 years of age and fulfill at least one of four criteria. The resource must be associated with (1) an event of historical importance, (2) a person of significance in our history, (3) a type of structure that is considered significant, or (4) it must contain information which is significant to the understanding of our past. These are usually referred to as National Register Criteria A through D. The resource must also retain at least some measure of physical integrity.

Bridges are most often determined eligible for the NRHP using Criterion A and Criterion C—transportation history (A) and type, design and engineering (C). Occasionally a bridge will be determined eligible under Criterion B for its association with an important bridge designer or an important bridge builder (e.g. Horace King). Criterion D is usually associated with archaeological sites.

Regarding age, the lifespan of a bridge is determined by several factors including the materials used for construction, engineering design, traffic (how much and how heavy), the maintenance program, weather, changes in roadway geometry, and damage--both natural (e.g. flooding) and manmade (e.g. wrecks). Generally speaking, however, bridges are considered to have a fifty-year lifespan although most are maintained in operation for much longer periods. Some, however, require replacement or

rehabilitation at much shorter intervals due to various reasons such as damage, poor design, poor construction, and changing design or use of the accompanying roadway.

Because of the need for states to establish their own historic preservation offices and develop their own guidelines (all of this took time, money and organization within state governments) it was several years from the passage of the aforementioned preservation and transportation laws before they were fully implemented. Also, except in cases where bridges were truly considered exceptional by the historic community (these were usually rare bridges such as the covered bridges and bridges of exceptional engineering such as the arches and some trusses), the “run of the mill” bridges such as the slabs and stringers were given very little attention because they were so numerous, repetitive, or simple in design.

But bridges were now part of the historic resource base and required historic preservation evaluation and processing. At first these “run of the mill” bridges were handled on a case by case basis as they came up for replacement or rehabilitation. Each was evaluated individually and not necessarily compared to the total population of bridges in the state, although this information was readily available through records in the state bridge engineer’s office. The time consumption required to conduct these individual evaluations was both frustrating and project delaying. Each case reinvented the proverbial “historic wheel.”

For this reason, the Georgia Department of Transportation (GDOT) undertook the development of its first bridge context study in 1981. This initial study addressed those bridge types that, at the time, were deemed most significant to the state’s transportation history. The study was limited to pre-1940 masonry arches and wood and metal trusses since these were relatively rare, of significant engineering design, and were being demolished and replaced at an alarming rate. The context itself set out to identify all such bridges so that they could be compared to all other extant bridges of that particular type in the state and evaluated for overall integrity, design, age, and number. The pre-1940 age cut-off made sure that all bridges 50 years of age and older would be included as part of the study and the additional ten years would ensure that the study would be relevant for an additional decade.

As previously stated, all historic covered bridges in the state were considered eligible for the NRHP. For this reason, these bridges did not need to be considered in a context. There was, however, a need to fully document these structures for historic purposes as well as cultural posterity. Therefore, in the mid-1990s, GDOT produced a publication of the remaining historic covered bridges in Georgia. At the time of the study, there were less than twenty such structures still extant in the state. The loss of these structures is primarily due to vandalism (arson), neglect (failure to repair and replace leaking roofs, rotten timbers and eroding abutments and piers), and natural disaster (flooding).

In 1997 the first comprehensive historic bridge context study was undertaken by GDOT. This study included all pre-1956 bridges with the exception of those previously addressed in the 1981 study. This context set out to address all criteria which would need to be evaluated to determine a bridge's historic significance. Not only were the bridges' ages and types reviewed, but also other defining data such as population size, builder, geographic location, and distinguishing engineering features (length, width, balustrade, cantilevering, façade design, etc.). This study, produced with the collaboration of bridge engineers and historic preservationists, derived at mutually determined recommendations regarding NRHP eligibility, replacement, rehabilitation, and preservation. With this study, the GDOT greatly enhanced its ability to comply completely, timely, and effectively with federal and state environmental laws and regulations.

The goal of the current study is to update information from the 1997 study and to extend the population of bridges evaluated up through 1965. This time interval (1956-1965) is extremely significant in the history of bridge construction in Georgia due to the advent of the interstate highway system and computer-aided bridge engineering and design. One important feature of the current study is the inclusion of the data in the state's Natural, Archaeological and Historic Resources Geographic Information System. The information produced by the study will now be readily available to preservationists, historians, and other interested professionals, along with members of the general public. The employees of GDOT should be commended for their ongoing dedication to a high level transportation program and pursuit of the historic preservation of significant transportation features.

William R. Bowen, Ph.D.
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Introduction

This compilation of bridge and highway development historic contexts represents over 20 years of the Georgia Department of Transportation's (GDOT) efforts to increase understanding of the state's population of pre-1966 bridges and its interstate highways. The first study to identify historic bridges was initiated about 1979 for masonry arch and truss bridges, which were deemed most significant to the state's transportation history. Eligibility recommendations were completed in 1981. In 1994, GDOT in cooperation with the Georgia State Historic Preservation Office (SHPO) and Federal Highway Administration (FHWA) division office, initiated an inventory of most other types of bridges built before 1956. That study was directed by Dr. Gail A. D'Avino, and the work was done by Lichtenstein Consulting Engineers (LCE) of Paramus, NJ. Two historic contexts, *Transportation Networks in Georgia* and *Bridge Building Technology in Georgia 1900-1955*, served to define significance and to support National Register eligibility recommendations. At the request of the SHPO, that study was augmented in 1997-99 by a historic context for pre-1956 highways or roadway segments with median divided, dualized travel lanes (dualized highways).

In 2007, GDOT retained LCE to update the historic bridge inventory and the historic contexts for bridges and highways built from 1955 through 1965. As before, *Historic Transportation Context 1955-1965* and *Historic Context for Bridge Building Technology in Georgia 1955-1965* served to inform and support eligibility recommendations. To complete the history of Georgia's highway system, a context for the completion of the interstate highways was prepared. The post-1955 studies were done under the direction of Dr. W. Rowe Bowen and Sandy J. Lawrence and with unfailing support and assistance from GDOTs bridge sections, GDOT library, and the state archives.

GEORGIA DEPARTMENT OF TRANSPORTATION
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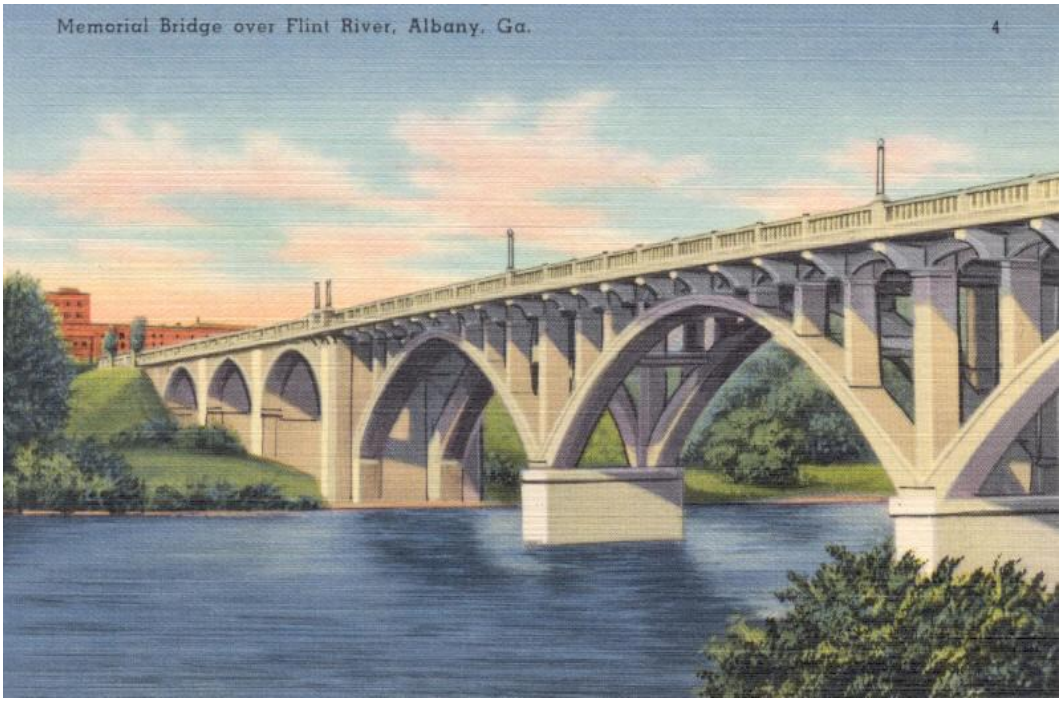
HISTORIC BRIDGE INVENTORY UPDATE FOR PRE-1956 NON-ARCH OR NON-TRUSS BRIDGES TRANSPORTATION NETWORKS & BRIDGE TECHNOLOGY



Open spandrel arch bridge over the Flint River in Albany. Postcard, ca. 1940.

HISTORIC CONTEXTS

June 2001
Lichtenstein Consulting Engineers

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GEORGIA DEPARTMENT OF TRANSPORTATION
HISTORIC BRIDGE INVENTORY UPDATE

Introduction

To assist with establishing the significance of the historical background of bridge building in Georgia, it is important to identify and understand the historic contexts associated with the resources. The bridges do not stand in isolation, historically or physically; they embody events and trends that must be considered when evaluating their individual or collective historical significance. Historic contexts organize historic resources in terms of theme, place, and time.

In order to evaluate the National Register eligibility of the pre-1956 bridge population in Georgia, two historic contexts have been researched and prepared: one on the history of the development of transportation networks in Georgia, and the second on the application of bridge technology within the state. Both contexts address transportation issues from the earliest days of settlement to 1956, and both set Georgia within the national context, noting how the state conformed to or differed from national trends. The contexts are based upon a wide variety of primary- and secondary-source materials, including but not limited to state archival materials, annual reports and plans of the highway department, state and local histories, historic atlases and maps, county official records, historic photographs, railroad corporate records, and technical literature like engineering journals and bridge engineering books.

The historic contexts developed for the Georgia Historic Bridge Inventory Update build upon the historic research prepared for the 1981 Georgia Historic Bridge Survey. The update does not consider the state's masonry arch and metal truss bridges in depth because these bridges were researched as part of the previous survey. Rather, the update takes the story of Georgia's bridge technology into the mid-20th century and focuses on the rolled steel beam and reinforced concrete bridge types that dominate Georgia's pre-1956 highway bridge population. These bridges reflect national trends toward increased strength of materials and well-established, standardized bridge technologies in an effort to build large numbers of highway bridges based on capacity, economy, and ease of erection and maintenance.

The history of Georgia's post-1900 highway bridges is also the story of the development of modern roadways to carry motor vehicles quickly, smoothly, and safely. Modern roadways and bridges are a step in the evolution of Georgia's transportation landscape that has been shaped in turn by navigable rivers and wagon roads in the 18th century and by turnpikes, canals, and railroads in the 19th century. The new 20th-century transportation system of motor vehicles and highways followed well-established patterns of travel and trade within and through the state, as well as created new

patterns. The rise of the automobile was a national trend made possible in part because of massive road improvements funded by federal and state governments. The Georgia State Highway Department was created in 1916, and like its counterparts in other states, constructed hundreds of bridges as part of the campaign to create a state highway system and improve thousands of miles of roadway for ever-expanding vehicular traffic.

The historic contexts provide a means of evaluating each bridge's technological significance, and its historic relationship to Georgia's transportation systems and their impact on state and local community planning and development.

Overview of Transportation Networks in Georgia

Bridges are integral parts of transportation networks that carry people, vehicles, and materials over natural barriers such as rivers and streams, and over man-made barriers such as railroads, canals, and other roads. They are utilitarian structures that function within larger transportation systems to support the social and economic life of the state.

Georgia's transportation history from the 18th century to the present has been characterized by a series of technological changes aimed at increasing capacity, speed, directness, flexibility, and regularity of service. After the initial period of colonial settlement, the first great period of transportation growth occurred from about 1800 to 1860 when turnpikes, canals, and railroads were introduced to advance the state's agricultural potential. Nationally, the period has been called the "transportation revolution" because of the impact these transportation technologies had on the transition from a colonial economy that was concentrated within 100 miles of the Atlantic Coast to a growing interconnected national economy that stretched from the east coast westward to the Mississippi River and beyond.

The second extraordinary period of transportation growth occurred from 1865 to 1910 when Georgia's railroads recovered from the devastation of the Civil War and increased mileage from approximately 1,400 miles of track to over 7,000 miles. Throughout the South, the expansion and consolidation of the railroads into several regionally dominant lines, such as the Central of Georgia, the Southern, the Louisville & Nashville, the Atlantic Coast Line, and the Seaboard Air Line, ushered in the era of the New South and its growing cities, industries, market towns, and cotton economy of sharecropping and tenant farms.

The third period of transportation growth occurred after 1920 when the state's roads and bridges were substantially modernized in stages to handle increased load requirements and increased volume of automobile and truck traffic. The result was to shift the emphasis from railroads to highways.

While Georgia's transportation history can be broken down into three important periods of development, the overall picture is much more complex. New transportation systems did not immediately replace old ones, rather they were integrated into existing networks. Thus, for many years, railroads transferred traffic to boats at navigable rivers and harbors. Likewise, competition between truck traffic and railroads was intense from the 1920s to 1950s. Some railroads and navigable rivers still play important although limited and specialized roles in the state's economic life, whereas numerous others have been abandoned. Georgia's transportation networks are best read as a series of cumulative developments that have left a direct and strong imprint on the cultural landscape in the form of right of way, road surfaces, railroad tracks, artificial water features, and bridges.

Georgia's transportation patterns have been heavily influenced by their specific roles in the movement of natural resources, goods, and people. Much of the state's history has been characterized by an economy based on agriculture and the extraction of natural resources. The economic potential of timber, mineral wealth, and staple crops like tobacco and cotton spread populations across large rural areas. The patterns of transportation were similarly diffuse and radiated from regional market centers such as Atlanta, Savannah, Augusta, Athens, Macon, Columbus, and numerous other smaller market towns and county seats. Turnpikes, canals, and railroads developed to serve the agricultural economy, but the seasonal and cyclical volumes of traffic and long distances limited investment in equipment, right-of-way improvements, and bridges. From a national perspective, Georgia and other rural states of the Southeast rarely were leaders in the development of new transportation technologies. Furthermore, equipment and infrastructure tended to be more lightly built than counterparts in the urban and industrialized Northeast.

Georgia's transportation patterns remained localized and oriented in an east-west direction from the interior to the coastal ports of Savannah and Charleston until the late 19th century and the advent of integrated rail systems. Early market towns were situated along navigable waterways such as the Savannah, Altamaha, Ocmulgee, Oconee, Chattahoochee, and Flint rivers. Augusta, Macon, and Columbus were founded in large part because of their advantageous position at the fall line, the transition point between the uplands and navigable headwaters. Dry goods, groceries, and farm supplies were delivered to river landings by boats, which in turn hauled agricultural products to the coast. Waterways were the transportation lifeblood of the cotton trade, and they served to connect plantations and river towns with ocean ports and the transatlantic markets in Europe.

Prior to the Civil War, long-distance overland roads were inefficient competitors with water routes, and antebellum railroads tended to serve only intraregional markets. Different gauge tracks, separate terminals, and sporadic service and schedules limited

through connections, especially for bulk freight. After Reconstruction, railroad companies consolidated operations and developed interregional systems to carry grain, flour, meat, and manufactured goods from the north to the south, and agricultural products back north. By 1880, two important interregional routes had emerged: one running northeast-southwest across the Georgia Piedmont and part of a larger route running in a crescent shape from Washington, D.C. to New Orleans; and the second running northwest-southeast from the Ohio and Mississippi river system through the mountains in the vicinity of Chattanooga and to Georgia. Atlanta quickly grew into one of the South's leading cities as a center of distribution and manufacturing at a point where the two routes and their various branch lines intersected. Railroad connections were extended southward to carry vacationers to Florida after about 1890. In most instances, the railroads developed the interstate routes that would later be paralleled by state highways.

Finally, Georgia's bridges document the evolution of the institutional and financial arrangements through which highway bridges were built in the state. The responsibility for highway bridge building evolved from a highly localized activity carried on by private individuals and elected local officials to a complex interaction between and among local, state, and federal officials and contractors. In the late 19th century, many Georgia communities still relied upon local craftsmen to build timber structures, often covered timber truss bridges, or continued to call upon ferry operators to carry people and goods across the state's numerous rivers. By the early 1900s, the trend was increasingly toward trained bridge engineers in the employ of bridge building companies or local governments, and after 1919 in the employ of the state highway department. 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. They measured progress by their ability to build bridges of greater strength, span, and durability to replace the functionally inadequate ferries and bridges of the earlier age. The many steel and reinforced-concrete highway bridges that comprise the Georgia Historic Bridge Inventory Update are part of their engineering legacy.

Transportation Networks Prior to 1916

Transportation Networks in the Colonial and Early National Periods

Although the overwhelming majority of Georgia's historic bridges date from the 20th century, the highways and byways on which they are situated reflect patterns of transportation that began their evolution in the colonial period. When Europeans first settled at the Savannah River in 1733, they found what was to them a wilderness with the only transportation networks the natural navigable rivers and the trails used by

Native Americans to travel between villages. Over the next 70 years, the settlers spread over the coastal and Piedmont regions of what today is modern Georgia. In the process, they transformed the landscape by clearing land, establishing cultivated plantations and farms, and building towns. The transportation system integrated river transport with overland roads and firmly established Savannah with its ocean port as the center of trade and commerce. The navigable rivers were the state's transportation corridors until the eve of the Civil War. The state's most prominent towns were those with river landings, such as Augusta at the navigable headwaters of the Savannah River; Darien at the mouth of the Altamaha River; Milledgeville at the navigable headwaters of the Oconee River; Macon at the navigable headwaters of the Ocmulgee River; Albany and Bainbridge on the Flint River; and Columbus at the navigable headwaters of the Chattahoochee River.

As was true with much of the South, agriculture dominated the economy of 18th-century Georgia. The coastal area between the Altamaha and Savannah rivers initially was home to the majority of the population, and it was here that rice plantations provided the colony with its first important staple crop. Rice was shipped to Savannah by boat, and then marketed for the coastal or Atlantic trade. As population grew, the frontier was pushed northwest of Savannah along the course of the rivers, and then westerly across the Piedmont, where farmers found the soil particularly fertile. By the 1770s, immigrants from the Carolinas and Virginia had transplanted tobacco culture to the Broad River Valley northwest of Augusta, which by virtue of its location at the head of navigation of the Savannah River had grown from a military outpost to become an important regional market town.

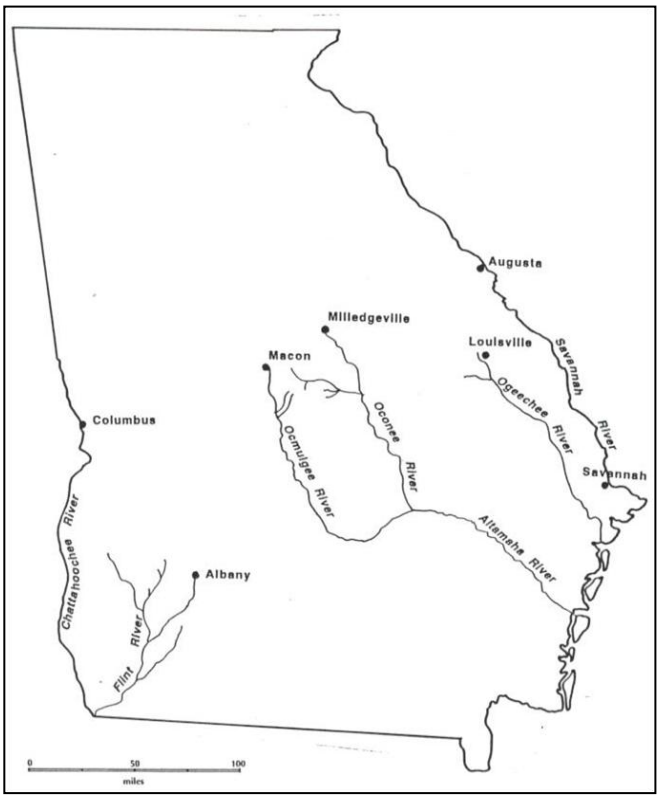

Figure 1: Georgia's navigable rivers and headwater market towns, ca. 1800.

Although the movement of goods to and from the market was accomplished by water to the extent possible, Georgians soon came to rely upon rural roads and trails to reach settlements, plantations, farms, and timber stands not located on major waterways. Many of the roads built in the coastal region were private roads cut by plantation owners to link neighboring plantations, and these later became the basis for public roads. As

population spread into the Piedmont, and thus above the fall line and the extent of river navigation, wagon roads took on greater significance as the primary routes of trade and communication with the river ports. The road connecting Augusta with Washington, an upcountry market town founded in 1783, was one such road that today approximates the route of SR 232 from Augusta to Appling, and US 78 north of Little River to Washington. The common roads, which were built to serve local resources and local distribution of goods, established the right of way of many of today's secondary and state routes. They were a significant accomplishment of the pre-1800 period.

Figure 2: Savannah developed in the colonial period by virtue of its port and the Atlantic trade. It remains to this day one of the most active ports on the East Coast. Here boats are shown at a lumber yard on the Savannah River in the late 19th Century.

Georgia's English settlers brought with them a heritage of road and bridge building institutions and techniques. As a British colony, Georgia passed its first road law in 1755, dividing the province into nine road districts, appointing six surveyors to each district to lay out and oversee the maintenance of roads and bridges, and requiring all male inhabitants to work as many as 12 days each year on the public roads. After the Revolution, responsibility for road work devolved upon each of the individual county governments, which continued the tradition of statutory labor. When a new road was to be built or an old one repaired, the hands of each district were called out by the surveyor and required to bring their own tools, which ordinarily consisted of mattocks, picks, shovels, axes, and farm plows. In many of Georgia's rural counties, the statutory method of road construction and maintenance remained in effect well into the early 20th century.

Most of Georgia's early roads were winding, rutted, and poor even by the standards of the time. Travelers often reported of agonizing stage coach rides where animals quickly tired in knee-deep sand and mud, and passengers were forced to walk alongside their coaches. Waterways were a blessing where navigable and flowing in the direction of travel, but they could also be a curse when drought or flood conditions made them impassable or where they formed a natural barrier to the direction of travel. In the low country of coastal Georgia, the swamps and broad river deltas practically prohibited any attempts to build roads other than in an east-west direction along the ridges between the rivers. In swamps, a common type of structure was a log causeway, often referred to as a corduroy road because the logs were laid lengthwise across the road to form a bumpy surface. Most major rivers were crossed by ferries, usually operated under government charter by private individuals.

Bridge building, such as it was prior to 1800, was limited to those crossings in towns and on major roads where the level of traffic required a bridge over the more common ford. Presumably, most bridges were traditional short-span timber pile bent and beam structures. No 18th-century bridges are known to survive in the state, although many of today's bridges span rivers at or near the site of pre-1800 bridge or ferry crossings, and are second, third, fourth, and even fifth generation spans at their particular sites.

Georgia's Transportation Revolution, 1800-1860

The period from 1800 to 1860 was one of significant growth for Georgia, leading to various improvements in transportation including the construction of turnpikes, canals, and railroads. The improvements aided the economic growth of previously established river towns such as Savannah, Augusta, Macon, and Columbus, and assisted the development of new primary cross-state routes and population centers such as Atlanta. Throughout the deep South, the transportation revolution was fueled by the international appetite for short-staple cotton — a profitable cash crop that was produced for export to textile mills in Great Britain, and later in increasing quantities to factories in the northeastern United States. The rise of King Cotton, and promises of its riches, inspired Georgians to find the means to move great quantities of the crop in bound bales to market towns such as Augusta, Macon, Columbus, and Savannah, where river boats and ships waited to gather the cotton for export.

A key component to the southern cotton boom was the availability of vast tracts of land for cultivation in the early 1800s. Georgia's population more than quadrupled between 1800 and 1840, and immense public pressure was placed on the federal and state governments to open land for settlement and to force Native Americans to give up their properties in western Georgia and the rest of the lower South. Between 1802 and 1835 ten cessions of Native American lands were negotiated, and in 1838 the Cherokee were forcibly removed from their lands in the mountainous northwest corner of the state. By 1840, most land considered desirable for farming had been distributed to settlers, and the only major unsettled portion of the state remained the southeastern coastal swamps and pine barrens.

Federal Roads, Turnpikes, and Toll Bridges

In the early 1800s, improvements to Georgia's roads were directed at providing access to western lands and improving communication between the coast and new settlements in western Georgia, Alabama, Tennessee, and Kentucky. Among the most important of the early cross-state roads were two built by the federal military for strategic ends should the United States become involved in a war with Spain, but which also served as corridors for settlers. The first was built in 1806 from the Ocmulgee River at Fort Hawkins (later Macon) to Fort Stoddert, Alabama (near present-day Mobile),

approximating the route of old US 80 from Macon to Columbus. The second was built in 1815 between Athens and the site of present-day Chattanooga on the Tennessee River, approximating the route of old US 129 from Athens to near Gainesville.

Georgia's network of roads grew as cotton plantations and farms spread across the Piedmont from the 1810s to 1830s. Increased population and commerce led to a greater degree and regularity of travel that warranted better care of roads connecting the larger towns and cities. By 1835, there were considered to be eleven principal passenger stage routes in the state, in addition to numerous other wagon roads to move cotton, goods, and people from the smaller market towns to the larger communities at Augusta, Savannah, and Columbus. The former military road from Tennessee to Athens was also growing in importance as horses and mules, meats, hay, and cereals (all in short supply in the cotton belt) were brought into the state from the Tennessee and Ohio valleys.

Georgia's planters and businessmen were not alone in thinking that their growing transportation network of roads and navigable rivers were economically vital, and like their counterparts in other states, they began to seek ways to improve and better maintain the routes of regional and statewide importance. In the northeastern United States, a popular means of raising capital for road improvements was the turnpike or toll road, the earliest of which had been established from Philadelphia to Lancaster, Pennsylvania in 1792. In the 1810s and early 1820s, the Georgia legislature, following the lead of the northern states, began issuing turnpike charters to private corporations that would take over existing roads, charge tolls to travelers, and, in return, pledge to offer more direct, wider, and better maintained roads. Although southerners made plans for a great number of turnpikes, the accomplishments were in fact less than impressive. Many turnpikes, although chartered and promoted, were never built. The historical significance of Georgia's turnpikes was mainly limited to establishing and improving connections between the state's northeastern Piedmont and the upcountry of Georgia, North Carolina, and Tennessee.

Three turnpikes of regional importance in the northeastern section of the state were the Unicoi Turnpike (1813), the Union Turnpike (1821), and the Washington Turnpike (1821). They were among Georgia's most successful turnpikes, because rather than relying on the seasonal movement of cotton during the fall and winter harvest, they connected upcountry communities with the cotton belt and thus provided a regular means for mountain farmers to bring livestock and produce to market. The Unicoi Turnpike ran from east Tennessee and western North Carolina into Georgia, past the site of present-day Hiawassee, through Unicoi Gap and the Nacoochee Valley and on to the town of Clarkesville (Habersham County). Today, SR 17 follows a route similar to the Unicoi Turnpike between Clarkesville and Hiawassee. The Union Turnpike connected the town of Loudsville (White County) through Tesnatee Gap to Blairsville

(Union County) and into Tennessee. Portions of the right of way of the Union Turnpike are still visible in White County, parallel to the route of US 129. The Washington Turnpike improved the road from Augusta through Washington and Lexington, and on to Athens. This road followed a route similar to US 78 with the exception of the southernmost section west of Augusta, which rather than passing through Thomson (as US 78 does) took a more direct route northwest through Appling.

Even those turnpikes which were so favorably located to develop a large volume of traffic found it difficult to maintain a profitable condition because of the high cost of keeping roads in repair. Only Georgia's Union Turnpike is known to have remained in operation after the Civil War. No inventoried bridges have been identified that are historically associated with turnpike construction.

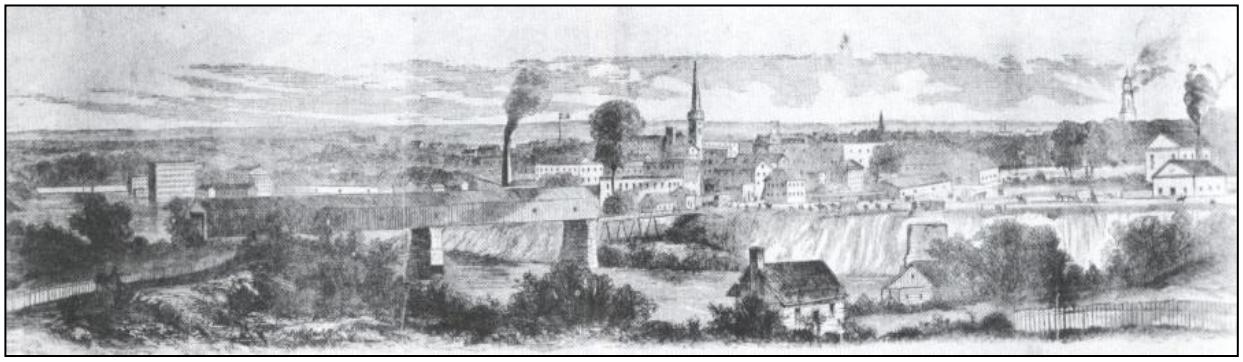

Figure 3: The covered bridge over the Chattahoochee River Columbus, built 1832-35 and re-built in 1865 after being put to the torch by Union troops.

Similar to turnpike charters were toll bridge charters granted by the state to private individuals or companies to erect bridges and to charge tolls to offset the cost of construction and maintenance. In the records of the state archives are several petitions for toll bridges, such as Alexander Hall's of ca. 1850 to build a bridge on the Flint River at Turrenetine's Ferry in Albany. The wood truss toll bridges were usually constructed at crossings where traffic had increased to such a degree that ferries had become inadequate or inconvenient. Some of these structures, like the Chattahoochee River bridge at Columbus, were notable for being the earliest timber truss bridges in the state. The Chattahoochee River bridge was a Town lattice truss, a type composed of a web of intersecting timber diagonals in a tight lattice pattern. Patented by Ithiel Town in 1820, the truss type became very popular because of its simplicity of construction and ability to span lengths up to 200'. Town lattice trusses continued to be built into the 1910s by local craftsmen in some parts of the state, such as Banks County. By one estimate, there were at one time at least 185 timber truss covered bridges in the state, mostly located in the state's northern section. At present, only 13 covered bridges survive, two located in state parks.

Navigable Rivers and Canals

Figure 4: Sections of the Ogeechee & Altamaha Canal are still visible today, although much of the canal is overgrown and filled with silt.

While turnpike and toll bridge charters quickened in the antebellum period, the primary transportation concern for Piedmont planters remained the maintenance of the state's navigable rivers. In general, river transport was well-suited to the shipment of cotton and other nonperishable bulk products. Transportation improved in the late 1810s and 1820s when steamboats were introduced on the Savannah, Ogeechee, Altamaha, Oconee, Ocmulgee, Flint, and Chattahoochee rivers. The boats offered faster, more reliable, and more frequent river transport than barges and rafts, and they contributed materially to the economic prosperity of the navigable headwater towns of Augusta, Louisville, Albany, Milledgeville, Macon, and Columbus. The state government sponsored large-scale projects to dredge river beds and improve navigability, and lawmakers considered linking and improving the rivers with an extensive system of canals. As with the turnpikes, lack of capital, engineering difficulties, and uncertainty about potential profits doomed most canals to the drawing board.

Only two significant canal projects ever moved beyond the planning stages. One, the Savannah, Ogeechee & Altamaha Canal, was chartered in 1818 with the intention of shortening the water route from the Altamaha River, on which Macon and Milledgeville are located, to the port of Savannah. Construction of the canal, however, did not begin until 1824, and was completed only as far as the Ogeechee River in 1831. The canal company went bankrupt in 1836, but was revived in the 1840s and 1850s with deepening of the channel and lock improvements. It prospered prior to the Civil War, carrying on a trade in cotton, rice, bricks, and especially lumber. It remained in limited use for the floating of timber rafts until the 1880s. Portions of the canal are still visible although filled or silted. The only bridge evaluated over the former Savannah & Ogeechee Canal was the Louisville Road bridge in Savannah (051-0150-0). The ca. 1920 steel stringer with concrete jack arch deck bridge was built well after the canal ceased operations.

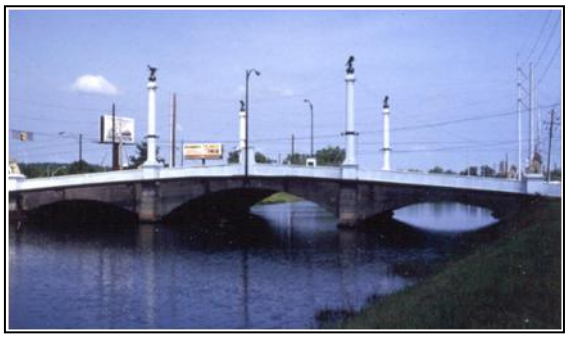

Figure 5: The Butt Memorial Bridge, 1914, spans the Augusta Canal

The second canal project was the seven-mile long Augusta Canal built in 1845-1847 with the

dual purpose of carrying cotton barge traffic around the falls of the Savannah River and providing water power for the city's mills and fledgling industries. The canal proved somewhat successful as a barge canal, but it failed to generate sufficient waterpower for large-scale industrial expansion. After the Civil War, the canal fell into disuse as a transportation facility. It was reconstructed in 1874-1876 for waterpower, with a second and third level added, widened from 40' to 150', and deepened from 5' to 11'. The improved power canal provided sufficient energy to power four large textile mills: the Enterprise, Blanche, Sibley, and John P. King, ca. 1870-1880.

The Augusta Canal is spanned by numerous bridges, including the handsome and monumentally detailed 1914 Butt Memorial Bridge (245-0074-0). The bridges over the canal are common reinforced concrete or steel bridge types built since the 1910s to accommodate motor vehicles. In most cases, the bridges incorporate portions of the historic canal retaining walls and spillways as substructural components, but are not themselves individually significant bridges.

Antebellum Railroads

Of all Georgia's antebellum transportation systems, the railroads had the greatest impact on the subsequent development of the state's transportation patterns. Georgia's railroads began in the 1830s as a series of disconnected lines designed primarily to move cotton from interior points to the rivers and coast, and to improve the means of importing foodstuffs, like grains and meat from Tennessee. As such, they did not initially introduce new patterns of trade but were meant to improve and service the already established transportation patterns. The advantage railroads had over roads and turnpikes was the application of steam power to carry bulk goods and people over a relatively level and

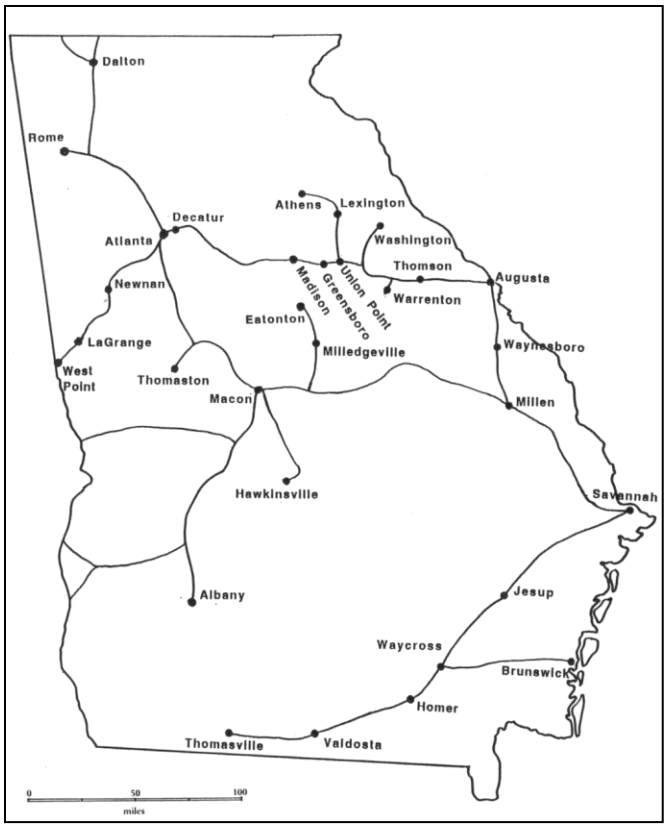

Figure 6: Map showing the location of Georgia's major antebellum railroads and branch lines: Central of Georgia (Savannah-Macon, 1843); Georgia RR (Augusta-Atlanta 1845); Macon & Western (Macon-Atlanta, 1850); Western & Atlantic (Atlanta-Chattanooga, TN, 1850); Southwestern (Macon-Albany, 1853); Atlanta & West Point (1854); Atlantic & Gulf (Savannah-Thomasville, 1860).

smooth surface of rails. The businessmen and influential planters of Georgia built the railroads to expand their control over larger areas of the surrounding countryside to the exclusion of neighboring states, and thus efficient connections with adjoining railroads were often jealously opposed. Prior to 1860, the railroads greatly improved travel along major routes within the state, but it was not until after the Civil War that anything approaching an effective long-distance, regionally integrated, rail system began to emerge.

The establishment, financing, and construction of antebellum railroads was an activity full of political intrigue and intense economic rivalry that rarely followed any overall plan for rational development or interconnection. Between 1833 and 1835 Georgia chartered three separate railroad companies: the Georgia Railroad, the Central of Georgia Railroad, and the Monroe Railroad, each designed to terminate respectively at the cities of Augusta, Savannah, and Macon, but with no plans to connect with one another. Construction of all of these railroads was delayed by various problems, most related to inadequate financing. In 1837, the three railroads were joined by a fourth, the Western & Atlantic Railroad, which was a state-owned railroad intended to run through the state's northwest mountains to Tennessee. The Western & Atlantic was a political expediency to head off attempts by businessmen in Charleston, South Carolina, to build their own railroad across the northern part of the state. Georgians feared that this railroad, known as the Memphis & Charleston Railroad, might cut-off Georgia's cities from the western trade in foodstuffs. The Georgia Railroad and the Monroe Railroad (rechartered after bankruptcy as the Macon & Western Railroad in 1845) each made plans to extend their lines to the southern terminus of the Western & Atlantic's line at a place known as Terminus, later renamed Atlanta.

After more than a decade of planning and financial setbacks, Georgia's four original railroads completed construction of their main lines by 1850. The Georgia Railroad extended west from Augusta through the towns of Thomson, Union Point, Greensboro, and Madison, and terminated in Atlanta. The Central of Georgia Railway began in Savannah and followed a westward course through the town of Millen and on to Macon. At Macon, connections were made with the Macon & Western Railroad, which took a northwesterly course to its terminus in Atlanta. The Western & Atlantic ran from Atlanta north to Dalton, and then across the Georgia-Tennessee line to the Tennessee River and Ross's Landing, later renamed Chattanooga. The 1850s saw some additional lines added to Georgia's rail system including the Atlanta & West Point Railroad (1851-1854), the Southwestern Railroad from Macon to Albany with a branch to Columbus (1845-1853), and the Atlantic and Gulf Railroad from Savannah to Thomasville with a branch to Brunswick (1856-60). Bridges on Georgia's early railroads were commonly timber trestle or timber truss types such as the patented Town lattice and Howe designs. An exception was the Central of Georgia Railway’s pair of impressive brick arch viaducts,

built in 1853 and 1860, at its terminal and shops in Savannah. They are among the nation's most significant surviving examples of antebellum railroad bridge engineering.

The original site of Atlanta was farm land, chosen by the Western & Atlantic's engineers because of its location where three ridges met, a condition that made it topographically suitable for the junction of the rail lines. By virtue of its strategic location, Atlanta boomed and had swollen to nearly 12,000 residents by 1860. At the beginning of the Civil War, the city had already emerged as Georgia's inland transportation hub, a bustling market town where traders bargained in cotton, wheat, flour, oats, corn, bacon, lard, tallow, butter, hogs, sheep, and whiskey. By the late 1850s, increasing amounts of manufactured and dry goods were arriving in Atlanta from Louisville, Memphis, Cincinnati, and St. Louis. This interregional trade suggested to Atlanta's optimistic businessmen that the city had even greater potential as a major rail distribution center for the southeastern United States, and it was this potential that they would capitalize upon after the Civil War. During the war, the Union Army also recognized Atlanta's strategic position and captured the city as a means of severing and destroying shipment lines of the lower South in 1864.

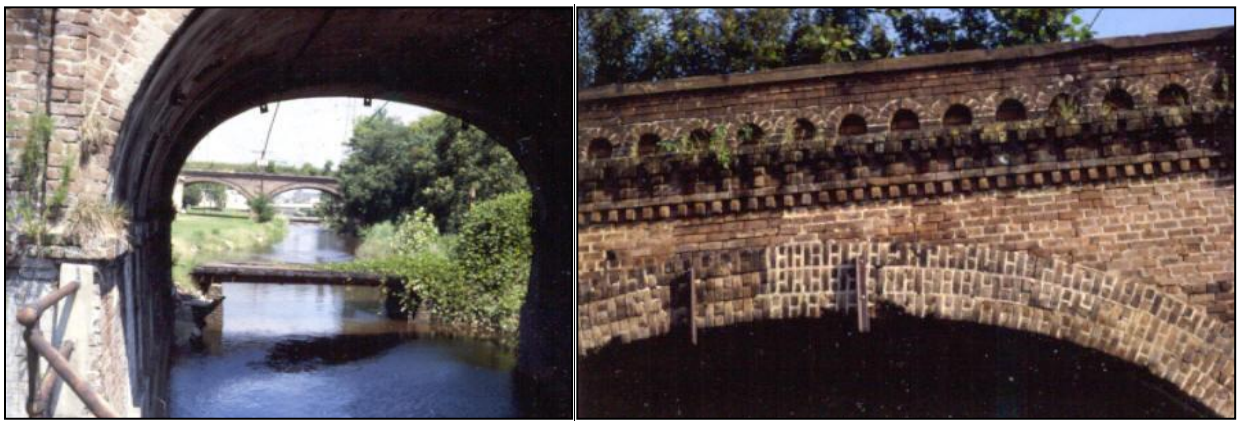

Figure 7: The Central of Georgia's brick arch viaducts in Savannah. Brick was used because stone was not available in coastal Georgia and brick was less expensive. Engineer Augustas Schwaab and architect Martin P. Mueller used the brick to great effect as shown in the detailing.

Reconstruction, Expansion, and Consolidation of Georgia's Railroad System 1865-1910

The story of Georgia transportation from 1865 to 1910 was the proliferation of railroads and the extension of rail lines into every corner of the state. Between 1865 and 1910, the state's railroad mileage increased from 1,420 miles to 7,056 miles. The expansion of Georgia's railroads was not unique, but part of a nationwide trend that brought the railroads to the forefront of the American economy. The railroads were the first large-scale modern business enterprises. They provided fast, regular, and dependable transportation of goods and people on an unprecedented scale, and they were essential

to high-volume production and distribution of manufactured goods. The national focus on railroads diverted attention away from turnpikes, canals, and navigable rivers, which declined in relative importance as railroads took over most of their transportation functions.

The railroads had a profound impact on the southern economy and landscape in the last third of the 19th century. In Georgia, the railroads brought to the forefront the urban transportation centers of Macon and Atlanta, which demonstrated steady growth throughout the last half of the century. Numerous small towns grew or were built around railroad depots, and although many had aspirations to become the next Atlanta, most formed the first tier in a hierarchy of distribution points that gathered cotton, tobacco, fruit, lumber, or other staples from the countryside, and shipped the crops to the larger railroad cities from which wholesalers redistributed goods to northern markets. One such small town is Lula, Hall County, founded in the mid 1870s at a junction of the Richmond & Danville Air Line Railroad and a branch line to Athens. Hundreds of small railroad towns like Lula, Social Circle, Newnan, and Griffin were locally significant centers of trade where a vast range of manufactured and dry goods flowed back down the market chain to be sold to farmers and townspeople at general stores. The density of trade and variety of goods far exceeded anything most southerners had known in previous generations.

The South's quickening ties to the national marketplace led to increased emphasis on cotton as a cash crop. King Cotton continued its reign in Georgia's Piedmont, and production of the crop reached all time highs, especially with use of fertilizers delivered by the railroads. However, the promised prosperity of cotton failed to materialize as falling prices brought on by overproduction contributed to a vicious cycle of sharecropping and high land tenancy. Some farmers attempted to diversify with crops such as tobacco, peaches, watermelons, peanuts, pecans, and vegetables, but these did not gain wider popularity until the first decades of the 20th century. After World War I, cotton prices declined even more dramatically, and the boll weevil infested southern crops.

The railroads also fostered the expansion of Georgia's industries, foremost textile mills and lumbering, but also smaller industries such as cottonseed oil, furniture, building supplies, paper, and phosphates. Georgia's textile industry began to expand in the 1870s in cities such as Augusta and Columbus where rivers provided a ready source of water power. After the 1890s, textile mills spread over a wider area when coal delivered by trains from the southern coal fields made steam power feasible. The southern mills effectively competed with older northern mills because of the regional and national markets opened by railroads, as well as the installation of up-to-date spinning and weaving machinery, inexpensive labor costs, and proximity to the cotton fields.

Lumber and lumber by-products, like turpentine, pitch, and tar, had been harvested from Georgia's piney woods since the colonial period, but a major impediment to the expansion of the industry had been transportation difficulties and the lack of a large market for yellow pine. In the 1870s, railroads tapped the vast stands of South Georgia forests, and they provided an important new market for yellow pine, suitable for use in railroad ties. The arrival of the railroads freed lumber companies from having to float logs downstream on rivers, allowing them to harvest and mill year-round from wherever a railroad spur could be laid and a portable saw mill erected. Georgia's wiregrass and pine barren regions of Pulaski, Laurens, and Montgomery counties were crisscrossed with such small timber railroads as the Brewton & Pineoria, Dublin & Southwestern, Wrightsville & Tennille, and Oconee & Western. Georgia's lumber industry continued to expand into the 20th century and spread operations throughout the coastal plain and southwestern portions of the state.

The agricultural and industrial development of the state was tied to the ability of the region's railroads to provide increasingly efficient service to markets throughout the South and other parts of the United States. After the Civil War, numerous independent lines took time to recover from wartime devastation, and then aggressively expanded their territories in the early 1870s. The period was one of rapid but uneven construction which left several Georgia railroads in receivership or bankruptcy in the depression of the mid 1870s. Expansion revived in the 1880s, and due to the need for large amounts of capital, the South's railroads were sold or brought under the financial control of consolidated rail systems in the 1890s and 1900s. The large railroad corporations had distinct advantages over the former short lines, most notably the ability to offer low freight rates for the movement of through cargoes between major rail centers such as Atlanta, Nashville, Louisville, Richmond, St. Louis, Chicago, Washington, and New Orleans.

Figure 8: Map of the Atlantic Coast Line railroad system. The consolidation of Georgia's antebellum railroads into regional rail systems brought efficiencies and economies to transportation, linking Georgia's agriculture and industry to regional and national market places.

By 1910, Georgia was served by four major railroads: the Atlantic Coast Line Railroad, the Louisville & Nashville

Railroad, the Seaboard Air Line Railroad, and the Southern Railway. A fifth railroad, the Central of Georgia Railway, remained independent but operated in harmony with the Southern Railway interests. The Atlantic Coast Line Railroad (ACL) was established from a series of formerly independent lines running from Richmond, Virginia to Florida in the 1890s and early 1900s. The route served the demand in northern cities for fresh fruits and vegetables in the winter, and it was a prime mover of lumber and phosphates. In Georgia, it passed through Savannah and Waycross to Jacksonville, Florida. The ACL also had a branch line to Atlanta and Birmingham, and a branch line in the southern part of the state touched upon Valdosta and Thomasville before terminating in Montgomery, Alabama.

A rival of the ACL was the Seaboard Air Line Railroad, reorganized from the consolidation of twenty separate companies in Virginia, the Carolinas, Georgia, and Florida in 1899. It connected Portsmouth and Richmond, Virginia with points south, and it had a main line that paralleled the ACL's for much of its length between Richmond and Jacksonville, Florida. Similarly, the Seaboard carried the trade in fruits and vegetables, and it was instrumental in the development of agriculture, mining, and tourism in Florida. In Georgia, the Seaboard's main line passed through Savannah paralleling the coast, but it also had two important branch lines: one west from Savannah through Vidalia and Columbus en route to Montgomery, and the second from Greenwood, South Carolina through Athens en route to Atlanta and Birmingham.

The Louisville & Nashville Railroad (L&N) gained access to Atlanta in 1890 when it leased the Western & Atlantic Railroad. The L&N grew to service the north-to-south trade from Chicago to New Orleans with extensive branch lines in Kentucky, Tennessee, and Alabama, bringing manufactured goods from the Midwest and coal from Appalachia into Georgia. It was also instrumental in the development of Birmingham as a major iron and steel city. The L&N served communities in the northwest portions of Georgia on its Atlanta-Chattanooga and Atlanta-Knoxville lines. A majority of the L&N stock was acquired by the Atlantic Coast Line in 1902, but the line

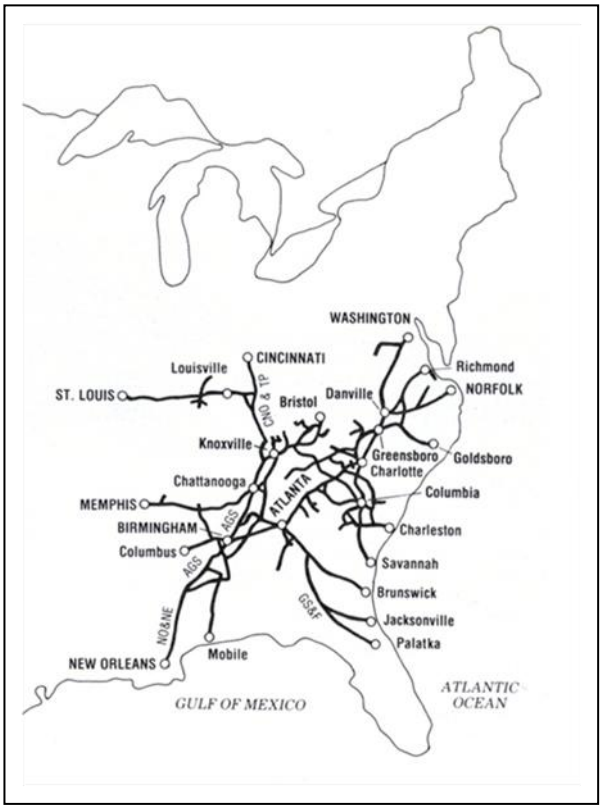

Figure 9: Atlanta was a terminal of the mighty Southern Railway system, which was the largest of the rail systems serving Georgia and the southern United States.

continued to be operated independently until 1982.

The Southern Railway was incorporated in 1894 by the J.P. Morgan interests and eventually operated a railway west from Washington, D.C. through Richmond, Charlotte, Atlanta to New Orleans; a line south from Cincinnati to Atlanta; and extensive branch lines in the Carolinas, Georgia, and Alabama. The Southern Railway, under the leadership of President Samuel Spencer, aggressively sought to develop southern markets, and it encouraged farmers to diversify their crops rather than rely on cotton and tobacco. By 1920, the Southern had more than 8,000 miles of track and entered every southern state except West Virginia, and as the largest of the systems entering Georgia, it carried on voluminous and diversified trade. In Georgia, the Southern's tracks radiated from Atlanta in the directions of Birmingham, Chattanooga, Greenville, Macon, and Hawkinsville. It also operated in cooperation with the Central of Georgia Railway to tap markets in Savannah, Columbus, and smaller market towns in the central and western parts of the state.

Georgia's Railroads in the Age of the Automobile, 1910-present

By 1910, the great age of railroad expansion and consolidation had ended. Railroad companies no longer sought to develop new routes, and instead they attempted to modernize their operations through such efforts as double tracking and automatic signaling. After World War I, the expansion of the federal and state highway systems provided intercity trucks an increasingly effective means to compete with and eventually surpass trains as carriers of all but bulk goods. The loss of freight and passenger traffic, as well as restrictive government regulation of rates, caused railroads to restructure their operations, abandon unproductive routes and lines, and to further consolidate the operations of competing lines. The process of decline accelerated in the Depression of the 1930s, which resulted in more than 77,000 miles of railroad nationwide falling into bankruptcy. Among the major Georgia carriers, the Seaboard Air Line was operated under receivership from 1930 to 1945, and the Southern Railway narrowly averted financial disaster. After World War II, automobiles, trucks, and airplanes took an ever greater share of the freight and passenger markets. In the 1970s and 1980s, the rail networks underwent another wave of mergers, abandoned thousands of miles of track, and discontinued passenger service except for the federalized Amtrak.

The fortunes of Georgia's major rail carriers were typical of those of the nation. The Seaboard Air Line and the Atlantic Coast Line railroads, facing heavy competition from trucks for the Florida citrus trade, and from airplanes and automobiles for Florida tourist traffic, merged operations in 1967 to form the Seaboard Coast Line Railroad. In turn, the Seaboard Coast Line and the Louisville & Nashville merged to become the Seaboard System in 1982, a subsidiary of the CSXT Corporation. The Central of

Georgia Railway lost its separate identity in 1963 when the financially-strapped railroad was taken over by the Southern Railway. Subsequently, the Southern, in order to protect its position against the "Family Lines" of the Seaboard System, merged with the Norfolk & Western Railway to form the Norfolk Southern Corporation in 1982. At the present, CSXT and Norfolk Southern are the only two major rail operators in Georgia.

Figure 10: Camak was once a thriving railroad town. In the 1870s, it developed at the junction of the Georgia RR and the Macon & Augusta RR. Today, freight trains pass through without stopping.

After 1910, Georgia's transportation story shifts focus from railroads to automobiles and modern roadways. Although Georgia's railroads were eventually eclipsed by the automobile and the truck, the heritage of transportation that they had nourished continued to exert a powerful influence in the present century. From the earliest days of modern highway development, Georgia's major cross-state roads closely paralleled preexisting rail lines. For example, old US 84 followed the Atlantic Coast Line's tracks from Brunswick to the Alabama state line, and old US 41 paralleled the L&N's Western & Atlantic Railroad from Atlanta to Chattanooga.

Today, the nation's highways and interstates connect major cities that were at one time largely served by integrated rail systems. The trains continue to carry bulk freight but no longer regularly stop at the old railroad towns that populate the lines. The economic fortune of Georgia's towns are now marked by an exit on the interstate as they were at one time marked by railroad depots.

The Automobile and the Development of Pre-1916 Modern Roadways: Georgia in the National Perspective

The history of the automobile and the development of modern roadways is a dynamic story of a transportation technology that has come to dominate the very fabric of the American culture and society. For the average American, the automobile is a decisive factor where one chooses to live, work, go to school, and shop. The landscape is divided and shaped by highways and bridges, and marked with ubiquitous parking lots, drive-throughs, motels, gas stations, convenience stores, shopping centers, and garages, each purposely designed to accommodate the automobile. The close connection between the automobile and the American lifestyle was established in the first half of the 20th century. From 1905 to 1945, the number of registered cars and trucks in the United States grew from about 9,400 to over 30.8 million. The motor vehicle, which started life in the 1870s as an impractical curiosity known as the

horseless carriage, had by the 1940s become a powerful, fast, mass-produced vehicle that was an essential component of everyday life. The automobile captured the minds, hearts, and pocketbooks of Americans of all classes and became the very symbol of an age.

The rapid rise of the automobile was accompanied by massive road improvements to carry the expanding traffic ever more quickly, smoothly, and safely. From 1900 to 1956, America's system of modern roadways evolved from the dirt roads of the age of horse and buggy to an impressive highway system of interconnected interstate, primary, and secondary highways. Efforts to improve roads originated in the 1880s, but did not gain significant momentum until after the advent of automobile travel. In 1904, the total road mileage in the United States was about 2.35 million miles of which only an estimated 10 percent was surfaced or improved. By 1955, the nation's total road mileage had increased by approximately 850,000 miles to 3.2 million miles, and nearly 70 percent of that total had been surfaced with gravel, bituminous, or concrete pavements. An important component of the road building program was a phenomenal increase in the number and size of highway bridges. Funding for the nation's highway system came in large measure from the federal and state governments and was spent under the direct supervision of the federal Bureau of Public Roads (BPR) and the various state highway departments.

Although it is tempting to view automotive transportation as a technological juggernaut that swept the earlier system of railroads away in its path, in retrospect it is more accurate to view modern roadways as a new type of transportation infrastructure that grew alongside the railroads and then only later supplanted them. When Americans began improving roads in the 1880s, those roads primarily served to connect the countryside to the city and to link outlying areas with rail facilities. In fact, railroad officials supported efforts to pave roads and streets as a means of facilitating the movement of people and goods to and from stations. As late as 1920, the railroads held sway over most types of passenger and freight traffic and were considered the binding fabric of the nation's industrial economy. The motor car and the truck had yet to be considered as serious competition. The transportation outlook changed rapidly between 1921 and 1941 when the American highway system developed most rapidly and spurred the growth of automobile tourism and interstate trucking. The situation was particularly bitter for railroad companies, many of which had helped foster the very tourist destinations and markets later served by the highway system. Eventually, the motor vehicle drove the rail carriers from the passenger business and seriously curtailed the railroads' portion of freight traffic, except in those areas, such as bulk commodities, where highway vehicles were a less economical alternative. Cars and trucks were devastating competitors in large part because modern roadways followed the same interstate through routes that the railroads had serviced.

The highways, especially after World War II, intensified trends of suburbanization, industrial growth, and agricultural diversification that had first developed in the age of the railroad. Highways radiated from Atlanta, just as the railroads had before them, and they contributed materially to the continued expansion of the metropolitan area as the commercial, financial, and transportation hub of Georgia and the Southeast. The highways provided a means for city residents to move into new suburban homes in Fulton, Cobb, and DeKalb counties, as well as to travel to work in new manufacturing industries such as airplane and automobile assembly plants. To a lesser degree, other Georgia cities, such as Savannah, Augusta, Macon, and Columbus, followed similar trends. In the area of agriculture, poultry, peanuts, corn, fruits, vegetables, and dairy products replaced King Cotton in the countryside, and they were delivered to market by trucks traveling over an integrated system of county and state highways. Higher farm productivity contributed to declines in tenant farming and to the movement of rural workers to higher paying jobs in cities.

The national perspective is important to the historic context of Georgia's roadways because Georgia's present-day roads and bridges were developed in response to national trends including the increase of automobile and truck ownership, the availability of federal dollars for highway improvements, the need for farm to market roads, and the need for through highways to serve automobile tourists and interstate truckers. Georgia automobile registrations climbed from 4,400 in 1910 to 127,000 in 1919. By 1927, the number of automobiles in the state had passed 250,000, and the one million mark was hit in 1956. Georgia truck registrations followed a similar trend from approximately 1,000 in 1915 to over 235,000 in 1955.

The vast majority of Georgia's pre-1956 bridge population dates from the post-1920 period of state-sponsored or influenced highway improvements. The records of the State Highway Department of Georgia show that state engineers carried on extensive correspondence with federal officials, attended national engineering conferences, and actively participated in developing national technical standards and policies for the construction of roads and bridges. When they viewed their plans for Georgia's roads and bridges, they adopted an essentially national outlook, but molded it to fit Georgia's political and economic environment, and the cost and availability of materials and labor within the state. This modern approach to highway and bridge construction contrasted markedly with the traditional local approach to road and highway bridge construction that had dominated earlier periods.

The Good Roads Movement in Georgia, 1880 to 1916

During the early 1880s, interest in improved roads revived in the United States for the first time since the turnpike boom of the early 1800s. The Good Roads Movement predated the widespread use of the automobile and was initiated by a variety of groups,

including proponents of improved farm transportation and bicycle enthusiasts. The Good Roads Movement had national scope, but it varied in intensity from region to region with greatest efforts in and around urban areas of the North and Midwest.

In Georgia and throughout the South, the Good Roads Movement had widespread grassroots appeal but lacked strong direction and leadership in large part because of the region's rural character and historically low tax revenues. The impetus for good roads came primarily from scattered urban areas such as Atlanta, Augusta, and Savannah where merchants and wholesalers, out of no lack of self interest, appreciated the economic burdens placed on the state's businesses by bad roads. For the most part, cities were the only places that had improved roads and streets. Brick, cobblestone, and stone-blocked city streets were an absolute necessity for the hauling of heavy raw materials and finished goods to and from factories, warehouses, docks and rail terminals. Poorly maintained rural roads and bridges limited the ability of southerners to transport products between local points and rail depots. While the South's railroads had been substantially rebuilt or improved in the 1870s, stations were spread out along the rail lines like so many beads on so many strings. Good roads reformers stressed that the only effective way to improve roads was to provide public funds to buy materials and labor, but farm interests were opposed to increasing tax burdens to the levels common in cities.

Under pressure from the advocates of good roads, most southern state legislatures passed acts patterned after North Carolina's 1885 "Mecklenberg Road Law" that provided county governments the <u>option</u> of replacing the system of statutory labor with special tax levies for road improvements. Mecklenberg County, which includes the city of Charlotte, was among the first counties in the South to develop an extensive system of improved farm to market roads funded by property taxes. In 1891, the Georgia legislature passed a law similar to the Mecklenberg Road Law that authorized the county commissioners upon the recommendation of the grand jury to exercise the option of levying a special road tax not to exceed 20 cents on each $100 of taxable property to pay for labor and equipment for roads and bridges.

Georgia counties with large urban centers such as Bibb, Chatham, Fulton, and Richmond quickly took advantage of the new law and organized the state's first successful road improvement programs. For the most part, these counties used their road taxes to pay for the costs of supporting convict road gangs. Convict labor was used for the clearing, grubbing, grading, and draining of roads and the construction of stone, gravel, and sand-clay road surfaces. After 1890, sand-clay road surfaces were a popular road improvement in Georgia, Alabama, and South Carolina because of the widespread local availability of suitable sources of clay and sand. Approximately one part sand was mixed with two parts clay and spread several inches thick over road sub grade. After compaction by traffic and repeated exposure to weather, the sand-clay

mixture formed a hard-surface roadway. Richmond County, which includes the city of Augusta, was one of the first Georgia counties to build an extensive system of sand-clay roads, reporting more than 250 miles of improved sand-clay roadway by 1904.

Figure 11: A typical sand-clay road, near Pine Mountain. The sand-clay road surface remained very popular for use on primary and secondary roads from the 1890s through the 1930s.

While urban counties used road taxes to improve local roads and bridges, most rural counties continued to rely upon traditional forms of statutory labor for road and bridge construction and maintenance. The slow and uneven road development in Georgia was highlighted in the federal Office of Public Roads' (OPR) 1904 report that showed that road improvements in southern states such as Georgia lagged far behind the rest of the nation. Defining an "improved road" as any road that had been properly graded, drained, and surfaced with some material providing a smooth, firm, and durable surface, the OPR found only 1,645 miles of improved road in Georgia of a total of more than 80,000 miles of public road. DeKalb, Floyd, Fulton, Jones, and Richmond counties were the only counties to report more than 100 miles of improved road.

The OPR report blamed the lack of good roads progress to limited sources of tax revenue linked to low land values, low population densities, and low road tax rates. Georgia ranked in the bottom fifth of states in the rate of its property tax levy, while at the same time ranking only after Texas, Alabama, and Mississippi in the estimated cash value of statutory labor. As late as 1904, 38 of Georgia's counties reported that they did not collect cash taxes for road or bridge improvements. Some of these counties, such as Banks, Crawford, Webster, and White, did not even require the maximum of 12 days statutory labor for road and bridge work but required male inhabitants between the ages of 16 and 50 to work only 5 or 6 days per year on the roads. The OPR report concluded that good roads reformers had yet to do enough to increase the understanding of the general public to the benefits of improved roads. While this was true, closer to the point was that many rural Georgia communities, burdened with high land tenancy rates and worn-out cotton fields, simply could not afford good roads and bridges at any price.

The Federal Government Carries Good Roads to Georgia

Good roads reform in Georgia and the rest of the South contrasted with the North where the movement had greater financial resources and the commitment of a large and politically influential urban upper-middle class. Their enthusiasm for good roads did not

originate with a concern for the plight of isolated rural dwellers but with a craze for the bicycle. Because northern bicyclists launched the first national good roads campaigns and eventually convinced Congress to create a federal agency for road improvements, their efforts had a lasting impact on the course of Georgia's highway development.

In 1887, the safety bicycle (a chain-driven bicycle with two wheels of equal size) was introduced in the United States from England. The safety bicycle, which replaced the earlier high-wheel bicycles, was an overnight success, especially among affluent city dwellers who by the mid 1890s were buying over one million safety bicycles per year. The cyclists formed groups to organize cross-country rallies, road races, and weekend excursions. Through these activities they gained first-hand knowledge of the poor condition of rural roads and the need to improve roads for both bicycles and farm wagons.

The leading cyclists' organization was the League of American Wheelmen (LAW), founded in 1880. The LAW, under the guidance of bicycle manufacturer Albert A. Pope and civil engineer Roy Stone, became an outspoken proponent and powerful political lobby in the cause for good roads. The Wheelmen sought social and economic justification for good roads, as well as the support of the farm interests. The LAW claimed that good highways would raise land values, open new markets, provide access to manufactured goods, end rural poverty, increase political participation by farmers, and improve education. The LAW promoted state aid for local roads and throughout the Northeast successfully guided model legislation through the state houses. New Jersey became the first state to pass a state-aid road bill in 1892, and Massachusetts created the nation's first state highway department in 1893.

In today's age of the automobile, it is hard to imagine that the bicycle was the catalyst that started the federal government's highway program. Under the influence of the LAW, Congress approved the formation of the Office of Road Inquiry (ORI) within the Department of Agriculture in 1893. The ORI began as a small bureau with the task of gathering information on the nation's roads. With leadership from bureau chief and Wheelman Roy Stone, the ORI developed a strong reputation for highway engineering expertise, promotion of the gospel of good roads, and cooperation with state officials on matters related to state road laws and supplies of road materials.

The ORI won increasing public support for roads and carried the Good Roads Movement to the South, where the movement lacked strong direction. A favored means of teaching local officials the benefits of durable highways was the ORI's object-lesson road program. Federal engineers visited communities willing to supply materials and labor and supervised construction of short stretches of model roadway using machinery donated by manufacturers. The graded and hard-surfaced object-lesson roads were a vast improvement over the narrow, rutted, and muddy roads most Southerners had

come to expect. In 1896, the ORI built the first quarter-mile long object-lesson road in Atlanta for the National Good Roads Parliament held in the city that year. In 1901-1902 the ORI worked in cooperation with the Southern Railway to sponsor a "good roads train" that carried exhibits on good roads, as well as equipment and engineers to build object-lesson roads. The train stopped in eighteen southern cities including Columbus and Augusta.

One of the strongest arguments for good roads was that they would reduce rural isolation. In particular, if reasonably good roads could be provided to rural areas, U.S. mail carriers could deliver mail directly to farms instead of farmers traveling to town to pick up their mail. Largely through the influence of granges and good roads advocates, Congress approved a program of Rural Free Delivery (RFD) in 1896. RFD began as a small experimental program, but by 1903, more than 8,600 mail carriers were traveling 200,000 miles per day and reaching almost five million people.

Figure 12: Bridge companies many based in the North and Midwest, expanded their markets into the South during the 1890s and 1900s. In 1899, the George E. King Bridge Company of Des Moines, Iowa, a subsidiary of the King Bridge Company of Cleveland Ohio, placed this thru truss over the Oconee River in Athens. It is one of the oldest highway metal truss bridges surviving in Georgia. (State Bridge No. 059-5025-0).

The post office department ruled that RFD routes would be established only where roads and bridges were reasonably well maintained and fit for travel. These requirements marshaled support in many rural communities for road improvements so that mail delivery would not pass them by. In Georgia and other southern states, farmers were reported as out in force grading dirt roads, filling ruts, and fixing otherwise impassable stretches of road. Under a 1906 agreement between the post office department and the ORI, rural localities desiring RFD routes could petition the ORI to assign an engineer to inspect their roads and make recommendations for whatever improvements were necessary for carrying the mail. According to a 1909 ORI report, the mileage of improved roads in Georgia increased from 1,645 miles in 1904 to 5,978 miles in 1909. Dougherty, Fulton, and Glynn counties topped the list of Georgia counties with more than 50 percent of county roadway mileage improved. An additional 16 counties reported from 30 to 50 percent improved, and 21 counties reported from 10 to 20 percent improved. Still, the

results were less than comprehensive. Fifty-two counties reported less than 10 percent of roadway mileage improved, and 54 counties reported no improved roads in 1909.

RFD was a leading factor in the expansion of the metal truss bridge building industry in the South. In Texas, for example, the ORI reported that 100 fords were replaced by metal truss bridges as a direct result of rural post road improvements. Southern metal truss bridge building companies listed a combined capacity of slightly more than 22,000 tons in 1894 prior to the introduction of RFD. In comparison, capacity of southern bridge shops had more than doubled to 47,000 tons by 1903. Leading metal truss bridge builders in the South included the Virginia Bridge and Iron Company of Roanoke, the Austin Brothers Bridge Company of Atlanta, the Converse Bridge Company of Ridgedale, Tennessee, and the Southern Bridge Company of Birmingham, Alabama. Furthermore, by the early 1900s some of the largest northern bridge-building companies such as the American Bridge Company and Champion Bridge Company had located agents in Atlanta and other southern cities in an effort to expand metal truss bridge sales.

As an example of the quickening pace of bridge construction and the types of bridges in use in the state at the turn of the century, Hall County records were reviewed as a case study. The county's minute books, which survive from 1895 forward, show that in 1896 the county maintained ten bridges, including two "wrought steel bridges," one at Shallow Ford and the second across the Chattahoochee River at Flowery Branch. The latter bridge, one of the earliest of its type in the county, had been built in 1895 by the Alabama Bridge Company of Jasper. Over the next 15 years, the county steadily improved its bridges, relying upon both the older timber truss and the newer metal truss bridge technologies. In 1906 and 1907, two Town lattice truss covered bridges were built, one over the Chattahoochee River at Seven Islands Ford on the Athens-Dahlonega road and the second over the Chattahoochee River at Brownings Ferry on the Cleveland-Gainesville Road. In 1912-1913 the Roanoke Bridge Company built a steel truss over the Oconee River at Gaine's Mill; in 1916 the Austin Brothers Bridge Company erected a truss on the Chattahoochee River at Lights Ferry between Hall and Forsyth counties; and in 1916 the International Steel and Iron Company of Evansville, Indiana, fabricated and erected a truss over the Chattahoochee River. The latter bridge followed specifications drawn by Searcy B. Slack of the University of Georgia's good roads extension service. Slack was to become Georgia's first state highway department bridge engineer in 1920.

The Drive for Federal Aid Roads, 1905-1916

The success and popularity of RFD and the favorable results of the ORI's object-lesson roads programs convinced many that some more substantial form of federal aid to roads was worthwhile. In 1905, the ORI was renamed the Office of Public Roads

(OPR). The new director of the OPR, Logan W. Page, carefully cultivated his image as the nation's foremost expert on highways in order to direct the national discussion on federal support for road improvements. Page favored and worked for a federal program that would distribute federal matching funds to only those states with highway departments staffed by professionally trained highway and bridge engineers. The federal government would work directly with 48 state highway departments rather than several thousand local governments. OPR engineers would approve federally funded highways based upon standardized guidelines that were developed in cooperation with the individual state highway departments and national professional organizations such as the American Society for Testing Materials (ASTM). Page believed that highway administration needed to be directed by the OPR along the "right lines," which to him meant that local governments in return for federal aid should turn over technical questions related to roads and bridge to supposedly apolitical government-employed civil engineers. Page worked patiently behind the scenes to get Congress to pass his version of the federal aid program. Through such groups as the American Highway Association, the American Road Builders' Association and the American Automobile Association, he built political and popular support for an expanded federal road program. By the early 1910s, most political observers believed it was only a matter of time before Congress passed some version of the federal aid roads program.

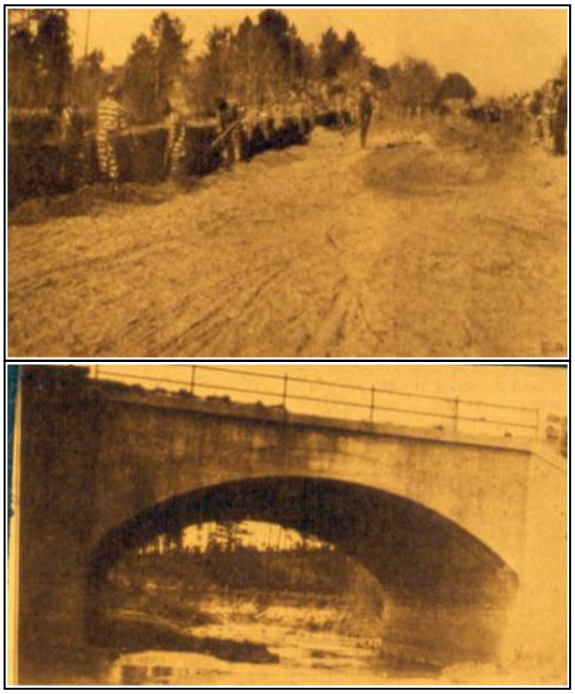

Figure 13 Top: A convict built concrete arch bridge in Fulton County, ca. 1914**. Bottom:** Fulton County officials wrote in national engineering journals about the results they achieved employing convict labor to surface roads and dig drainage ditches. Most Georgia counties could not afford to maintain large convict labor forces.

In Georgia and other southern states where "local control of local affairs" was the rule, Page's federal aid legislation met with little enthusiasm from the bourbon Democrat political establishment. There was resistance to the expansion of federal authority over traditional local prerogatives such as roads and bridges. An additional concern was that the state treasury was too poor to fund a highway program without a major change in the state's relatively limited means to generate matching funds. Even Georgia Governor Hoke Smith, who was considered one of the state's leading proponents of good roads, turned down OPR assistance for a 50-mile section of rural post road on the grounds that federal law did not permit Georgia to employ convict labor on federal contracts. Smith favored federal aid but felt that county governments should simply be reimbursed for

the improvement of post roads to carry the U.S. mail without compliance to mandated federal standards.

By 1914 Georgia was one of only six southern states that had not created a state highway department along the lines suggested by the OPR. Alabama, Louisiana, Maryland, and Virginia maintained state highway departments and applied state funds to road improvements. Arkansas, Kentucky, North Carolina, Oklahoma, and West Virginia also had highway departments in operation but limited the work to educational, advisory, and engineering assistance to county governments. While other states moved ahead with state road programs, in Georgia the only major piece of road legislation to pass from 1900 to 1915 was the 1908 act that enabled counties to use state prison inmates for construction and maintenance of roads and bridges. The law outlawed the practice of convict leasing, which previously allowed state prison officials to sell prison labor to private individuals and companies at a personal profit. That practice was substituted with a system that permitted many Georgia counties to replace statutory labor with chain gangs for the cost of equipping, housing, feeding, and guarding the state prisoners. While larger counties such as Fulton were able to maintain upwards of 700 convicts in prison road camps, many poorer rural counties found their state convict allotments too small to make much of a difference in overall road and bridge conditions. The prison commission occasionally hired trained engineers to supervise road and bridge work, and it cooperated with the University of Georgia's civil engineering department to promote an extension program between county officials and university engineering professors and students.

Events at the federal level finally overtook the slow progress and lack of direction of Georgia's good roads efforts. In July 1916, after more than ten years of debate Congress passed the nation's first federal aid road act (Federal Aid Road Act of 1916). The act provided a five-year, 75 million dollar appropriation for the grading and surfacing of rural post roads, as well as the construction of bridges. The funds were apportioned among the states on the basis of population and total mileage of postal department certified roads. The federal dollars had to be matched dollar for dollar by the states, and road and bridge projects had to be initiated and supervised by state highway department officials. The federal aid was available to pay for construction only, not to pay for highway department staff or administrative costs. In order to provide time for those states that did not yet have a state highway department to organize one, the federal aid appropriations were made available until the close of the third fiscal year after they were apportioned. Page's OPR was charged with developing technical standards for federal-aid roads in cooperation with state highway departments, as well as with approving all project plans and specifications.

For Georgia, what was most important about the Good Roads Movement in terms of bridge building was not the number of bridges that were built or improved prior to 1916,

because quantitatively this was quite small. Rather, it was the political and organizational framework for highway and bridge building that had taken shape by World War I. It had become clear that the federal government's OPR (renamed the Bureau of Public Roads [BPR] in 1918) would provide leadership and direction for the future of Georgia's and the nation's highways. The BPR would wield the power of the purse through large grants in federal aid and insist that technical decisions about highways and bridges be left to federal and state engineers and not in the hands of local politicians. The BPR supported its position through an extensive highway research program that placed the agency at the forefront of almost every advancement in highway and bridge design in the period between the world wars. With BPR approval and support, the State Highway Department of Georgia would in 1920 launch one of the nation's largest federally funded bridge building programs.

Automobile Tourism and Trail Associations in Georgia

The Federal Aid Road Act of 1916 was not a highway policy designed specifically for the technical needs of automobiles or automobile tourism. At the time, few Americans, including OPR director Logan Page, perceived that the United States would soon be a motor vehicle-based society, or that the hard-surfaced roads and "permanent" bridges best suited for horses and carts differed significantly from those types of bridges needed for the ever-increasing cars and trucks. While motorized vehicles figured in the congressional debates over the purpose of the federal aid program, with automobile enthusiasts backing a draft bill that would have built a system of interconnected long-distance national roads, the bill was opposed by Page and other more traditional good roads reformers who perpetuated the Progressive ideal and insisted that the federal aid program serve a social function in rural America. Page's viewpoint prevailed, and the federal aid program was targeted specifically at the farm-to-market roads that connected the countryside with the nation's rail system and cities on the assumption that the railroads would continue to be the primary long-distance movers of people and goods. In retrospect, the failure of the Federal Aid Road Act of 1916 to promote interstate highways was shortsighted. The number of motor vehicles on the highways increased so rapidly that by 1920 the OPR under its new chief, Thomas MacDonald, was firmly in favor of a system of national highways.

Figure 14: Unmaintained roads, lack of directional markers, and scarcity of roadside services were among the many challenges faced by early automobile tourists. Trail associations such as the Dixie Highway Association published maps and guidebooks to meet the need.

Prior to World War I, the automobile's primary contribution to the Good Roads Movement in Georgia and throughout much of the nation was to spark interest in long-distance automobile travel. In the 1910s, small but ever increasing numbers of Americans were taking to their automobiles to experience the "freedom" of the road. Early automobile tourism often took the form of road rallies, such as the October 1910 "All-Around Georgia Good Roads Tour" sponsored by the Atlanta Constitution, the Augusta Chronicle, and the Macon Telegraph. The rally was organized as a nine-day event with a counterclockwise route through the towns of Atlanta, Macon, Americus, Albany, Moultrie, Bainbridge, Thomasville, Valdosta, Waycross, Savannah, Statesboro, Waynesboro, Augusta, Washington, Athens, and Decatur. The event was designed to publicize the "financial, economic, and industrial value of good roads," but it also pointed out just how difficult long-distance automobile travel could be in the days before widespread highway improvements. Several of the 74 entrants did not complete the tour due to mechanical breakdowns, and rally officials had difficulty finding a passable route in the southern part of the state where the sandy roads were "deep enough to hide the entire rim of the wheels."

Despite the difficulties of bad roads, there is no doubt that early automobilists saw their cars as a means for a new type of personalized vacation. They did not have to rely on train and boat schedules, all they needed were good directions and knowledge of road conditions. However, there were surprisingly few accurate road maps, and most people did not know the roads except within several miles of their own homes. The need for directions and marked routes was met by trail associations. The most famous of the tourist-inspired trail associations was the Lincoln Highway Association, which was founded in 1913 to promote a paved coast-to-coast route from New York to San Francisco. The Lincoln Highway was backed by wealthy automobile and parts manufacturers Carl Fisher and Henry Joy, who saw the coast-to-coast highway as a personal dream, as well as a convenient way to promote automobile sales and improved roads. Although Fisher and Joy began with the intention of paving the entire route, the astronomical cost of the venture soon led them to pave only a few short demonstration sections and to plow their funds into promotion and recruiting local "consuls" (businessmen, lawyers, editors) to represent the association along the highway. The route made use of improved roads east of the Mississippi River, but from Illinois to Wyoming in the spring of 1915, the route was described as little more than one large mud hole.

Even though the traveling conditions on the Lincoln Highway were far from ideal, the promoters successfully introduced the nation to the idea of long-distance interstate roads. They also prompted numerous imitators. By 1924, at least 250 marked trails criss-crossed the United States. Most trail associations produced maps and magazines that reassured automobile tourists that the roads were passable, had adequate

Figure 15: Dixie Highway roadside marker, Mitchell County.

services, and led to desirable tourist destinations. In fact, most trail associations placed more emphasis on promoting destinations than on improving roads.

The Deep South, especially Florida, because of its mild winters and beaches, became a favorite destination of northern automobile tourists beginning in the mid 1910s. Destination promoters, chambers of commerce, civic leaders, bankers, and real estate speculators enthusiastically formed and promoted trail associations. The Dixie Highway, Capital Highway, Bankhead Highway, and National Highway were all well-known southern tourist trails that passed through Georgia and were founded or conceived prior to World War I [See Appendix A].[1]

The Dixie Highway was the leading tourist trail through Georgia to Florida. Founded in 1915, it had several braided branches that began in northern Michigan, and wound their way south and east through Ohio, Indiana, Kentucky, Tennessee, the Carolinas, and Georgia, and terminating in Miami, Florida. In Georgia, the Dixie Highway roughly corresponded to the present-day route of old US 41 north of Macon and old US 19 south of Macon, but it also had several branches including portions of old US 27 north of Atlanta, old US 341 south of Macon, old State Route 24 east of Atlanta, and an eastern branch passing through Augusta, Savannah, and Brunswick. The Dixie Highway Association, like many other trail associations, placed little value on directness and was subject to all matter of political pressures to change the route. It is worth noting that the tourist trail roughly paralleled existing rail lines such as the Atlantic Coast Line, Seaboard Air Line, and Georgia Southern railroads that offered competing service with connections to Florida. These rail lines predated the tourist highways and remained the leading promoters of Florida tourism into the 1920s.

The tourist trails were not new roads but existing roads marked, mapped, and described for the convenience of automobile travelers. In most instances, the associations chose their routes over improved roads and bridges, but often they had no choice but to pass over country roads and across unimproved river fords. The designation of an unimproved road as part of a trail sometimes aroused local officials to improve roads or bridges along the route. In Sumter County, for instance, the Board of Commissioners

[1]Because of the importance of the tourist trails to the highway development of Georgia, specific histories of the individual routes are provided in Appendix A.

resolved in May 1915 to guarantee that if the Dixie Highway came through the county they would promptly put the road in first-class condition and permanently maintain the route. The trail did pass through the county, but county funds were too limited to undertake paved improvements and build new bridges until the road (old SR 3/US 19) was placed on the state highway system and federal aid dollars became available to match a county bond issue in 1919. The efforts of Sumter County's officials were typical of the type of boosterism that followed the Dixie Highway, but they also illustrated the inherent weakness of the trail associations, which had no legal power to improve roads and had to rely upon the support of each local jurisdiction through which the route passed. Many county governments in rural southwest Georgia declined to improve tourist roads, and as a result portions of the old Dixie Highway remained unimproved in Grady, Thomas, Macon, and Peach counties as late as 1927.

While the trail associations did not lead directly or immediately to large-scale coordinated road and bridge improvement programs, they did have a lasting impact on Georgia's highway development. The routes promoted by the trail associations were eventually incorporated into the system of US-numbered highway routes. In 1926, the American Association of State Highway Officials (AASHO) instituted a highway numbering and marking system of interstate character for the principal tourist trails. The tourist trail markers were replaced by the now familiar shield-shaped signs bearing the US route number. By the late 1920s, most of the trail associations, no longer serving an important purpose, disbanded. However, the names of the more popular tourist trails, such as the Dixie Highway, continued to be widely used, especially for bypassed sections of the old trails, and the colorful trail names lived on in the gas stations, motels, restaurants, camp grounds, and attractions that had sprung up along the original routes.

Establishing a System of State Highways, 1916-1956

Creating the State Highway Department of Georgia, 1916-1919

In August 1916, the Georgia legislature in a direct response to the Federal Aid Road Act of 1916 created the State Highway Department of Georgia with authority to administer the federal aid. Although its federal aid allocation amounted to over 2.6 million dollars, Georgia was in a poor position to make use of the funds. Georgia state government had no tradition of large-scale public works programs, no means of raising significant funds for state aid to highways, and no means of securing materials and machinery, either directly or indirectly, to build roads and bridges and to maintain them in service.

Under its enabling legislation, the Georgia highway department initially consisted of the members of the state prison commission together with the state geologist, the dean of the college of engineering of the University of Georgia, and the professor of highway engineering at the Georgia School of Technology (Georgia Tech). The members

performed their highway department duties without additional compensation. They were authorized to employ civil engineers, but no state funds were appropriated to pay department staff until January 1918. The state prison commission was designated because it had charge of convict labor, and could thus offer labor assistance with road construction.

The situation in Georgia was typical of South Atlantic and Gulf states where rural county politicians dominated state politics and state highway departments were initially created as politically weak and underfunded agencies. The rural county commissioners or ordinaries in counties without commissions persistently objected to the centralization of control of road improvements. The Georgia legislature had structured the department to make it financially reliant upon each of the state's 151 individual counties for funds to match the federal dollars. Those counties willing or able to match federal appropriations with county tax revenues and highway and bridge bonds received federal aid and were able more or less to determine where the federal aid money was spent. Those poorer counties that could not raise bonds were left to match a smaller level of federal aid with in-kind donations of materials and labor. Or, they could simply choose to forego federal-aid roads.

From the outset, administration of the federal aid program proved too large a task for the members of the department as it was originally structured in 1916. The department produced no overall plan for the development of the state's roads, and from 1916 to 1918 spent only $38,000 of some $2.6 million in federal aid available to the state. Admittedly, the expenditure of the federal aid was slowed by World War I, which made road and bridge materials difficult and expensive to come by, but the department was simply too small and too underfunded to provide surveys, plans and supervision of the federal road program.

As wartime restrictions eased, many of Georgia's richer counties approved bond issues in order to cash in on the federal aid windfall. In order to cope with the increasing amount of work, the department resorted to prevailing upon the individual counties to provide funds to hire private consulting engineers to perform the actual plans and construction supervision on a project-by-project basis. In June 1919, the department had under contract over $5 million appropriated by 72 different counties for more than 590 miles of graded, paved, and surfaced roadway and 53 bridges. It was frankly admitted, however, that the state highway department's small staff was providing no on-site supervision of the work and that the BPR was not pleased with the situation.

Early in 1918, the department hired its first highway engineer with the meager appropriation provided by the state legislature. The choice for the position was Warren Rabun Neel (1883-1961), a 1901 graduate of Georgia Tech in civil engineering. Neel, a native of Kirkwood, Georgia, served as a consulting engineer on highway and bridge

projects for the Republic of Mexico from 1901 to the Mexican Revolution in 1916, and he served as Georgia's first state highway engineer until 1929. Initially, Neel worked to expedite the various counties' federal aid road and bridge plans. More important, he joined with Charles M. Strahan, the engineering dean of the University of Georgia, and with R. K. Kneale, highway engineering professor at Georgia Tech, to educate state politicians about national trends in highway construction. They were determined that the department should be fully staffed, adequately equipped, and free of the control of the counties.

In June 1919, Neel reported to the governor and legislature that Georgia's federal aid was in jeopardy. The large number of county-directed highway projects underway had attracted unqualified and inexperienced contractors who were not able to "handle large sums of money with skill and judgement." At best, Georgia was receiving poor quality roads and bridges built at high cost, and at worst, unscrupulous contractors were illegally pocketing highway funds. A far greater problem was that a large number of the poorer counties were unable to provide funding necessary for the federal match. Neel wrote that unless some form of state aid for road construction was provided to the poorer counties, Georgia would end up with thousands of miles of neglected roads and hundreds of inadequate bridges. Additionally, Neel was concerned that the individual counties were not capable of adequately maintaining the roads and bridges constructed with federal aid. If the roads and bridges were not well maintained, the BPR had the option of withholding future federal aid or even requiring the state to refund the federal aid. Neel concluded

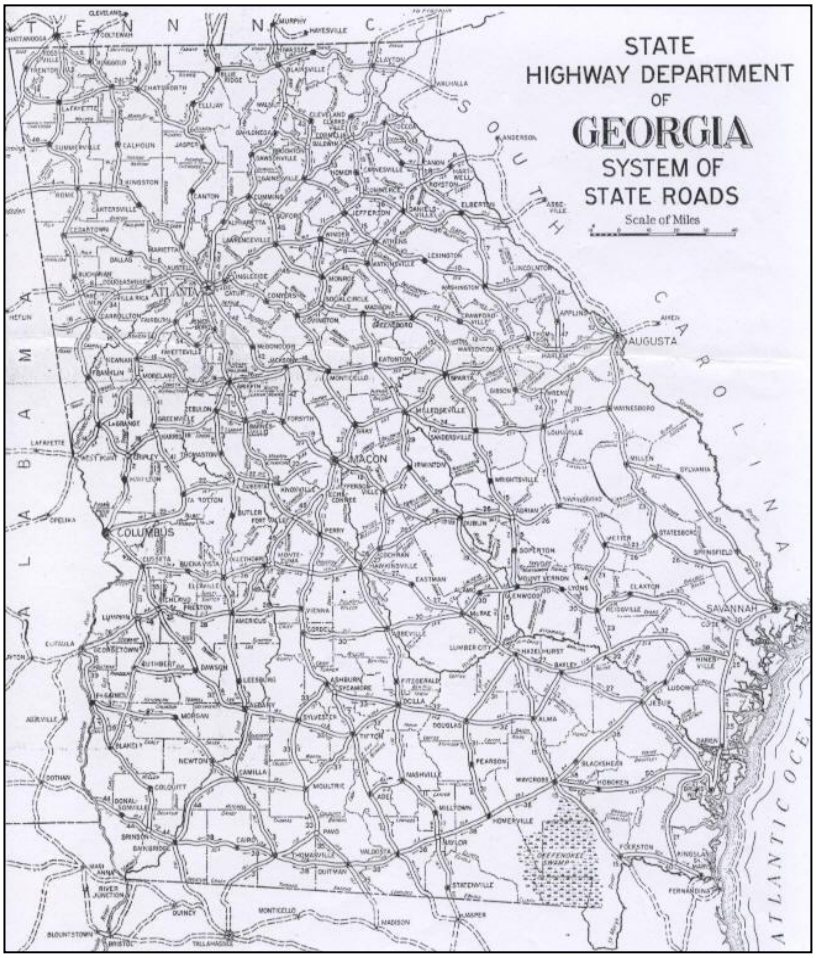

Figure 16: Map of the Georgia State Highway System, 1920. The state took over at least two roads leading from each county seat to the county line and connecting with roads in adjoining counties. The system also provided for "trunk line" routes for long distance automobile tourism.

that Georgia's highway program to date had been earnest but misguided, and what was needed was a reorganization of the department and its finances.

In August 1919, the state legislature met to discuss the highway situation. Attending the meetings was Edwin W. James, the BPR's administrator of the federal aid program, who had been invited to Georgia by Neel. He spoke to the legislators about how the department could be restructured to provide more efficient and centralized control of the federal aid program. James indicated that the BPR would have difficulty approving Georgia's federal aid under the current conditions. The meetings resulted in a new law that reconstituted the highway department under the direction of a three-man board appointed by the governor for staggered six-year terms. It also officially created the position of the state highway engineer who was appointed by the board, and who had the authority, with the approval of the board, to hire the entire department's engineering staff. Furthermore, the law funded the department with receipts from motor vehicle registration fees, which were to be used to pay for the department's administrative costs and for the construction and maintenance of roads and bridges.

Even more important, the 1919 law established for the first time a basis for the creation of a system of state highways. The guidelines provided that state highway engineers, in consultation with county commissioners, would take over two roads leading from each county seat to the county line and connecting with roads of adjoining counties. All work done on the roads and their bridges would be supervised by state engineers whether the work was funded by the federal, state, or county governments. Improved roads would be taken over immediately by the department, but counties would continue to maintain unimproved roads included in the state system until such time that they were improved. The state system roads would be eligible for federal and state aid dollars. The guidelines also provided that the state highway engineers could at their option add roads to the system up to a total limit of 4,800 miles. These additional roads were thought necessary to interconnect county seat roads and to provide the state with trunk line routes. The provision for trunk lines was significant because it gave the department the authority to include long-distance tourist trails such as the Dixie Highway within the state system.

The effort to reorganize the department demonstrated the force of federal aid in elevating the standards of state highway administration. It also showed its limitations. The 1919 law provided very limited amounts of state aid for the construction of new roads and bridges, and instead continued to rely upon the individual counties to match the bulk of federal aid for new construction. It placed county seat roads above the trunk lines, and because counties voluntarily contributed road and bridge construction matching funds, it in no way ensured that the counties would provide improvements for the trunk lines first. Furthermore, although the motor vehicle registration fees were dedicated to the department's support, the fees were collected by county officials, who

were known to underreport and divert revenues to other purposes. Even if all the fees were collected, they would still have been too meager to improve the initial 4,800-mile state highway system.

The shortcomings of the 1919 law highlighted the political issues that the department would continue to face for the next 30 years. The issues were common to almost every state in the deep South. Ironically, nowhere else in the nation was the federal aid road legislation a greater force for the betterment of roads than in the South, and nowhere else was the control of highway money by state highway departments met with more persistent resistance from state and county politicians. In Georgia, the department's engineers recognized that the constant petty political interference and battles over revenue sources were a major issue that limited their abilities to build and maintain a first-class state highway system. Economy was their constant goal, and the department built many lightly constructed roads and bridges with the knowledge that they would have to serve temporarily until money for more permanent solutions could be found.

Building the State Highway System, 1919-1932

In August 1919, state highway engineer Neel began to hire engineering staff and to organize the highway department along lines that stressed professionalism, business-like management, efficiency, uniform design standards, and cooperation between the department and local officials. The department's most immediate problem in late 1919 was pushing forward old federal aid rural post road contracts that had not been executed. Many of the newly hired engineers were University of Georgia or Georgia Tech graduates with wartime experience. These young men in their twenties and thirties would form the very heart of the department for the next several decades. It served to the credit of the state universities that Georgia had such a dedicated and energetic group of civil engineers from which to draw.

In his annual reports, Neel expressed a growing confidence in the technical ability of the department, but a first-rate highway system was possible, he said, only if Georgia's elected officials "abandoned entirely the idea of county identity in connection with state roads." Georgia's urban and Piedmont counties were reaping all the rewards of federal aid, while the poorer coastal and mountain counties were being left further behind. In May 1920, Neel reported that more than nine million dollars worth of federal aid roads and bridges were under construction, but about 50 percent of the total had been spent in only 38 of 151 counties. The funds paid for the construction of more than 1,000 miles of macadam, graded sand-clay, or top-soil surfaced roads and 61 bridges, mostly of reinforced concrete T-beam, slab, and arch types.

In early 1920, the highway board approved the state's first highway system road map of 49 routes with at least two roads leading from each county seat. Neel wrote that in the

process of planning and mapping the state highway system he had found it necessary to exceed the 4,800 mile limit set by the 1919 law. He suggested that the legislature increase the limit to 5,500 miles in order to include all of the connections and trunk lines "necessary to make a complete state system, and equitably serve every community." Furthermore, he admitted that because the department had no accurate surveys of the existing county roads, there was no way to accurately determine the current condition or the exact location of many of the proposed routes. What was known was that the quality of the roads ranged from paved highways through gravel, sand-clay, and earth roads to mere trails through the woods. The sand-clay roads, however, represented the bulk of the mileage because they had been the focus of previous county road improvements.

Beginning in 1920, the department placed a priority on using revenues from motor vehicle registration fees to help out the poorer counties of the state such as Putnam, Jones, Crawford, Johnson, Berrien, Turner, Brantley, and Jeff Davis that had not received any federal aid but nonetheless had important cross-state highways that passed through their boundaries. In general, the funds were too meager to carry out the necessary construction to build an interconnected system of state highways.

This problem of achieving an interconnected system of improved roads was not unique to Georgia. It was common in many rural states of the South and Midwest where county governments were still the basic political units for building and maintaining roads. In Washington, the BPR was well aware of the difficulties facing state highway departments, and it promoted new legislation that concentrated federal aid funds on a limited system of state highways that interconnected with state highways of adjacent states to form routes of interstate character. The Federal Highway Act of 1921 achieved this end by mandating that each state highway department dedicate a minimum of 60 percent of its federal aid for use on system highways as approved by the BPR. The Federal Highway Act of 1921 placed pressure on state governments to find other sources of revenue to match the federal aid. The pressure continued to be applied over the next several years as amendments to the act steadily increased the amount of federal aid available to the states.

How states matched the aid varied and depended greatly upon state politics and tax structures. Since Reconstruction, the Democratic Party had dominated Georgia politics, and they ruled by the county-unit system of primary elections that gave power to the representatives from rural Georgia. In general, the Democrats were fiscally conservative and suspicious of federal involvement in local affairs. What the highway department needed if it was to meet its federal aid obligations was a political ally in Georgia's Democratic Party, and it found one in John N. Holder from Jackson County. Holder was elected to the legislature in 1898, and served four terms as speaker from 1909 to 1920. He shepherded Georgia's 1919 highway law through the legislature, and

he became chairman of the highway board in 1922. Over the next six years, Holder worked diligently to increase the level of financing for Georgia's highways while shifting the financial burden for highways from the county to the state level of government.

In Georgia, as in most states, there were two options for raising funds for state highways outside of motor vehicle registration fees. One was to levy a sales tax on gasoline and dedicate that revenue for highway construction. In period literature this was often referred to as "The Pay As You Go Plan." A second was to issue state bonds for highway improvements. The latter option was illegal under Georgia's constitution, which did not permit the state to incur indebtedness for the purposes of internal improvements. In 1921, state engineer Neel came out in favor of an amendment that would permit the state to issue bonds. Over the next several years, he also worked with highway board members and influential citizen's groups such as the President's Club of Atlanta to promote various legislative provisions that would have created a highway authority that could issue bonds.

Figure 17: John N. Holder (right), chairman of state highway board (1922-1929), led efforts to increase the level of financing and political support for a modern highway system. With Holder are Governor John M. Slaton (left) and Benjamin Turnispeed (center), mayor of Ft. Gaines.

In reality, there was little chance of the legislature passing an unpopular law to increase the state debt. Chairman Holder, however, used the threat of having to issue bonds to leverage the lawmakers into dedicating the gasoline tax to highway construction. Georgia began to collect a one cent a gallon gasoline tax in 1921, but the revenue was used to pay off state obligations, not to build roads. The increasing number of motorists on Georgia's roads made even this meager gasoline tax a bonanza for the general treasury, and the legislature was unwilling to hand over the money directly to the highway department. The situation came to a head in early 1922 when motor vehicle license fees fell short of projections, and the department suspended operations for two months. In 1923, Holder forged a compromise; the gasoline tax was raised from one cent to two and one-half cents per gallon with half of the revenue to go for construction of the state highway system and the other half to be distributed among the counties for use on county roads.

Despite the 1923 gas tax law, more than one-third of the department's revenue was diverted to the state's general fund in 1924-25. Holder wrote that if the legislature continued to be unreasonable he would have no other choice but to support a bond

issue, even though "bonds left a bad taste in his mouth." The lawmakers again compromised, and in 1925, 1927, and 1929 they voted to increase the state gasoline tax dedicating larger percentages to state road funds. The gasoline tax accounted for more than half of the department's roughly 13 million dollar budget in 1929. The other half was made up from motor vehicle license fees and contributions from participating counties. While this sum was modest by national standards, it made the department the behemoth of Georgia state bureaucracies.

The state highway department's engineers went about the work of planning, designing, supervising, and building the state highway system surrounded by the ever present swirl of state politics. As a result of the gasoline tax, department revenues steadily increased after 1923 but there always existed an atmosphere of uncertainty about the level of future appropriations for road and bridge work. The department, like other state highway departments across the nation, responded directly to the goals of the federal aid highway program as shaped by the administrative policies of the BPR, but had to adapt the policies to fit local conditions. Thus, while urban states such as New Jersey, New York, and Massachusetts were planning and building concrete-paved highways at more than ten thousand dollars per mile, states such as Georgia, Virginia, and Alabama were grading and surfacing roads with local sand-clay and topsoil at several hundred dollars per mile.

The focus of the department's highway building program throughout the 1920s was grading, draining, and surfacing state roads in rural areas. The department followed the BPR's stage construction policy, which allowed the state to forego permanent pavements of concrete or macadam in favor of less-expensive temporary road surfaces such as graded earth, sand-clay, and gravel. As traffic increased, Georgia upgraded the initial efforts with better surfaces, but these second-stage projects were not an appreciable part of the state's highway program until after 1926. The BPR policy allowed states such as Georgia to provide a modest improvement to the greatest road mileage as soon as possible. It also provided a means to overcome chronic material shortages of concrete and bituminous concrete. By the mid 1920s, the department had improved more than 3,500 miles of sand-clay road. A typical section of sand-clay road consisted of a 30'-wide graded road bed with 9"-thick sand-clay surface providing two, 9'-wide traffic lanes and 6' improved shoulders. Of course, the trade off was that sand-clay roads required a higher level of maintenance and were more easily destroyed by weather and heavy traffic. The department stated that it was desirable to have a five-man maintenance crew with tractor for every 50-mile stretch of highway surfaced with sand-clay. In order to maintain smooth hard surfaces, the sand-clay roads needed constant attention including dragging with a grader after every rain.

Concrete and bituminous concrete road surfaces were at first reserved for state routes radiating out from large cities and county seats such as Atlanta, Savannah, Columbus,

Macon, Augusta, Rome, and Athens. The department initiated traffic counts in 1922, and this data was used to determine where traffic was heavy enough to require better surfaces. The traffic count date confirmed that the state's most heavily traveled roads were those that connected the countryside with nearby cities. These farm-to-market roads were followed in traffic density by the cross-state trunk lines, the most popular of which was the Dixie Highway.

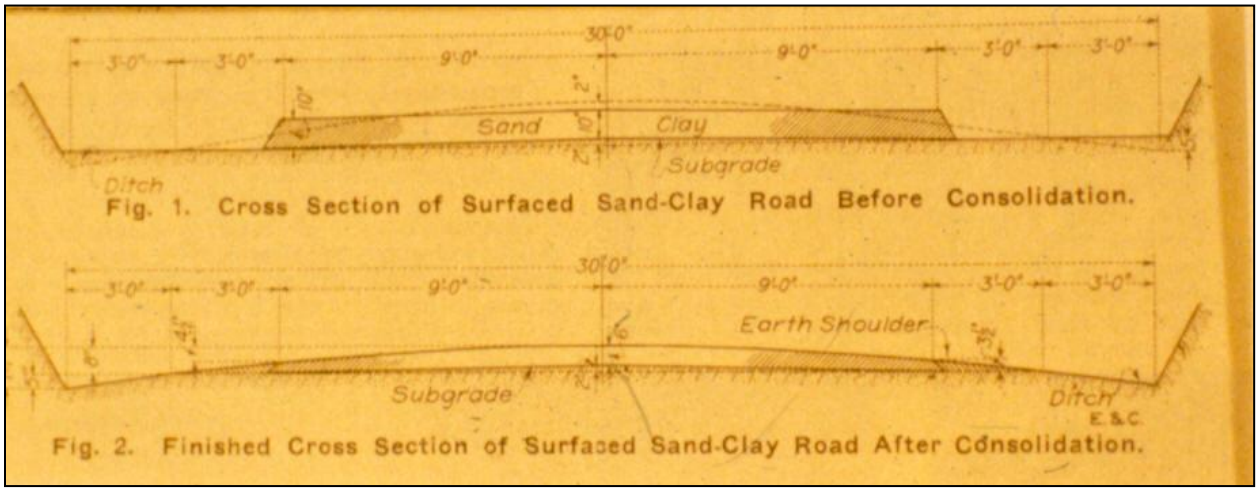

Figure 18: Cross sections of sand-clay roads. Sand-clay roads were less expensive than more permanent surfaces and allowed the state highway department to improve as much mileage of state road as possible spreading the benefits of federal and state aid. They also required a higher level of maintenance.

Paving was painstakingly slow through the 1920s, especially given that the state highway system continued to expand from an initial 4,800 miles in 1919 to over 7,000 miles in 1929. The department managed to hard-surface somewhere in the neighborhood of 100 to 200 miles of road every year from 1920 to 1929. Yet, even as late as 1927, the Dixie Highway remained unpaved for most of its 150 mile length south of Macon. The reason for the slow progress, according to state highway officials, was the persistent reluctance of the counties to allow the road building funds to be given to the completion of the main highway arteries instead of roads within the borders of the respective counties.

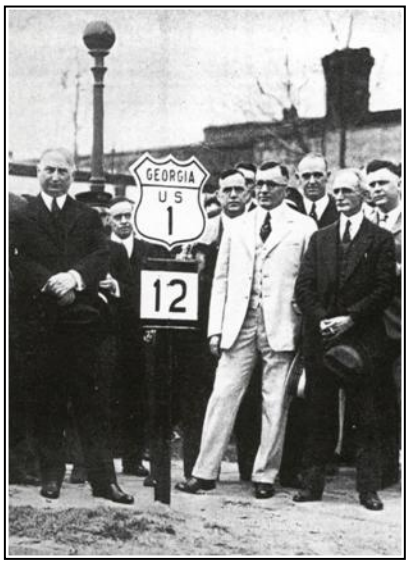

Figure 19: The first US Route 1 marker was unveiled at a ceremony in Augusta in spring 1926. The marker was at the corner of Fifth and Reynolds streets. The route was also State Route 12.

In 1926, the department followed the recommendations of the American Association of State Highway Officials (AASHO) and removed most of the trail association's route markers and replaced them with US route markers. In most cases, the department took over the tourist trails as

existing sections of county road right of way, but as the state worked throughout the late 1920s to improve the US-numbered routes for automobile travel, the roads were widened, graded, and realigned by stages. In 1929, the department announced a major initiative to connect with hard-surface the remaining unpaved sections of the major US routes including old US 1, US 19, US 29, US 41, US 78, US 80, and US 84. This plan called for paving more than 1,200 miles of road using federal aid and matching funds from state-generated road-user fees and gasoline taxes. This work, however, took over ten years to complete.

Figure 20: The Houlihan Bridge over the Savannah River near Port Wentworth was built as part of the Coastal Highway project in 1922. The original swing span, shown in this postcard, was replaced in 1954 with a new 12' wider structure (051-0054-0).

While most sections of the US routes followed preexisting county roads, an important exception was US 17 (Coastal Highway) stretching from the South Carolina state line, through Savannah and Brunswick and south to the Florida state line. In 1920, the state highway department determined that a new highway was desirable to open up poor rural counties to develop coastal counties to development and to form an approximately 155-mile long link in a chain of highways running the full length of the southern Atlantic seaboard. The route incorporated only short stretches of preexisting county roads because the topography of swamps, marshes, and broad river deltas had historically prohibited the construction of coastal roads in a north to south direction. In 1924, the six coastal Georgia counties (Chatham, Bryan, Liberty, McIntosh, Glynn, and Camden) organized the Coastal Highway District to raise a quarter of the cost of the highway by means of a bond issue. The remaining funds were obtained by state and federal aid. The route was built by stages from north to south from 1922 to 1930 when the two-lane concrete pavement of the entire route was completed. Georgia's work on the Coastal Highway received AASHO's blue ribbon of distinction in 1926. Original construction included portions of an extant swing span and T-beam bridge over the Savannah River (051-0054-0, 051-0055-0, Chatham County), but all other bridges on the route have since been replaced with second- or third-generation designs, as part of the modern widening and dualization. US 17 quickly became an important tourist highway for vacationers on route to Florida. It also stimulated the growth of Georgia coastal resorts such as Jekyll and St. Simons islands.

Establishing the State Highway Department's Bridge Department, 1920-1955

In early 1920, State Highway Engineer Neel wrote that "it was the plan of the department to construct as many permanent bridges as possible." Bridges, he argued, were of statewide importance because they spanned the rivers that had historically formed barriers to the creation of a system of interconnected roads. To oversee this important work, Neel created a bridge department for the planning, engineering, and supervision of bridge construction.

Bridges had as high a priority and visibility as any of the highway department's programs, and Neel needed a highly qualified, energetic leader to serve as the state bridge engineer. He chose Searcy B. Slack of LaGrange, Georgia. Slack had graduated from the University of Georgia in civil engineering in 1911, and he had received a masters degree from Harvard University in 1912. He had worked as LaGrange city engineer, Troup County surveyor, a U.S. Army engineer, and as a principal member of the engineering consulting firm of Garrett and Slack. Slack had been a consultant on some of the highway department's first federal-aid bridge projects in Brooks, Oconee, and Dooly counties in 1919.

Figure 21: Searcy B. Slack, State Bridge Engineer, 1920-1932

Beginning in September 1920, Slack and a small staff took over all of the state highway department's bridge engineering. In the early 1920s, when highway bridge engineers spoke of "permanent" bridges, they usually referred to reinforced concrete bridge types such as the T beam, slab, and arch. The bridge department undertook a policy of building as many reinforced concrete bridges as possible, and to help contractors "gain experience and become proficient in the construction of [reinforced concrete] bridges." Slack was confident that "education [would] lead to more reasonable bids for bridge construction and a better quality of work." By the end of 1922, Slack had supervised the construction of 217 reinforced concrete bridges, and the department had a corps of experienced contractors. Many of the reinforced concrete bridges, especially slab and T beam bridges of less than 50' long, were built to standard designs.

Figure 22: The slab bridge, built in 1922, carrying old SR 19 (Holiday Road) over Turkey Creek in Laurens County is an example of the standard reinforced concrete bridge types and designs used by the state bridge department in the 1920s.

If Slack expressed a bridge aesthetic, it was for the functional, unadorned, and economical. These considerations, especially economy, were as common to bridge engineers then as they are today,

but Slack's level of sophistication was something wholly new to the construction of highway bridges in Georgia. For each bridge, he carefully considered such economic factors as the availability and cost of materials; transportation of materials from railheads to bridge sites; the cost and available skill of labor; bridge site conditions including suitability of foundation, width and depth of waterway, size of flood plain, road alignment, and level and load of traffic; and reasonable future maintenance costs. While Slack favored new reinforced concrete bridge construction, he was also willing to take advantage of special opportunities such as when the department purchased and rehabilitated a steel draw span (non extant) that had been abandoned by the Georgia Coast & Piedmont Railroad where the railroad crossed the Altamaha River near Darien.

Figure 23: The 6 span, reinforced concrete T-beam bridge over the Atlantic Coast Line's Waycross-Albany rail line (321-5069-0) near Poulan, Worth County. The bridge was built ca. 1923 by the state highway department as a grade crossing elimination. It carries old SR 50/US 82. The railroad is now abandoned.

Given the department's policy of building permanent reinforced concrete bridge types, bridge construction received a large portion of the department's federal aid allotments. Neel reported that between 1919 and 1926 the department built over 23 miles of bridges, or an astounding 19 percent by length of all federal aid bridge projects in the United States. Georgia had twice as many miles of federal aid bridge work as the next ranked state (Oklahoma). One reason for the length of Georgia's bridges was that the department directed its federal aid dollars to bridge construction instead of permanent paving. Another reason was that much of Georgia's highway system passed over low-lying areas where traffic had been previously served by ferries or by low-water bridges that were frequently closed during high water. Slack replaced the ferries and low-water bridges with higher and longer bridges and causeways that crossed over both stream and flood plain, thus keeping roads passable. State Highway Engineer Neel was proud to write that:

> The large amount of permanent structures designed and erected under the supervision of the [bridge] department are of the most modern type, and the details of construction have been most carefully looked after. The District Engineer of the Bureau of Public Roads stated in a public address that the work in Georgia on bridges required practically no supervision from his department.

By the mid 1920s, Georgia's bridge department had become a nationally recognized leader in the construction of low-cost, efficient highway bridge structures.

Searcy B. Slack undertook to build his reputation as an expert on low-cost bridge designs and published research papers on such subjects as the detection of marine

boring animals in wood-piling and the comparative costs of abutments and open-end bents. He also placed a priority on developing cooperative arrangements with neighboring states in order to expedite the construction of bridges over the rivers that form Georgia's borders. In 1926 alone, three new bridges were opened over the Chattahoochee River between Georgia and Alabama. Slack also expanded the state's program of railroad grade-crossing eliminations, with the state sharing the cost of engineering and construction with the railroad companies. The state's grade-crossing laws were amended in 1927 to expand the power of the highway department to determine where grade crossing eliminations were necessary and to apportion the cost of construction between the railroad companies, municipalities, and the state government.

As impressive as the bridge department's accomplishments were, Slack was concerned that the failure to expand state financial aid for highway and bridge improvements had led to some serious deficiencies in the department's bridge building program. A most difficult problem was providing adequate maintenance for the older bridges on the state highway system. In 1922, the first complete inventory of bridges on state system roads revealed that the state had inherited more than 1,400 county-built bridges. Of that total, at least 1,100 were wooden bridges that, according to Slack, needed to "be reconstructed in the near future to meet the requirements of modern motor loadings." An additional 250 metal truss bridges were not adequate for use on the state system, but for the sake of economy could be taken down and relocated on off-system roads. A bridge maintenance program was instituted in late 1922 to cope with the problem of repairing and reconstructing older bridges. Several hundred of the county-built bridges were replaced with so-called "temporary" bridges of timber stringer construction until such time that funds were available for more permanent reinforced concrete construction.

Even more disturbing to Slack than the state's bridge maintenance problems was that the department's early bridge designs had not anticipated the rapid increase in the size, power, and speed of automobiles, trucks, and buses. In 1931, Slack wrote that many of the reinforced-concrete bridges that had been constructed in the early 1920s were already antiquated because of narrow roadway widths and sharp alignments, even though the bridges were still structurally sound. The problem was not unique to Georgia; everywhere across the nation, many state highway departments found their bridge designs outpaced by changes in the level and character of motorized vehicles. However, the difficulties arising out of the need to replace and substantially rebuild bridges were particularly acute for Georgia because of the department's funding situation and the fact that the state had invested so much of its federal aid money in bridges that were now functionally obsolete. In addition to reconstructing state-built

bridges less than 12 years old, hundreds of old county-built bridges also needed to be replaced.

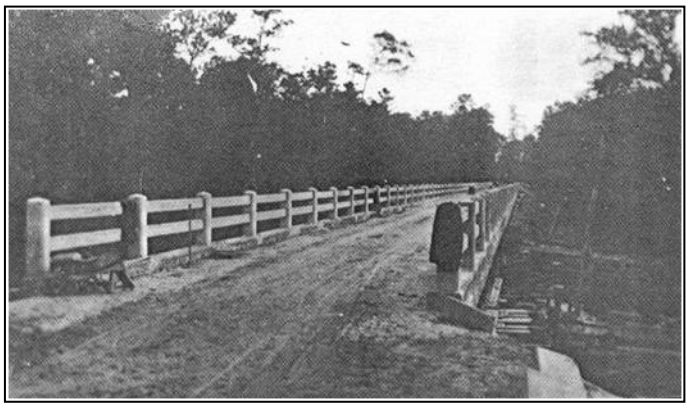

Figure 24: The 30-span, 660' long reinforced concrete slab bridge over the Ohoopee River on old US 80, built in 1920, east of Adrian, Johnson County. Between 1919 and 1926, Georgia's state highway department built more bridges by total length than any other department in the nation, much of it over the state's rivers, swamps, and flood plains. Unfortunately, the bridges proved too narrow for motorist safety and soon had to be replaced. The bridge was rebuilt with a wider deck in 1932, a mere 12 years after its original construction.

Slack upgraded the state's standardized bridge designs in the late 1920s and early 1930s to meet the ever-increasing requirements of automobiles and trucks. The department abandoned roadway widths of between 16' and 18' for new standards of between 20' and 22', and reinforced concrete was no longer de rigueur as the construction material. Steel stringer (rolled beam) had become competitive with reinforced concrete due to the falling cost of steel and wider availability of heavier and deeper beam sections. Slack reasoned that stringer bridges could be more readily widened, or in case of a change in bridge location or alignment, salvaged and reused elsewhere. The bridge department was particularly adept at designing lengthy multi-span bridges that minimized the need for expensive and heavy construction equipment and that economized on material and construction costs through the use of continuous beams, cantilevered sections, and suspended beams. Indeed, in the late 1920s, Slack had begun to move Georgia's bridge program to the leading edge of standardized continuous-span bridge designs. However, the Depression and some unforeseen political events cut short Slack's career with the state highway department in 1933.

Road and Bridge Building and the New Deal, 1932-1940

In October 1929, the stock market crashed and the Great Depression hit the nation. Interestingly, while the nation's economy languished and unemployment soared, road building policies and procedures during the early years of the Depression were little affected by the economic downturn. The Hoover administration and the BPR strove to maintain the basic intergovernmental relationships on which state highway officials had come to depend and which had proven to be an efficient and effective way to distribute federal funds. The federal aid highway program was one of the few existing programs for distributing federal funds on the state and local levels left in place when the Depression hit, so federal aid apportionments continued to flow to the states. Surprisingly, state-generated road-user revenues such as motor vehicle registration fees and gasoline taxes remained relatively stable. In 1931-32, the Georgia state

highway department built a record-setting 279 miles of concrete roadway including a 40-mile stretch of highway on US 80 from Savannah to Swainsboro. The bridge department designed an annual high of 120 bridges aggregating a length of 5.2 miles.

In 1933, President Roosevelt announced the first New Deal programs to bolster the nation's economy through large-scale grants of federal assistance aimed directly at making work. Large federal highway appropriations in 1933, 1934, and 1935 were made available through the regular federal aid system and also through the National Industrial Recovery Act (NIRA) of 1933, the Hayden-Cartwright Act of 1934, and the Emergency Relief Appropriation Act of 1935. The acts channeled federal money to the federal aid system of highways, and, for the first time, to urban roads and secondary farm-to-market roads not on the federal-aid system. Additional federal funds were made available in 1935 through the Public Works Administration (PWA) for hiring thousands of workers to build roads and bridges for state, county, and municipal highway projects. The Civilian Conservation Corps (CCC), one of Roosevelt's pet projects, provided temporary jobs for young men building recreation and conservation projects, including some 46,000 bridges, mostly in national forests and parks. The Tennessee Valley Authority (TVA), another New Deal agency, built dams and other public works including roads and bridges along the Tennessee River system, which touches on parts of northern Georgia.

Throughout the United States, the New Deal was a major boost to road-building programs, but in many southern states the New Deal reopened controversy over the old issues of federal versus local control of government programs. Never before had the federal government spent so much money on domestic programs, nor had it been involved to such an extent in providing jobs to a broad segment of southern society. Vocal political opponents such as Louisiana's Huey Long and Georgia's Eugene Talmadge criticized the New Deal for creating huge bureaucracies that intruded into local affairs. The populist-style politicians appealed to rural southerners who had seen their lives go from bad to worse as agricultural prices dropped and banks foreclosed on farms. In the face of severe economic suffering, the expenditures of state highway departments, in particular, seemed to them especially extravagant when state and county treasuries were empty. In southern states, the highway departments were the targets of political attacks because of their size and control of federal aid, and in Georgia the attacks became so heated that the department's road- and bridge-building programs came to a grinding stop.

In November 1932, Georgians elected Eugene Talmadge as governor on a platform of fiscal conservatism that contrasted markedly with the promises of the New Deal. The highway department had played an important role in the governor's campaign because Governor Talmadge had promised a reduction in the state motor vehicle tag fee. He also promised to divert the state's gasoline tax from road improvements to the general

treasury for the purpose of paying off state and local government debts. A vocal opponent of Governor Talmadge was highway board chairman J. W. Barnett, a civil engineer and Athens city engineer for more than 40 years. In 1930, Barnett was appointed to the highway board for a six-year term. He strongly believed the highway department should develop the state highway system "according to practical needs and not according to political expediency." During 1932, the official magazine of the highway department, called Georgia Highways, printed articles suggesting the department would do everything in its power to oppose any plan to divert the gasoline tax to non-road purposes.

Figure 25: Governor Eugene Talmadge spearheaded a major political showdown in 1933 between the governor's office and the highway department over highway financing. Talmadge had the chairman and the department's chief engineers removed by military guard. Symbolically, the governor's statue with pointed finger was later placed the highway office building in Atlanta.

The showdown between Governor Talmadge and the department was without doubt one of the more dramatic 20th-century events in state political history. Early in 1933, the governor refused to release state highway funds to the department. He then ordered the state highway board to fire the department's top engineers and to cut its administrative budget. Barnett was shocked by the dismissals and refused to fire the engineers, among whom was bridge engineer Searcy B. Slack. In an unprecedented move, Governor Talmadge declared martial law in June 1933 and had Chairman Barnett, the state highway board members, and the department's chief engineers physically removed from their offices by military guards. Governor Talmadge installed his own hand-picked highway commissioners, lowered department salaries, and cut the department's staff by nearly half.

In retaliation, the BPR withheld Georgia's road funds for several months on the grounds that the state could no longer adequately administer the federal aid program. Eventually, the funds were released, but the department was understaffed and it had difficulty securing approval from the BPR for its new highway projects. To put a stop to the diversion of gasoline tax revenues to non-road purposes in Georgia and other financially strapped states, Congress placed a provision in the Hayden-Cartwright Act of 1934 that penalized states that diverted gas tax revenues for purposes other than road improvements. By 1935, the situation had become so critical that President Roosevelt threatened to establish a separate state agency to administer Georgia's federal public works funds.

Realizing that a confrontation between Roosevelt and Talmadge could be politically damaging, Georgia's U.S. Senator Walter George arranged a compromise between the two. He prevailed upon Governor Talmadge to enlarge the department's engineering staff in order to have the trained personnel necessary to design, qualify, inspect, and supervise federal aid road and bridge projects. In return, the governor was assured that road and bridge projects would not be required to comply with federal labor laws. One of the governor's objections to the New Deal was that it established federally mandated pay scales without regard for local conditions. He feared that high-paying road projects would cripple the state's economy by drawing agricultural workers away from their farm jobs to federal works projects. The collapse of Georgia's cotton economy had already caused tens of thousands of agricultural workers and tenant farmers to migrate from the countryside to the cities, causing farm labor shortages. Additionally, he was offended by federal regulations that required the state to pay the same wages to black laborers as white laborers on federally funded projects.

From 1933 to 1935, the state highway department's road and bridge program staggered along with the engineering staff doing the minimum amount of work that was necessary to keep the state from losing its federal aid. As a cost saving measure, newly appointed state engineer M. E. Cox temporarily discontinued the department's use of concrete paving in favor of lower-price asphalt wearing surfaces. The number of maintenance districts was reduced from nine to three with a consequent reduction in maintenance staff. Thus, highways and bridges suffered from lack of attention. From 1935 to 1936, as a result of the compromise struck between Governor Talmadge and President Roosevelt to increase department staff, the pace of highway improvements picked up and soon reached pre-1933 levels. In 1935-36, the bridge department placed under construction some 4.7 linear miles of bridge work, mostly of steel stringer bridges with concrete deck and timber substructure. Still, WPA wages remained so low in some rural Georgia counties that the highway department found it impossible to hire adequate labor forces to complete its projects.

In 1936, Governor Talmadge lost the governor's race to Eurith Rivers. Governor Rivers had campaigned on a pro-New Deal platform and a promise to expand the state's public works programs. The 1937 state legislative session reorganized the state highway department and removed the Talmadge appointees. The flow of New Deal works funds resumed and the department's new administration moved quickly to commit federal and state funds to road and bridge projects. The number of maintenance districts was increased from three to seven. In direct response to the availability of federal emergency relief funds for rural post roads, the legislature created a rural post roads division within the highway department. The division was charged with cooperating with the federal, county, and municipal governments to improve rural post roads. From 1937

to 1940, more than 1,291 miles of rural post roads were improved including 4.8 miles worth of bridges, mostly of short-span timber or steel stringer construction.

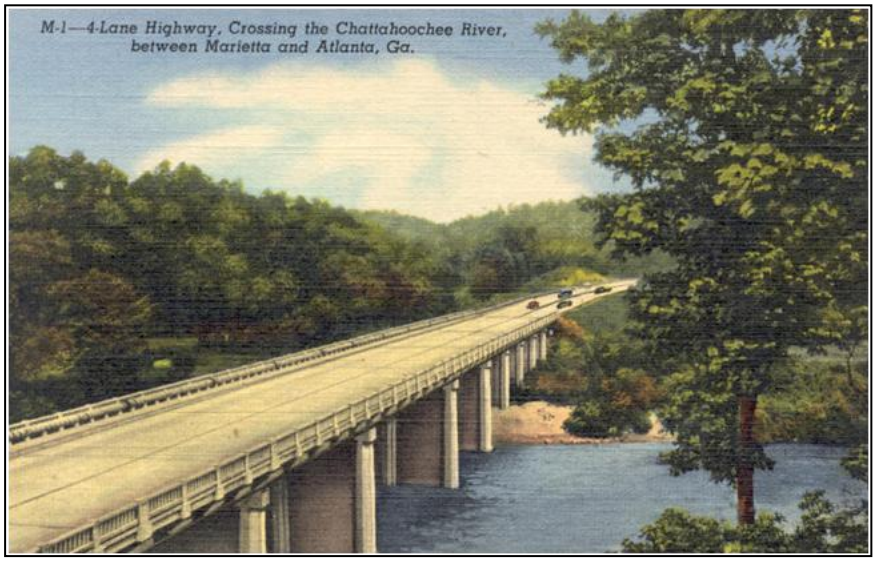

Figure 26: Postcard of the Atlanta-Marietta Highway bridge over the Chattahoochee River (121-0015-0). Georgia's earliest attempt at a "high speed" 4-lane highway, completed in 1938, illustrated the shortcomings of early dualization efforts, including lack of controlled access, no provision for turning lanes, and dumping heavy traffic onto the local street grid at the city line.

In 1938, the state highway system was expanded from approximately 7,000 to 11,000 miles of highway as the department took over nearly 4,000 miles of county roads. The move was part of a legislative act to relieve counties of the cost of highway maintenance and to shift the burden to the highway department. In the same year, the department created under federal mandate a division of highway planning that for the first time prepared complete county road maps and undertook a comprehensive statewide traffic study. State traffic engineers earmarked the highest volume roads for upgrading based upon traffic count data. In 1937, the department began construction of its earliest large scale upgrade project, the Atlanta-Marietta Highway (SR 3E). The dualization project was built on a new right of way from where it left Northside Drive in northwest Atlanta to a point north of Marietta, where it connected with SR 3. The four-lane highway consisted of two 20'-wide strips of concrete pavement (10' travelways) separated by a 4'-wide "dividing strip" which was raised slightly above the surface of the pavement. Although the Atlanta-Marietta Highway was not innovative by national standards (such highways had been built in urban northern states for more than 10 years), it was the first Georgia dualized highway designed to promote safety on a heavily traveled section of primary road (see Appendix B, Dualized Highways).

A significant component of the BPR's New Deal highway program was the elimination of hazardous railroad grade crossings by building overpasses and thus separating vehicular and train traffic. From 1932 to 1941, the federal government made available several hundred million dollars to the states to build more than 2,100 grade-crossing elimination bridges and to install thousands of automated train-activated protective signaling devices. Georgia's bridge department participated in this nationwide program and in its publicity material the department considered the bridges (some of which were

several hundred feet in length) among its most notable accomplishments. The New Deal was the most concentrated period of grade elimination bridge construction in the state's history. The Georgia Historic Bridge Inventory Update evaluated more than 80 New Deal-era highway bridges that span railroads. Approximately three-quarters of the bridges are steel stringer construction, and the remainder are timber stringer construction. Many of the bridges are located in urban areas and small towns on sections of state highway that became eligible for federal aid as a result of New Deal works projects. A good example of a New Deal grade-crossing elimination bridge is the 1937 East Avenue (old SR 6, 233-0009-0) viaduct in Cedartown, Polk County.

The federal grade elimination program evolved from the need to superimpose a modern highway system over the preexisting rail system. Prior to the New Deal, state and local officials had only limited success convincing railroad companies of the benefits of railroad-sponsored grade elimination programs. In the late 19th century, the problem of grade eliminations was generally confined to urban areas, except in some rare instances where railroad cuts passed through farmland dividing fields and rural lanes, in which case the railroads occasionally allowed for the construction of overpasses. In the

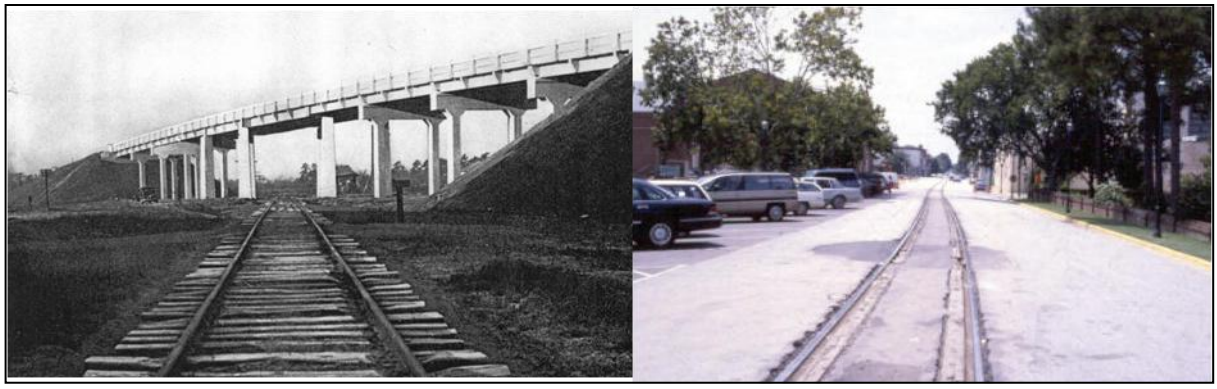

Figure 27 and Figure 28: With ever increasing number of automobile and trucks, at-grade crossings were a growing safety concern of transportation officials. Rail freight lines sharing city streets, such as the one (right) in Augusta, were once a common sight. In the 1930s, New Deal programs helped the state highway department redouble its efforts to carry state highways over or under rail lines. The steel stringer bridge (left) was built in 1937 to carry SR 21 over the Central of Georgia RR in Richmond County.

20th century, the problem of providing for safe and efficient crossings of railroads and roads became widespread as both locomotives and automobiles increased in size and speed. Safer grade crossings received nationwide publicity from the 1900s to the 1930s. In 1919 alone, nearly 14,000 persons died from being struck by trains. Railroads and local, state, and federal governments struggled to find ways to meet the safety needs of the traveling public. The railroads erected signals and signs and sponsored public education campaigns to "Stop, Look, and Listen." The separation of tracks and roads was another answer to the problem, but grade eliminations involved significant changes in elevation of either track or roadway at a substantial cost that the

railroads were rarely willing to bear alone. Railroad officials usually preferred less costly means of providing for safer crossings, but they were sometimes left no option but to build viaducts and bridges, especially in densely populated urban areas. The reluctance of the railroads to fund grade eliminations resulted in the revision of Georgia's grade-crossing laws in 1927. The new law required railroads to help defray the cost of the grade eliminations as determined by the state highway department, yet still limited each railroad's annual contribution to a rather meager $40,000.

Of Georgia's cities, Atlanta has the most extensive system of railroad viaducts and bridges. Like many cities, Atlanta's railroad crossing problems had become serious by the late 19th century as pedestrians, horse-drawn vehicles, streetcars, and trains all moved through the downtown area at grade. The problem of grade crossings was made ever more acute by the city's street plan. Rapid growth and inconsistent planning had resulted in streets that were parallel to a variety of reference points, resulting in a confusion of odd-angled intersections. The introduction of automobiles only made matters worse. Between 1921 and 1935, a system of viaducts was planned and implemented in downtown Atlanta, effectively raising the level of vehicular traffic by one story over the railroad tracks. New Deal money funded much of the viaduct program.

Overseeing the state’s bridges and railroad overpasses during the New Deal was a State Bridge Engineer Clarence B. Crocker who filled the position vacated by Searcy Slack following Governor Talmadge's 1933 purge of the department. Crocker reorganized the bridge department to meet the needs of the Depression years, calling for bridge designs that could be built with a maximum of manual labor and a minimum of heavy equipment and machinery. Under his direction, the bridge department built more than 680 bridges between 1936 and 1940. Crocker continued to use and refine the continuous and suspended-section cantilever steel stringer bridge designs first developed for Georgia by Slack in the late 1920s and early 1930s. The total included in excess of 30,000 linear feet of the steel stringer bridge type with timber pile substructure and concrete deck. The steel stringer bridge was by far the most prevalently built bridge type in Georgia and throughout the entire nation in the 1930s.

In 1935, Crocker began the process of updating the department's bridge specifications to meet national guidelines, which were and are set by the American Association of State Highway Officials (AASHO) bridge committee. AASHO's specifications, which had first been published in 1931, served as a model for the preparation of state standards and set forth minimum requirements for every detail of bridge design from the substructure to the railings. An important innovation of AASHO was the adoption of a truck system of live load designated as H-20, H-15, and H-10. The loadings specified bridge designs based upon 20-, 15- and 10-ton two-axle trucks in each lane of the bridge followed by a train of trucks weighing three-quarters as much as the basic truck. The result of AASHO specifications was that highway bridge design reached an

unprecedented level of national standardization in the 1930s. Thus, the majority of Georgia's post-1930 highway bridges were not technologically exceptional as their design, construction and appearance were much like those of every other state.

A small handful of the state's long-span bridges required special designs that employed an unusual amount of judgment and technical skill. The Darien River bridge on US 17/SR 25 between Glynn and McIntosh counties (191-0007-0) has a cantilevered deck girder suspended unit of 150' length. It is an early example of a high-level bridge designed to eliminate a movable span and provide vertical clearance for river navigation. The bridge department designed the bridge in 1939-40, but the advent of World War II delayed construction until 1944. Another significant bridge is the Tallulah Falls bridge (SR 23/SR 15, Rabun County), completed in 1939. The bridge spans the Tallulah Gorge in the rugged northeastern part of the state. The three-span continuous deck girder design, with a center span of more than 220', was one of the nation's longest when built. The superstructure of the bridge was widened in the early 1990s, but the unusual cellular concrete piers remain.

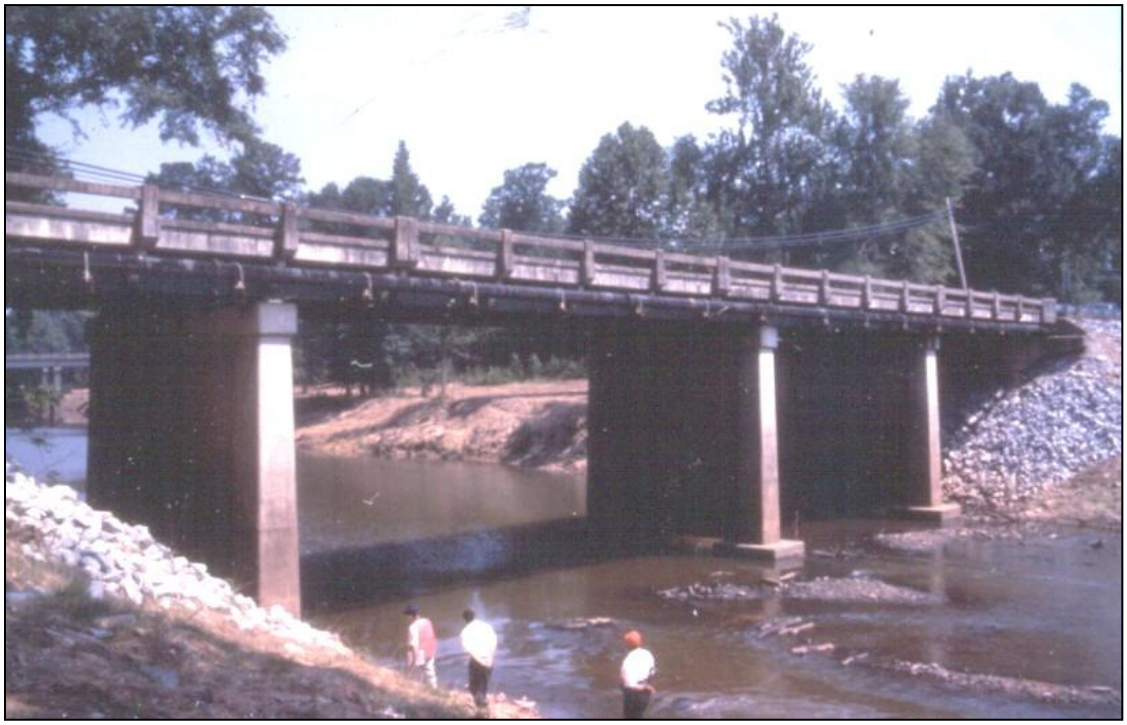

Figure 29: Fulton Mill Road over Obesofkee Creek, southwest of Macon, Bibb County (021-0064-0). The continuous-cantilever steel stringer bridge, built in 1937, is an example of the economical standard designs used by the state bridge department.

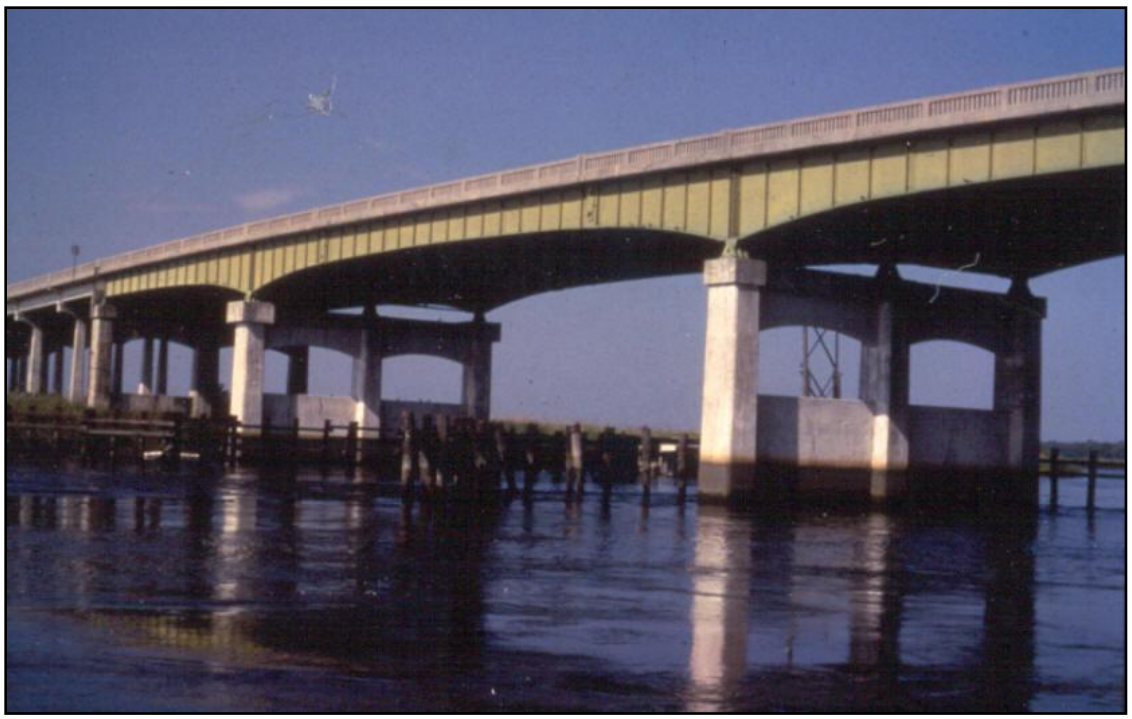

Figure 30: US 17/SR 25 over the Darien River between Glynn and McIntosh counties (191-0007-0). State bridge engineer Clarence Crocker oversaw the design and construction of the 30 span, 1,452' long bridge between 1939 and 1944.

By the end of the 1930s, the state highway department was building roads and bridges at a healthy pace, and it had begun to regain the momentum lost as a result of the political and financial disruptions of the first Talmadge administration. Compared to other states, Georgia's participation in federal New Deal roads programs had to be crammed into a few short years at the end of the decade. Additionally, the 1933 takeover had set several political precedents which would continue to hamper the department through the late 1940s. Each succeeding governor prevailed upon the legislature to pass a bill discontinuing the highway department and establishing a new one, thus making it possible for the governor to appoint all new members to the highway board and dictate state highway policy. Between 1933 and 1947, the department was headed by eight different state highway engineers, a reality that made consistency in planning of the state highway system impossible. Furthermore, withdrawing administrations in their final year in office would seriously overspend in order to leave the entering administration with a large deficit to overcome. As an example, in 1940 the Rivers administration left the highway department with a deficit of 12 million dollars. As a result, the department in late 1940 failed to meet matching payments on federal aid projects and work discontinued for several months.

Planning the Postwar Future of Georgia's Highways 1941 - 1946

The great national highway boom that began in the 1920s and continued through the Depression came to an end when the nation mobilized for World War II. The federal Office of Defense Mobilization restricted road-building supplies in June 1941, and gas rationing sharply curtailed tax revenues for highway construction and maintenance beginning in April 1942. State highway departments worked with reduced staffs after employees left for the armed services. Nationally, federal aid highway projects fell from an all time high of 12,936 miles in 1941 to only 3,035 miles in 1945.

In Georgia, new construction on the state highway system almost completely stopped and existing roads and bridges suffered for lack of maintenance. In late 1942, State Bridge Engineer Crocker reported that, due to the extreme shortages of steel, "radical changes had been made to reduce the quantity of steel in design of highway and bridge structures." Steel was so hard to come by that abandoned metal truss bridges were salvaged for repair material. Shortages also occurred in such items as bronze expansion bearings, rubber and cork expansion joint filler, galvanized metal, copper flashing, aluminum paint, and burlap for curing concrete; even treated timber was hard to find, and repair of bridges was largely limited to the use of untreated cypress and pine woods.

Nationally, as well as in Georgia, what little road and bridge construction did occur was focused on those highways most essential to national defense. In November 1941 Congress passed the Defense Highway Act, providing $150 million for construction of defense-related highways. By the end of 1942, more than 600 access roads to military bases and defense factories were under construction nationwide. Georgia had a large share of defense highway projects due to the important army posts and airfields located within the state. Fort Benning, near Columbus, was the largest infantry training school in the nation, and the army considered the maintenance of roads in and near the camp essential to the efficient movement of troop convoys. Other important defense facilities included Robins Air Service Command and Camp Wheeler, both near Macon; Fort Gordon near Augusta; Hunter Field near Savannah; and the Bell Bomber Plant near Marietta. As part of the war effort, Georgia State Highway Department engineers designed and supervised the construction of a 2-mile long, four-lane, grass-median dualized highway from Macon to Camp Wheeler, and a similar 11-mile long dualized highway from Columbus to Fort Benning (Victory Drive). They also provided in 1943 for the construction of a continuous T beam bridge to carry an access road over the Chattahoochee River to the Bell Bomber Plant in Marietta (SR 280/James Jackson Parkway, 121-0116-0, Fulton-Cobb County) (See Appendix B for more information on Georgia's wartime and postwar dualized highways).

Although wartime construction was limited by the federal government to a few critical defense highways, it was a crucial period for the planning of postwar construction. The initiative for postwar planning originated in Washington. BPR Chief Thomas McDonald stressed the need for states to prepare for the construction boom that was seen as a necessary component of postwar economic recovery. In 1939, McDonald sponsored the publication of Toll Roads and Free Roads, a master plan advocating a system of limited-access, interstate express highways that linked urban centers. McDonald used the postwar planning process to build support for urban expressways and a system of free interstate superhighways. The Federal Aid Highway Act of 1944 provided $125 million to urban areas for the planning, acquisition of right of way, and construction of expressways. The 1944 Act signaled a fundamental shift in federal highway policy away from rural road systems, and formed the foundation for the landmark 1956 Federal Aid Highway Act that launched the modern interstate program.

State highway departments began gearing up their planning departments for the federally sponsored urban and interstate highway programs in 1944. Georgia requested funds to prepare plans for 1,713 miles of roads. Included was a comprehensive plan for the Atlanta metropolitan area and special investigations in Savannah and Brunswick to determine the best locations for the most important roads. Within the next two years, similar studies were underway in Waycross, Columbus, Macon, and Augusta. The department transformed its 1937-39 traffic count and destination study into planning documents that determined major arterial routes in to, out of, and around cities, as well as logical linkages to already existing state and federal routes. The department also created a right of way division to facilitate acquisition and a landscape department to design roadside improvement projects such as ornamental plantings and landscaped shoulders with ground cover and flattened slopes to prevent erosion. In anticipation of a heavy demand for postwar highway improvements, the bridge department updated a number of its standard T beam and steel stringer bridge designs and drawings to take into account wider roadways with greater load capacities.

By far the largest of the state's urban expressway planning projects was the plan for Atlanta, where traffic congestion was legion. The state turned to outside consultants H. W. Lochner & Company of Chicago to prepare the plan, and they proposed a system of limited-access expressways to serve the city's needs through the year 1970. Lochner advised that the expressways were not tourist facilities built to carry the seasonal pilgrimage around or through the city, but "utilitarian highways to serve primarily the traffic moving about the metropolitan area or traffic either with origin or destination in the urban center." The expressway plan marked a major reorientation in Atlanta's transportation systems, placing the highway and not the railroad as the starting point of the city's transportation planning. The planners envisioned Atlanta as a trucking terminal with expressways and interstate highways radiating from the city center hub

toward Spartanburg, Chattanooga, Birmingham, Montgomery, and Macon. The primary link in the expressway system was a downtown connector, planned as a below-grade expressway through the heart of downtown and extending around the north, east, and south sides of the central business district. The consultant's plan was widely hailed as a solution to the worst of Atlanta's traffic congestion and safety problems. In retrospect, it largely ignored mass transportation systems and even called the city's plan to eliminate streetcars and trolleys "a sound policy." The present system of interstate highways located in downtown Atlanta, including I-75, I-85, and I-20, follow the routes suggested by H. W. Lochner in 1946.

The Postwar Highway Program in Georgia, 1946-1956

In October 1945, Congress lifted the war emergency and released the road funds authorized by the Federal Aid Highway Act of 1944. Georgia received about 11.5 million federal dollars per year from 1946 to 1948, and the state was able to supplement the federal aid with record-setting gas tax revenues. State highway officials began construction of the Atlanta North-South Expressway (route of present I-75/I-85 connector, portions of US 23 Buford Highway, completed in 1954) supplemented by bonds issued by the Joint Bond Commission of Fulton County and the City of Atlanta. Another major initiative included upgrade projects on US routes 1, 17, 23, 29, 41, and 80. US route improvements were based on new national standard design policies that had been developed cooperatively by AASHO and approved by the BPR in 1945. The AASHO standards established requirements for highway geometry predicated on traffic volumes. In heavy urban traffic areas (over 800 cars per hour), highways were expanded from two- to four-lane dualized highways with heavier bridge design loadings. Postwar inflation slowed construction progress in 1946, but from 1947 to 1948 the state

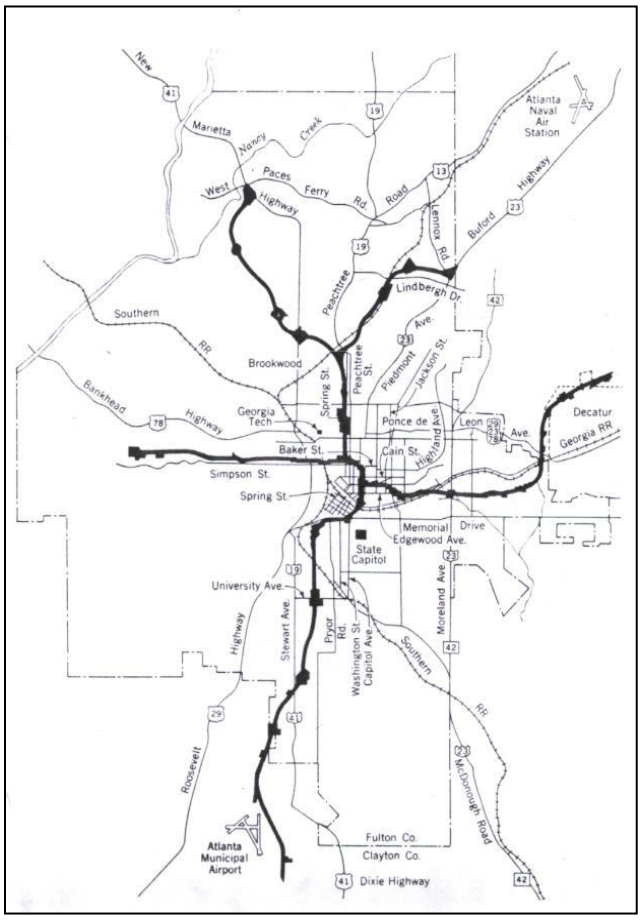

Figure 31: The Lochner plan for Atlanta's freeway system, as adopted in principle in 1946 by the Georgia State Highway Department, formed the basis for federal aid financing of expressways that eventually became I 20, I 85 and I 75.

highway department placed under contract 2,340 miles of roadway, the largest volume in the department's history for any two-year period to that date. Contracts included 251 bridges and over $600,000 in major bridge repairs.

Throughout the postwar period, Georgia's highway program was influenced more than ever by national trends. After the war, Americans released their pent up consumerism and went on a car-buying frenzy. Auto manufacturers increased annual production from a mere 69,000 cars in 1945 to over 3.9 million in 1948. In Georgia alone, motor vehicle registrations doubled from more than 523,000 in 1945 to over 1,069,000 in 1953. At the same time, an unprecedented flood of tourists passed through the state on automobile vacations to Florida. The postwar boom revived the state's tourist industry, which had languished during the Depression. The increasing number of vehicles influenced roadside landscape and resulted in the rapid development of commercial strips and accelerated rates of suburbanization.

Figure 32: The 2 span T beam bridge over North Avenue (121-0470-0) is one of the few surviving bridges that was part of the original Atlanta Expressway plan. In 1951, it was built to access a multimodal transportation and freight distribution district along the tracks of the Southern Railway. The expressway plan specifically took into account the need for truckers to access terminal facilities.

The transportation of goods by highway also became increasingly important in the postwar years. Nationally, trucks showed a steady strong upward trend in numbers, as well as weight class throughout the 1950s. As Atlanta grew as a major trucking terminal, the state highway department became increasingly aware of the toll heavy trucks were taking on lightly built roads and bridges. Atlanta's expressway plan specifically took into account the need for truckers to have accessibility to terminal facilities.

The growing number of cars and trucks created congestion, especially in urban areas like Atlanta. The city had for years struggled to meet automobile safety and parking needs, and despite an impressive series of downtown viaducts found itself with one of the worst accident records of any urban area in the country. The death of the city's acclaimed author Margaret Mitchell, struck by a taxi in 1949, helped galvanize the urban community into creating a blue-ribbon commission to work with city planners to improve the problems related to narrow and poorly laid out streets, lack of parking space, and inefficient traffic enforcement. In general, Atlanta's efforts to rebuild the city for the automobile mirrored similar efforts in urban areas across the country.

The state highway department, handicapped by lack of funds in past years, found more stable sources of financial support in the postwar years. From 1946 to 1950, the

department had at its disposal 19 to 30 million dollars per year from gasoline taxes and motor vehicle license fees. In 1951 and 1952, the legislature appropriated 50 million dollars to the department at the special insistence of Governor Herman E. Talmadge, the son of former governor Eugene Talmadge. In 1952, voters passed a constitutional amendment requiring that all net funds from gasoline taxes and motor vehicle license fees be appropriated exclusively to the improvement of roads and bridges through the state highway department. By 1953, the state highway system had been increased to more than 15,000 miles of roads.

Clarence Crocker served as Georgia's state bridge engineer until 1956. He oversaw the largest volume of bridge construction in the state's history, surpassing even the impressive efforts of Searcy B. Slack in the 1920s. In the ten-year period from 1946 to 1956 the department let contracts for over 1,440 bridges; a large number were for the reconstruction and enlargement of previously built bridges on state and federal aid highways. In 1953 the bridge program was given a financial boost by state legislation that created the State Bridge Building Authority to issue bonds in the amount of $30 million for the exclusive use of bridge construction. From 1953 to 1955, the department built more than 230 bridges with state bonds. Much of the money was used to replace the state's "longest and most troublesome" wooden truss bridges, such as Glass Bridge over the Chattahoochee River at West Point, which was replaced in 1955. The number of covered bridges in Georgia dwindled from over 130 in service in 1948 to approximately 40 in service in 1960.

A constant theme of the immediate postwar years was the bridge department's need to adapt quickly to changing prices and levels of supply of bridge materials. The war had depleted the nation's timber reserves, and Crocker reported that timber of the sizes and grades required for timber bridges was expensive and difficult to obtain. During the Korean conflict (1950-53) steel was rationed, and the department received about half as much structural steel as needed to complete its scheduled bridge projects. As a result of the timber and steel shortages, Crocker directed the department's engineers to update standard low-cost designs for reinforced-concrete bridges. The department expanded use of concrete piles and continued its reliance on reinforced-concrete T beam bridges. For the department's secondary road program, the bridge department designed light, precast concrete deck slabs, including waffle types. The latter were constructed and transported by rail to the bridge sites. Under the existing material conditions, Crocker considered the precast deck slab bridges "most economical.”

During the first half of the 1950s, the department refined bridge types that had been in use since the 1920s. Many standard bridge types, such as the T beam and steel stringer, were simply built with deeper beams, widened, and given minor detail changes to strengthen them for modern loadings and conditions. The department hired hydraulic engineers and began work in 1948 with the United States Geological Survey (USGS) to

determine ground elevations, flood elevations, angle of stream crossings, drift-carrying potential, and area drained by streams. Hydrological data was used to establish whether bridge designs would have sufficient span-length, substructure design and waterway to pass floods of expected frequency with velocities that would not produce excessive stream erosion.

Crocker's departure as state bridge engineer in 1956 and his replacement with C. A. Marmelstein was a fitting transition as the state highway department prepared to gear up for the interstate highway program that would dominate the construction agenda for the next 20 years. The numerous large interchanges, complex grade crossings, and long-span bridges hastened the nationwide development of new bridge types using such technologies as prestressed concrete, composite steel, and welded steel which prior to 1957 had not been a significant part of Georgia's bridge program.

Figure 33: In the late 1940s and 1950s, the state bridge department continued to refine the continuous designs that had been adopted in the 1930s. The 1952 US 80/SR 26 over Oconee River bridge (175-0017-0) in Dublin, Laurens County, was a steel stringer bridge with haunched continuous steel beams. The Moderne-style railings reflected the changing tastes of the postwar period.

Bridge Building Technology in Georgia, 1900-1955

Introduction

In the late 1910s and early 1920s when Georgia embarked on its statewide road improvement programs, the great period of innovation and experimentation in bridge design was coming to an end. By the start of World War I, the rolled steel I beam, or stringer, and reinforced concrete T beam, introduced in this country in the late 19th century, emerged as the two dominant bridge building technologies based upon their economy, ease of erection, capacity, and maintenance requirements. The older technologies, like metal trusses and reinforced concrete arches quickly fell from favor.

Georgia's pre-1956 bridges reflect the national trends in bridge building, and as such their history is marked more by the increased strength of materials than development of innovative new designs. The state's extant bridges illustrate the dominance of steel beam and reinforced concrete beam and slab technologies, and their nearly universal application to any crossing requirements as the strength of steel and the depth of rolled beams increased during the course of the first half of the 20th century. Georgia's bridge engineers, like those everywhere, utilized well-established, standardized technologies for ordinary highway bridges. Stringer, reinforced concrete beam, and slab bridges so dominated the national scene after World War I that bridges from Georgia to Maine or Ohio were virtually indistinguishable from one another.

The Georgia State Highway Department's application of bridge building technology prior to 1930 was driven by simplification of design and economy in selection and use of materials. This approach facilitated the erection of as many bridges as funds would permit to satisfy short and medium-term needs. The result of this emphasis on economy was often that the first non-truss and arch bridges built this century were too narrow and too low in live load (traffic passing over the structure) capacity to meet increased usage demands in later years. In Georgia, as across the nation, vehicular traffic increased more quickly and to a greater degree than anyone could have foreseen. Where in 1913 a 16' to 18' roadway with a capacity of 10 to 15 tons was considered ample, by 1928, a 24' roadway and bridges capable of carrying 20-ton trucks was the norm. Thus, many bridges initially built by the new state highway department in the late 1910s and 1920s were soon obsolete and had to be replaced in the 1930s, 1940s, and early 1950s with wider and stronger spans. Usually, the replacement bridges utilized the same bridge technologies as their predecessor spans. Some technologies, like rolled beam stringers and reinforced concrete abutments and piers, are frequently used to this day. Not until after the start of the interstate highway program in 1956 were new technologies, like prestressed concrete, used in Georgia.

Because the qualities of the material of which a bridge is built directly affect its design, bridge building technology is best understood from that perspective. Three materials dominate pre-1956 bridge building technology in Georgia – wood, steel, and reinforced concrete. The same engineering principals are applied to specific bridge types and designs regardless of its construction material. Thus, the only differences between a stringer bridge built in steel or wood are those inherent to the material itself.

Wood Bridges

Stringer Bridges

The stringer, or longitudinal beam, bridge represents the oldest bridge technology, dating to time immemorial when felled trees were laid across streams. Whether the material is wood or metal, the principle behind the stringer bridge is the same; it relies on the bending strength of the material to resist the loads.

In Georgia, the earliest bridges were wood, both as simple beam, or stringer, spans and later, as longer truss bridges. The present population of wood stringer bridges, found primarily on unimproved rural roads or railroad overpasses, trace their origin to the state's earliest surviving bridge building technology. Wood span lengths are generally controlled by live-load deflection (vertical movement of member under load) making the modulus of elasticity of a particular wood specie as important a factor in selection as the ultimate fiber strength. Black and red heart cypress and long leaf yellow pine were the commonly used species because they balance elasticity with fiber strength.

The fledgling Georgia State Highway Department adopted a standard timber trestle bridge design in 1919 (old Standard No. 20). That design was for a 16' roadway and span lengths from 10' to 26', depending on the species of wood used. Subsequent standards for wider roadways were also developed by the department through the 1930s. Wood beams up to 16" in depth have a present day span limit of about 16' long, but any number of spans can be used to achieve the desired overall bridge length.

The wood stringer bridge is usually carried on a wood bent substructure composed of round wood piles driven into the ground and a wood cap beam upon which the stringers rest. This technology takes advantage of the fact that timber is an excellent material in compression. The bents usually have diagonal bracing to add rigidity and prevent movement and thus failure of the individual piles.

Most wood stringer bridges are finished with wood plank decks. Frequently, plank runners are placed in the area of greatest tire wear, thus prolonging the useful life of the plank deck. Timber decks, subject to wear deterioration and rot from moisture

penetration, are frequently protected by preservatives or a wearing surface. Another common design is a reinforced concrete deck instead of a wood plank deck.

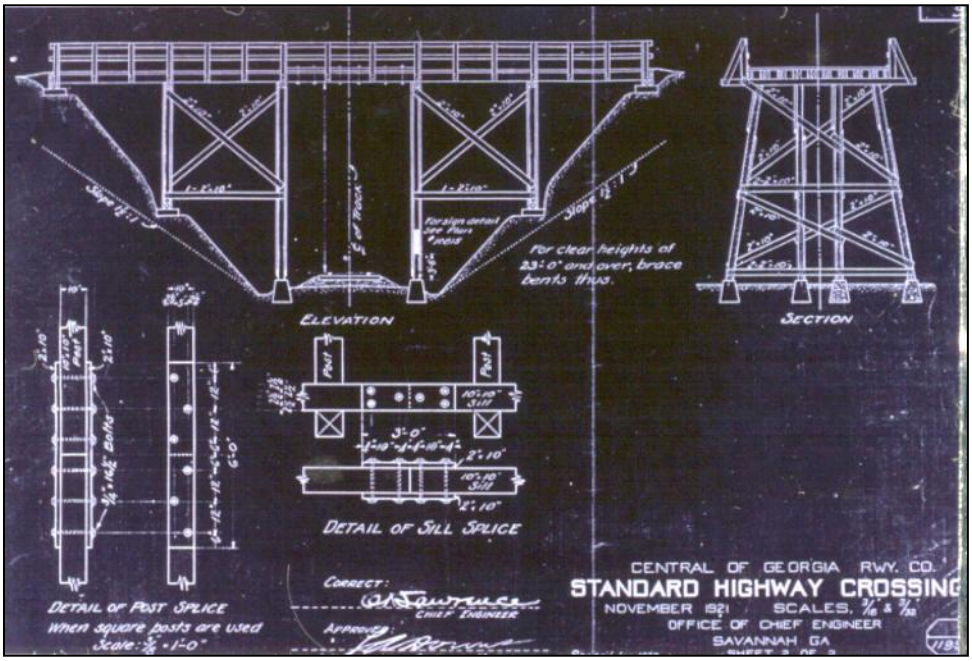

Figure 34: Railroads made frequent use of timber stringer technology for overpasses. The Central of Georgia RR had standard plans, such as this plan sheet, dated November 1921. The bridges were supported on timber bents and had wood plank railings.

Creosote, a distillate of coal tar, is the most common treatment for extending the life of timber bridges. The creosote process involves the removal of moisture from precut wood and its impregnation with creosote by pneumatic pressure. Creosoted timber is not water soluble and is resistant to decay. Wood species not naturally resistant to rot can be used for structural applications when treated. The creosote process was invented in England in 1838, but was initially so expensive that its application was limited to railroad ties. Treated timber for bridges became common in about 1900, and treatment facilities were located in Georgia by the 1910s. The early standardized designs for bridges developed for the state highway department in the late 1910s included plans for both treated (creosoted) "pile trestle" bridges (Standard No. 33, believed to date to 1919, redrawn in December, 1934) and a similar design in untreated wood (old Standard No. 20, dated 1919).

The Georgia experience is not unlike other regions of the country where timber stringer bridges are frequently used in coastal regions but not commonly found in upland regions. Due to climate, they are not as durable in areas where the wood specie is not indigenous.

The life expectancy of timber bridges varies from 20 to 35 years, and individual deteriorated members are usually replaced in kind. Rotted timber piles are cut off and replaced with new ones, installed on concrete footings that extend several feet below the ground line, or are driven but cutting a hole in the deck and then pulled into place. Thus, most, if not all, of the more than 100 identified pre-1956 wood bridges in Georgia continue a long lived technology but are composed of replacement material. Examples of the wood stringer technology that retain integrity of design and setting include Bridge Street over Norfolk Southern railroad in Coweta County (077-5082-0), Hazel Street over Central of Georgia Railroad in Macon, Bibb County (021-5016-0), and Oil Mill Road over Central of Georgia Railroad in Morgan County (211-5005-0).

Truss Bridges

The modern era of bridge technology in this country was ushered in about 1810 when the truss was applied to building longer-span wood bridges. Until that time, bridge technology was limited to stone arches or wood beam, or stringer, structures. While the truss (a triangular shape in which the diagonal members transfer vertical forces in a horizontal direction) was known since at least the 16th century, what was innovative at the beginning of the 19th century was that the basic truss pattern was multiplied many times over to span much greater distances than those possible with the timber-beam or king- or queen-post bridges of the 18th century.

Georgia county records and historical photograph collections are filled with written and pictorial evidence that wood truss bridges were ubiquitous during the 19th century. As significant as its contribution to the history of bridge technology in Georgia, the bridge type was not without inherent weaknesses that eventually made it defunct as stronger, stiffer bridge types were developed. Wood truss bridges were susceptible to fire, insect damage, and moisture-related deterioration. But the most significant factor in the disappearance of the wood truss bridge in the late 19th century was the development and acceptance of metal truss bridges, which started in the state in the late 1850s.

Wood works well in compression, but connections in tension are problematic. This limitation was resolved by William Howe (1803-1852) who, in 1840, patented a truss bridge design that used wrought iron rods for the tension members (posts) and wood for the bulkier compression members and top and bottom chords. His design with the iron tension rods heralded the beginning of the switch from wood to metal truss bridge technology. The Howe truss, initially designed as a long-span bridge for railroads, was eventually eclipsed by long-span all-metal truss bridges, whoever it continued to find favor until about 1920 for short-span highway bridges. The state built iron and wood truss bridges in the early days of the department, as evidenced by a 1919 standard design (Old Standard No. 18) for a Howe pony truss bridge with a 16' roadway. No wood truss bridges associated with the state highway department were identified, but

the Howe truss is represented in the state by two, ca. 1910 railroad-built overpasses at Fort Valley in Peach County (225-5004-0) and Jasper in Pickens County (227-5030-0).

Figure 35: Howe pony truss bridge in Fort Valley, Peach County (Bridge# 225-5004-0); non-extant.

Steel Bridges

Stringer Bridges

Steel was initially utilized for truss bridges, but with technological advances in rolling mills and metallurgy, stringer bridges composed of rolled steel beams came to the fore after World War I, and by the mid 1920s, steel stringer bridges were ubiquitous. The advantages of the technology were particularly attractive to the highway departments and county bridge engineers for spans up to 60' in length. They could be easily and economically erected with available beam sections, which were cheaper than pony truss bridges. They also required no field riveting. With accessible flat surfaces, stringer bridges were easy to clean and paint, and a concrete deck covering of the beams added protection from exposure. Concrete diaphragms were used to provide lateral stability and stiffen the structure. Another advantage that was particularly important to state highway department bridge engineers in the era of rapidly increasing volume and weight demands was the ability to widen the bridge or salvage the beams should the bridge be bypassed.

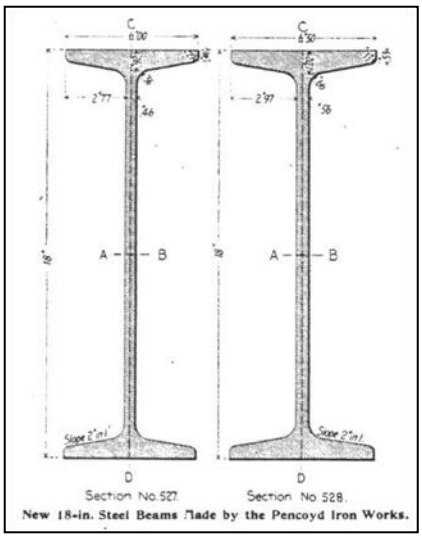

Figure 36: Steel I beams became increasingly available between 1890 and 1910 as manufacturers made improvements in their ability to make deeper beams at less cost. Pencoyd Iron Works advertised its new 18" deep beams in 1896. The availability of the beams encouraged highway bridge builders to adopt steel stringer bridges for short and medium span lengths.

Although structural wrought iron I beams had been rolled since the early 1850s and steel I beams since the early 1870s, several technological and financial hurdles, like the ability to roll deep sections, prevented their widespread use. By the end of the 19th century, civil engineers were well aware of the potential application for metal beams in bridge construction, but they were generally employed for components, particularly the flooring, of truss bridges. J. A. L. Waddell commented in his 1884 The Designing of Ordinary Iron Highway Bridges that in most cases built-up members were far

stronger and stiffer than wrought iron I beams, and he limited his recommended use of rolled beams for stringer spans of less than 20'.

The introduction of steel I beams for stringer bridges was related to improvements of the open-hearth steel making process that resulted in larger quantities at lower prices. The Pencoyd Iron Works (established in Philadelphia in 1852) advertised their steel I beams in Engineering News beginning in April, 1896, noting their progress in the production of beams of greater depth and strength. Despite the claims of the trade, the inability to roll steel beams of sufficient length and depth at a competitive price remained a technological limitation until a major breakthrough in 1908 when the Bethlehem Steel Company began producing wide-flange steel beams on the Grey Mill. The mill rolled beams at greater speed with greater depths and at an approximately 10 percent savings in material with no reduction in strength. Although the company first met difficulties producing and marketing the new 26", 28", and 30" deep beams, by the early 1910s, Bethlehem had overcome the problems. In his 1916 edition of Bridge Engineering, J. A. L. Waddell now touted the superiority of steel stringers, calling them "a great boon to bridge designers and builders" because of their simplicity, compactness and lower price. A wide top and bottom flange allowed for increased capacity of a beam without increasing its section depth, an important issue for vertical clearance. The 30" beam was suitable for spans up to 35', according to Waddell.

The earliest extant steel stringers in Georgia date to the 1910s. The state highway department adopted standards for the simply supported steel stringer bridges in 1919 with an average span length of 30'. Simply supported bridges have only two supports, each of which is at or near the end of the span. The wide flange sections that provided efficient bending (moment) resistance were used in Georgia by the late 1930s.

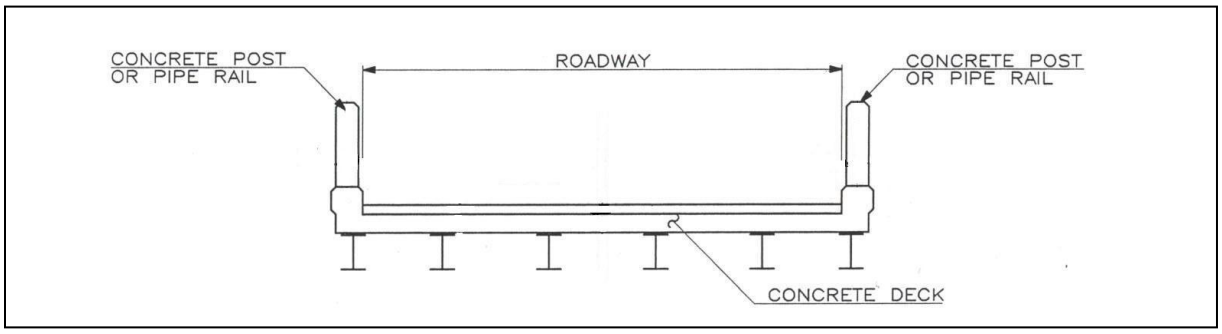

Figure 37: Section of a typical steel stringer bridge. Rolled steel beams support a concrete deck and railings. Steel stringer bridges are the most common pre-1956 bridge type in Georgia.

From the early days of the Georgia State Highway Department, steel stringers were combined with concrete, like that specified in the 1919 Standard No. 24 with encased individual beams from 10" to 30" in depth. Complete encasement of the beams adds dead load to the superstructure, but its long term benefits are in protection form

destructive atmospheric exposure. There are about a dozen remaining examples of the design with the 1914 Bay Street subway in Macon, Bibb County (021-5026-0) and the 1929 Hicks Mill Road bridge in Macon County (193-5038-0), illustrating the urban and rural applications of the detail.

A design that was used with steel stringer bridges from the 1910s to the 1930s was the concrete jack arch deck. By using a form liner, most frequently corrugated metal sheets placed in an arched shape between the stringers, the concrete deck was poured so as to integrate the stringers with the deck. Jack arches formed a strong deck with a minimum of reinforcing bars. Their use on the county level was promoted by the federal Office of Public Roads through "how-to" pamphlets. The jack arch design became obsolete in the late 1930s, for economic reasons and technological advances, including advanced understanding of continuous reinforced concrete decks. The 1911 Sixth Avenue over the Central of Georgia Railroad bridge at Columbus, Muscogee County (215-0129-0) and the ca. 1930 bridge at Massengale's Mill in Meriwether County (199-5052-0) are good examples of the jack arch deck spans. Over 100 examples of the jack arch design were identified.

Neither the jack arch nor encasement are designs unique to Georgia. Rather, they are typical details of the period that reflect national thinking about technology and design. A design detail that is used on most bridge types, not just stringers, is the cantilevering of the fascia (outermost section) portion of the superstructure, which usually carry any safety walks or sidewalks and the railings. The fact that live loads are concentrated toward the center of the structure offered engineers the opportunity to save material and cost by supporting the outer most sections on bracketed, cantilevered extensions. This economical detail was not used by the department for its earliest standard designs, but it was a common detail by 1926, and it continued to be used through the 1950s.

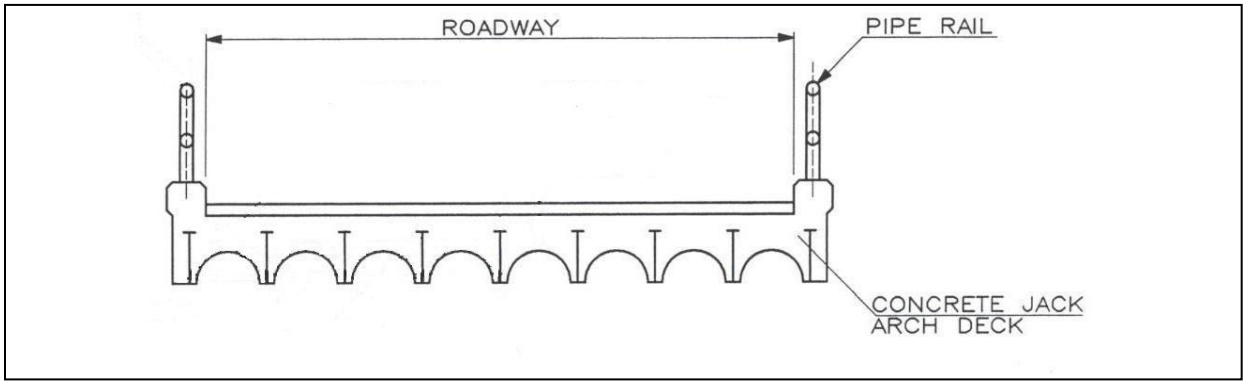

Figure 38: Section of a typical steel stringer with concrete jack arch deck bridge.

In 1953, E. A. Logan, a consulting engineer who had worked with the department at one time, designed a simply supported steel stringer bridge with a 10-ton loading for use on secondary roads. Known as the Logan bridge, it was frequently used through the 1960s

and was popular with the counties because it could be erected without the use of heavy machinery. Although designed with a 24' wide roadway for span lengths of between 16' and 28', supported on timber, H-pile, or concrete piles, depending on the span length, it was the 16' span length with a timber pile and concrete cap beam bent that was by far the most common variation. Logan bridges ceased to be used when labor costs increased to the point where they were no longer an economically viable design. There are over 100 surviving examples with the 25-span example built in Butts County in 1954 (035-0020-0) illustrating the application of the module to a long bridge.

Continuous Spans

Continuous spans, as opposed to simply supported spans, have uninterrupted members over one or more piers and are supported at the beam ends by abutments. The continuous span distributes loads from bearing to bearing over two or more spans. The advantage of continuous spans is the economy of material achieved by spanning greater lengths with smaller section beams than comparable simple spans, which must accommodate the load within the span. An additional advantage is that the reinforced concrete deck is also continuous over the interior substructure units, thus reducing the number of expansion joints, whose failure is a primary source of bridge deterioration.

Georgia was among the national leaders in the application of continuous span technology to standardized steel stringer highway bridges. After World War I, the widespread introduction of heavier, deeper, and less costly rolled steel beams opened up possibilities in designs of continuous steel stringers with span lengths of 40' to 100', yet many engineers resisted the economy of longer span continuous designs because of the impossibility of precisely analyzing the stresses. In the late 1920s, the Georgia State highway Department bridge division under the direction of Searcy Slack began to experiment with continuos technology as a solution to the state's pressing need for numerous low-cost highway bridges. In 1932 the department adopted a standard design two-span continuous steel stringer module with lengths of either 20'-20' or 27'-27'. The design proved so successful that by 1935 it was the most commonly built state highway bridge. The two earliest examples of the standard continuous design bridges are US 80/SR 26 over Ohoopee River in Johnson County (167-0007-0) and SR 22 Spur over Auchumpkee Creek in Upson County (293-0007-0). The two-span continuous steel stringer bridges continued to be constructed in great numbers through the 1950s with only minor modifications for wider roadways and heavier loadings.

Contemporary with the application of continuous span technology was the use of the cantilever and drop in section for long-span beam and girder bridges. The continuous-cantilever design has a suspended or drop in section placed between two cantilevered sections. The design allows for a longer clear span with a shallower beam, achieving economy not only in the depth of the beam, but also in reducing the number of piers

necessary to span a given length of crossing with a simply supported span of the same beam depth. The continuous-cantilever steel stringer design built upon engineering principles developed during the late 19th century for larger cantilever thru truss bridges, like Gustav Lindenthal's 1901-08 Queensboro Bridge in New York City. In the late 1920s, engineers, like Georgia State Bridge Engineer Searcy Slack, used the principles in combination with the newly available 30", 33" and 36" wide flange beams to build continuous-cantilever bridges upwards of 100'. Previously that length was usually spanned with truss structures.

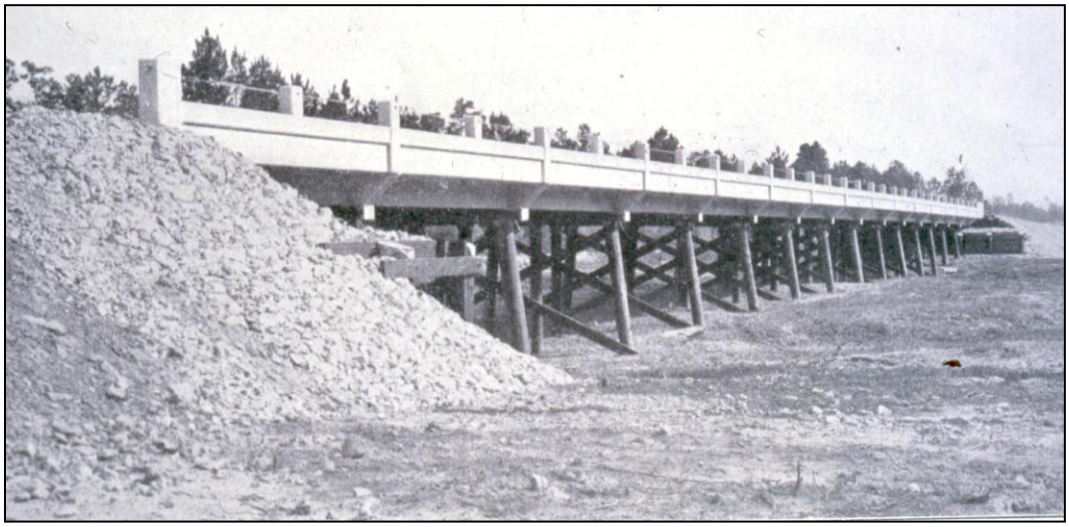

Figure 39: The state bridge division was a national leader in the development of standard design, continuous unit, steel stringer bridges. The two span continuous units of 20'-20' or 27'-27' on timber pile bents became the most widely built state highway bridges in Georgia during the mid 1930s. This example is the SR 35 bridge over Big Creek in Thomas County, built in 1932. Source: Annual Report, 1931-32.

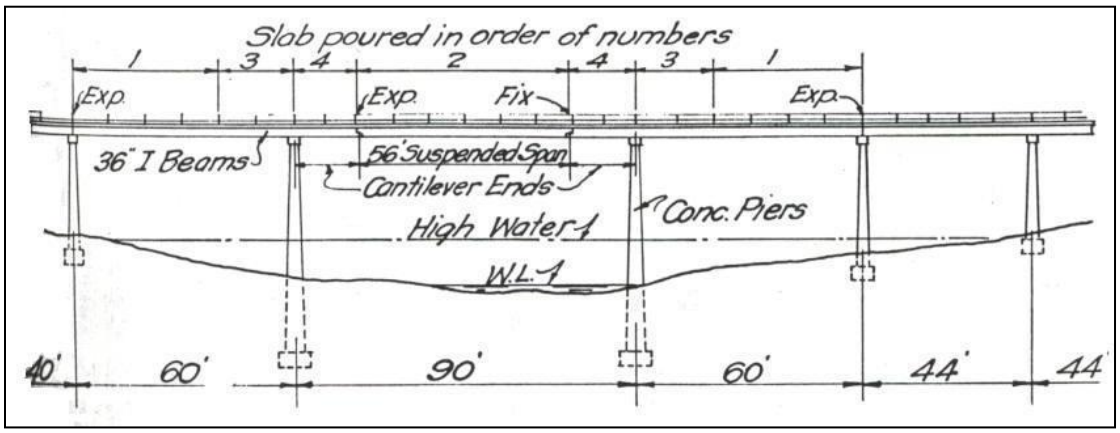

Figure 40: Elevation of a continuous-cantilever steel stringer bridge. The design has a 56' long suspended or drop in section placed between two cantilevered sections. Source: Georgia Highways, July 1931.

Georgia's earliest surviving example of a continuous-cantilever bridge with drop in section is the 1929 former US 5/SR 1 (Jeffersonville Road) bridge over Walnut Creek at

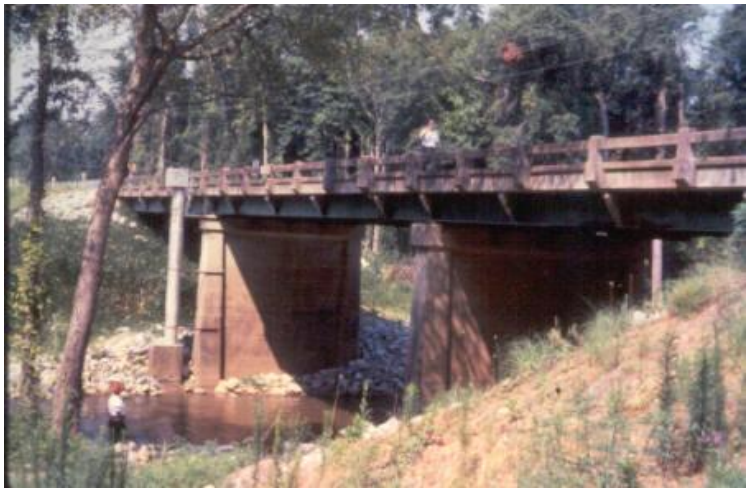

Figure 41: Old US 5/SR 1 (Jeffersonville Road) bridge over Walnut Creek is the state's earliest surviving example of a continuous-cantilever steel stringer bridge. It was built by the state highway department in 1929.

Macon, Bibb County (021-0182-0). It has span lengths of 57'-64'-57'. The earliest standard for the design is Standard No. 3751 that dates to 1935 and has 40'-60'-40' spans and a 24'-wide roadway. It is represented by US 80/SR 19 over CSX railroad in Twiggs County (289-0003-0), built in 1935. From 1929 to the late 1930s, the state highway department used a shiplap connection detail for its drop in sections. Known as the shiplap because of the overlapping design of the end joint, the ends of the drop in beams are connected by a radial cast-iron rocker bearing that rests directly on the cantilevered beam's saddle-like seat. A channel is placed to prevent lateral movement within the connection.

In the late 1930s, the standard shiplap connection was replaced by the pin and hanger connection. The pin and hanger was a more efficient way to connect the sections, and it made the spans determinate while still achieving economy of material through greater clear span lengths for given depth of the beam. The earliest extant suspended section bridge with the pin and hanger detail is SR 57 over the Oconee River in Wilkinson County (319-0018-0) built in 1938-39. The pin and hanger continued to be used through the 1970s, but with the collapse of the Mianus River bridge in Connecticut in 1984 because of a failure in one of the pin and hangers, engineers all across the country initiated a systematic program of eliminating this detail and/or frequent inspections of remaining bridges.

Starting in 1945, the department adopted standard designs for even longer continuous design bridges. Continuity was established over three, four, or more spans by using riveted splice plates or continuity plates. Adoption

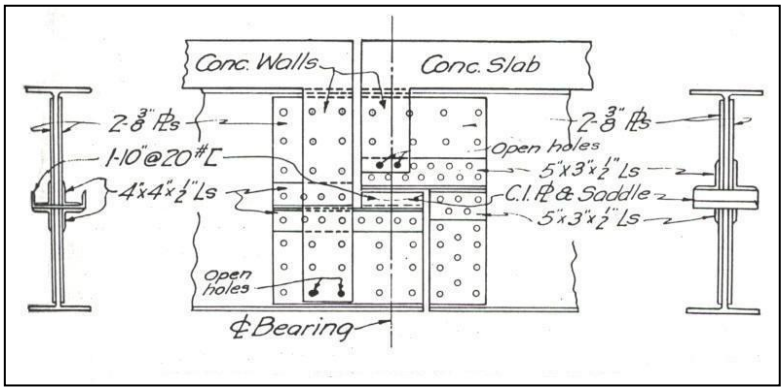

Figure 42: Shiplap connection details. Source: Georgia Highways, July 1931.

of the splice plate connection in the mid 1940s reflects what was occurring nationally rather than being particular to Georgia. The design and detail are still being used. A good example of the design is the 1947 US 27A/SR 26 over Chattahoochee River at South Whitesburg in Carroll County (045-0001-0). It is an example of Standard No. 3759 with 80'-100'-100'-80' continuous spans.

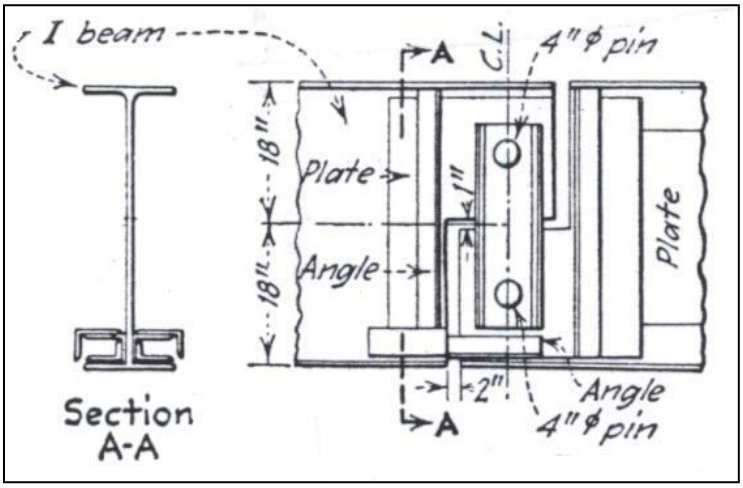

Figure 43: Pin and hanger connection details from Augusta's 5th Street bridge over the Savannah River, built in 1932. The bridge, which probably was Georgia's first example of a drop in section with the pin and hanger detail, has been replaced by a modern bridge. Source Engineering News-Record, Feb. 16, 1933.

Girder Bridges

Girder bridges, defined here as longitudinal beams at the fascia connected by floor beams, were used by the railroads as early as 1847. Girder bridges proved to be the only serious competitor to the metal truss for railroad use in the 19th century. Initially, girder bridges took advantage of the tensile strength of wrought iron with the built-up girders composed of rivet-connected web plates and flange angles. The built-up girders provided a section of sufficient depth to span greater distances than possible with then available rolled beams. In 1916, noted bridge engineer and author J. A. L. Waddell stated that while "plate girders are as unscientific structures as a bridge specialist ever has to design, they are

Figure 44: Downtown Atlanta's Wall Street viaduct (121-5163-0) has 11 thru girder spans over city streets and parking lots. It was built in 1927 as part of the effort to separate street and railroad traffic.

without doubt the most satisfactory type of construction possible for short spans [up to 100']."

Girder bridges proved to be efficient and economical for rail-carrying spans. In Georgia, girder bridges were used extensively by the railroads beginning in the late 19th century. An added reason for the popularity of the bridge type is its ease of installation. The girders were almost completely assembled in fabricating shops, and thus could easily be loaded onto flatbed cars. Once at the erection site, cranes quickly hoisted them into position, often on earlier abutments, with minimal traffic interruption. The ability to transport girders was often the factor limiting their length. For longer spans, as well as for continuous spans, field riveted or bolted splice plates were used to establish continuity.

The more common girder bridge type in Georgia is the deck girder where the floor beams are placed near the top flanges of the girders and the roadway is located at the top. It was used when vertical clearance and grade considerations permitted. The depth of the girder was determined by its span length. In both rail over road and road over rail applications, the three-span arrangement was common with two short, and thus shallower, girders supported on the abutments and built-up curb columns flanking the longer and deeper main span. The single span thru girder, where the floor beams are placed above the bottom flange and the roadway passes through the two built-up girders, is also very common, especially in urban areas where aesthetics and/or vertical clearance were considerations. Curb columns were not generally considered a civic amenity.

Although a very common 20th century bridge technology, girder bridges were not adopted by the Georgia State Highway Department as a standard design bridge for highway use. For this reason, the number of girder bridges on state highways is relatively small.

Reinforced Concrete Bridges

Well represented among the earliest surviving bridges in Georgia are those built using reinforced concrete. The material was introduced from Europe into this country for bridge construction in 1886, yet it was not commonly used until the first years of the 20th century. After that, its advantages as a strong, versatile, and low-maintenance material were quickly and universally adopted for several bridge types, both as cast in place and precast units. By 1912, reinforced concrete bridge technology was in widespread use all across the country.

Concrete, composed of sand, gravel, or other aggregate held together by a hardened paste of natural cement and water, has been known since Roman times. However, concrete did not come to the front as a modern building material until after the

perfection of Portland cement, an artificial hydraulic cement, in England in 1813. Noted for its strength and abrasion resistance, Portland cement was initially very expensive, and as result of the cost, its use in this country was limited. In 1871, David O. Saylor was granted a United States patent for the manufacture of artificial cement, and this breakthrough gave great impetus to the experimentation and usage of the material in a variety of building applications. The earliest use of the material, which has good compressive strength but little tensile strength, was for building footings, walls, and bridge substructures.

Advancement in the understanding of reinforcing placement to accommodate tension and shear forces resulted in reinforced concrete being used more frequently for arch, slab, and T beam bridges early at the turn of the 20th century. The appropriateness of one bridge type over another was predicated on several factors, such as length of span, roadway profile, and economical use of steel. Reinforced concrete bridges are very common in Georgia.

Arch Bridges

The earliest reinforced concrete bridges built in this country were arches dating to around 1890. Of great influence in promulgating reinforced concrete arch technology is the Melan design. Invented in 1892 by Austrian engineer Josef Melan, and patented in this country in 1893, the design utilizes steel beams (rolled beams for shorter spans and latticed angle girders for longer ones) embedded in concrete. Really more a steel arch with concrete encasing than a true reinforced concrete structure, the Melan system was able to support greater capacity for longer span lengths than the earlier Monier system that is based on reinforcing mesh placed in the tension zones. Georgia features an important example of the Melan design, the 1910-12 Dillingham Street bridge at Columbus, Muscogee County (215-0127-0). It is a well-preserved example with Neo-Classical style balustrades.

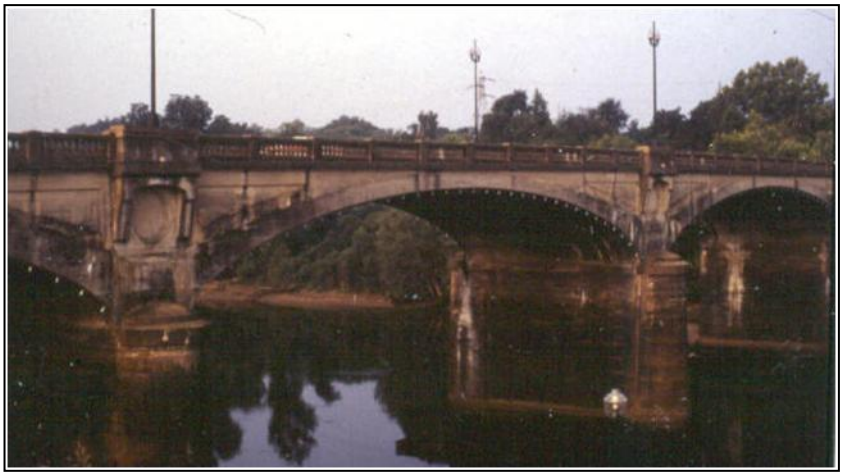

Figure 45: The 1910-12 Dillingham Street bridge in Columbus is a Melan arch designed by the Concrete Steel Engineering Company of New York and built by the Hardaway Contracting Company of Columbus

By 1906, the Melan system had been eclipsed by designs based on the use of reinforcing bars distributed only in the tension zones. After 1910, reinforced concrete technology became fairly common in Georgia, especially reinforced concrete deck arch spans, slab, and T beam bridges. Reinforced concrete bridges proved to be an economical, less flexible, and relatively low maintenance alternative to metal truss spans.

Part of the reason for the rapid acceptance and application of the technology was that the material was also being used for a variety of structure types, like buildings, railroad ties, piers and bulkheads, and even ships, and the knowledge transfer benefitted all. Additionally, individual promoters and companies, such as Daniel Luten, whose deck arch bridges are well represented especially in the northern part of the state, published "how-to" brochures on reinforced concrete bridges using their designs, calculations, or reinforcing bars. In the era before the consulting engineer and a professionally trained county engineer and staff, such promotional literature did much to spread information about the advantages of reinforced concrete arch bridges.

Figure 46: County Road 36 over the Conasauga River in Whitfield County is a ribbed arch, built by the Luten Bridge Company in 1926.

Slab Bridges

Slab bridges, which can be cast-in-place or precast units, simple or continuous, date to at least 1911 in Georgia. The simply supported, cast-in-place slab bridge was used primarily for clear spans of up to 20' prior to World War I. The state highway department and county engineers used the bridge type through the early 1950s for spans up to about 35', beyond which point other bridge types were more economical. The slab bridge concentrates reinforcing steel, in the form of twisted or deformed rods, in the lower portion and ends where tensile forces and shear are the greatest. As with all other bridge types, the amount of steel and depth of the slab is predicated on its length and live-load capacity.

Figure 47: Slab bridges, such as this ca. 1925 example on the old Dixie Highway in Mitchell County (205-0005-0) were one of the state highway department's most common standard bridge designs for the development of the state highway system.

The earliest surviving state highway department design for a slab bridge dates to 1919. The state highway department used the cast-in-place slab bridge extensively on its first state routes, and over 30 from before 1930 remain. Many, like the ca. 1920 CR 236/Old SR 38 over Okapilco Creek tributary bridge in Brooks County (027-5056-0), stand in a complete state of preservation with their concrete railings and paneled slab fascia, illustrating the decorative, moldable qualities of concrete. A good man other early slab bridges, built to the state standard 16' or 18' wide roadways, form the nucleus of bridges widened in kind in the 1930s. A significant assemblage of first-generation slab bridges surviving in their original context are the seven, ca. 1925 examples on FAS 1790 (Old Dixie Highway) in Mitchell County (205-0003-0 through 205-0009-0).

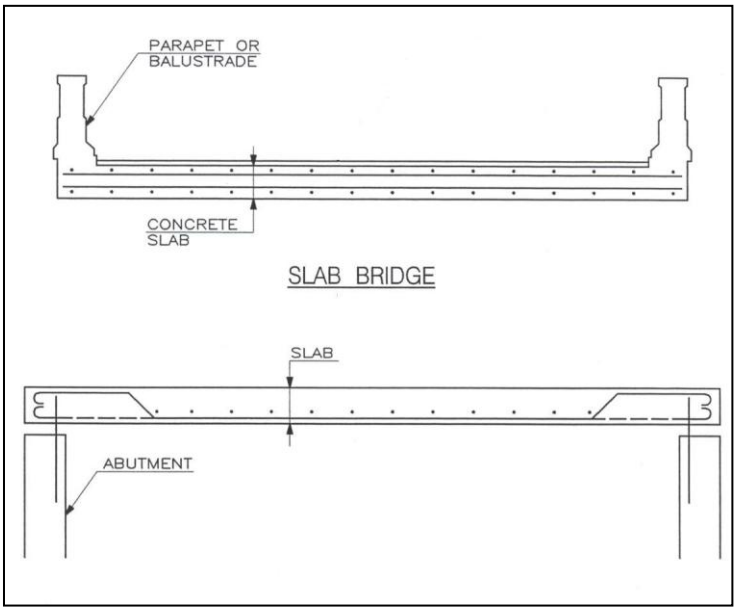

Figure 48: Transverse section (top) and longitudinal section (bottom) of a typical slab bridge showing the placement of reinforcing bars to accommodate tensile forces.

The precast slab bridge was composed of panels approximately 15'-long and between 4'-6" and 5'-0" wide that were hoisted into position and placed approximately 1' apart. That space was filled with cast-in-place concrete shear connections that link the individual slabs into a unit. The exterior panels were cast with integral curbs, and railings were attached to that curb. One of the salient characteristics of concrete is its moldable qualities, and this stimulated thinking about precast bridge components that could be fabricated off site under controlled conditions, shipped to the site, and then quickly hoisted into place.

World War II proved to be a watershed in precast concrete bridge construction. The desirability of using precast concrete over structural steel or cast-in-place concrete construction for short-span bridges became by the mid 20th century a matter of

Figure 49: Rectangular precise panels show in the deck of a slab bridge in southern Georgia.

economics rather than technological development. Following the war, the federal and state government redoubled their efforts to improve the nation's highways with massive infusions of aid, not only for state and federal highways as had been the practice in the past, but also for secondary and local road systems. The expanded highway program, in combination with rising labor costs and shortages of structural steel, prompted state highway departments to seek out the most economical means of building large numbers of bridges for small streams on secondary roads. Precast concrete had the advantages of savings in forms and falsework, elimination of on-the-job labor, speed of construction, better maintenance of traffic flow, and closer control of concrete mix, placing, and curing, obtained through factor-like operations in large casting yards.

The most common precast slab bridge is composed of panels approximately 15' long and 5' wide. The panels are set approximately 1' apart and the space between filled with cast-in-place concrete shear connections that link the individual slabs into a unit. The exterior units are cast with integral curbs, and railings are attached to the curb. The design is well represented by SR 230 over Big Creek in Pulaski County (235-0017-0), a 25 span bridge built in 1953, and by CR 226 over Fish Pond Drain in Seminole County (253-5018-0), built in 1954.

Figure 50: "Harry Brown" railing.

A variation on the precast slab bridge is the "Harry Brown type," adopted as a state standard in 1952 (No. 3546). The bridge is composed of about 4'-6" wide panels keyed together and sealed with a compound. What is interesting about the design is the profile of the integral 2' high curb/railing with the chamfered shape of its roadway face, known as the "safety shape." The railing shape deflects vehicles back onto the roadway with a sudden stop and was popularized in New Jersey starting in 1950. Interestingly, according to longtime department engineer Vernon W. Smith, Jr., the Brown railings were not originally designed with safety in mind. The goal of the curb face detail was to protect the curb during impact. The shape was to serve as a brace. A documented early example is the ca. 1951 Browns Cross Road over Fishing Creek in Baldwin County (009-0032-0).

Channel beams, or waffle slabs as they are better known, are precast members consisting of 3' to 4' wide slab decks between two legs. The channel section resembles a T beam bridge because the legs of adjacent channel beams are connected and

appear as a single stem. The primary reinforcing steel is located in the bottom of the channel leg and is placed longitudinally, and both sides of the leg have stirrups. Curbs are cast integral into the exterior units, and any additional railings are attached to them. The panels are suitable for spans up to 35' in length, and the individual beams are bolted together to act as a unit. The advantages of the design are common with other precast structures; economical to produce, economy of material, and ease of erection. The design is still being used, but its heyday was the 1950s and 1960s.

Figure 51: Underneath view of a waffle slab bridge.

Waffle slabs were known in the late 1910s and were one of the state highway department's early standardized bridge designs. Old Standard No. 36 dating to 1919 illustrates that the basic configuration of the individual beams and the engineering principles behind their design changed little from the 1910s through the 1950s. What did change was the method of connecting the beams; the 1919 design joins the beam legs by a sand and cement mortar poured into a key way, whereas the post-World War II examples are bolted together through the legs and formed into a unit by grout poured into keyways that also serve as a shear detail. No pre-1945 waffle slab bridges are known to survive. The most commonly found post-1945 waffle slab design is a state standard for 24' wide roadways with span lengths from 15' to 35'.

T Beam Bridges

T beams bridges are cast-in-place reinforced concrete beams with integral monolithic flanking deck sections used for spans of up to 50' in length. The primary reinforcing steel is placed longitudinally in the bottom of the beam stem, and the deck or flange reinforcing is placed perpendicularly to the stem. T beams are almost always supported on reinforced concrete substructures, and they were favored in Georgia for span lengths of over 20' because of their low long-term

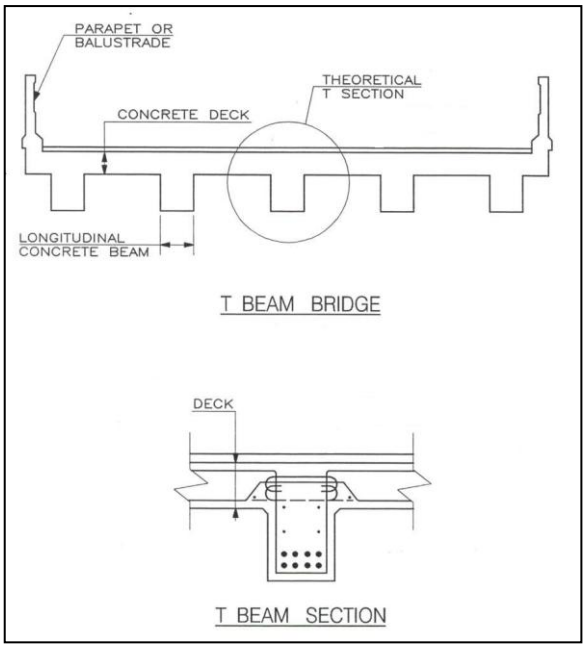

Figure 52: T beam bridge section (top) and a beam section (bottom) showing reinforcing bars placement.

Figure 53: A standard design T beam bridge, built by the state highway department in 1922, on the old Dixie Highway, Bartow County (015-5055-0).

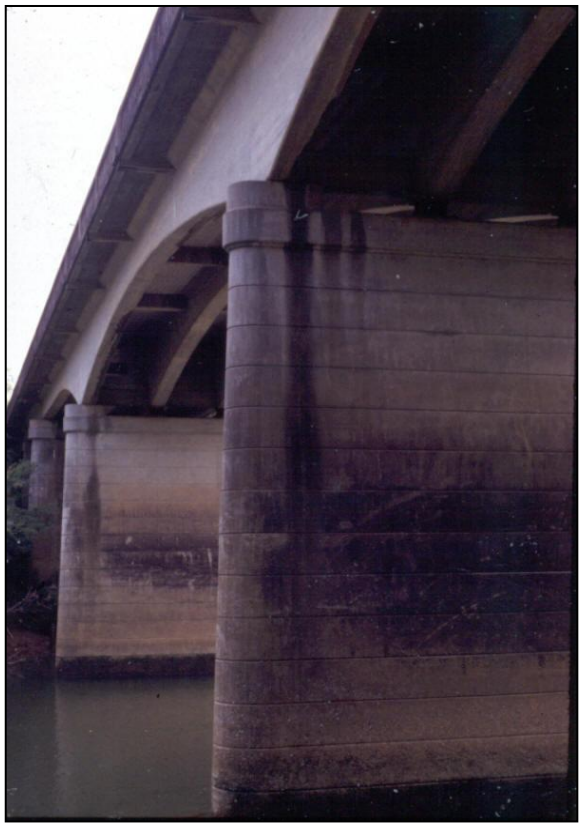

Figure 54: The James Jackson Parkway bridge over the Chattahoochee River is an impressive 15-span continuous T beam bridge that ranks as one of the most significant mid 20th century bridges in the Atlanta area. It was built in 1943 by the state highway department to improve access to the former Bell bomber plant at Marietta.

maintenance, and thus overall economy of material. The T beam bridge, with its integral connection between the longitudinal beam and deck section, is a more efficient use of material than the slab design. It proportions the deck thickness and longitudinal beam size and spacing to achieve a lighter, stronger, and more economical section.

T beam bridges were a popular early state highway department design, in use since the department's inception in 1917. Standard No. 35 for a five-line T beam bridge with spans from 16' to 26' long was one of the department's first standards, approved by state highway engineer Warren R. Neel in 1918. T beam bridges have been identified as the most common surviving bridge type from the department's first decade of efforts to improve an interconnected system of highways. Over 60 pre-1930 examples have been identified. Some T beam bridges, such as the four T beam bridges on a bypassed section of old US 41/SR 3 (Old Dixie Highway) near Adairsville, Bartow County (015-5022-0, 015-5023-0, 015-5055-0, 015-5056-0), have excellent integrity of setting.

Although the cast-in-place T beam bridges were labor intensive owing to the requisite form work, they continued to be used by the highway department bridge division into the 1960s. The technology of the T beam did not change from the 1910s through the 1960s, and state standards were merely updated for wider roadways and heavier loadings.

Continuous T beam bridges were also built in the state. Some of the longer examples, like the 1943 SR 280 (James Jackson Parkway) over the Chattahoochee River between Fulton

and Cobb counties (121-0116-0) have haunch shaped beams to achieve the needed depth at the pier, where the stresses are greatest. The haunch shape also maintains the economy of material.

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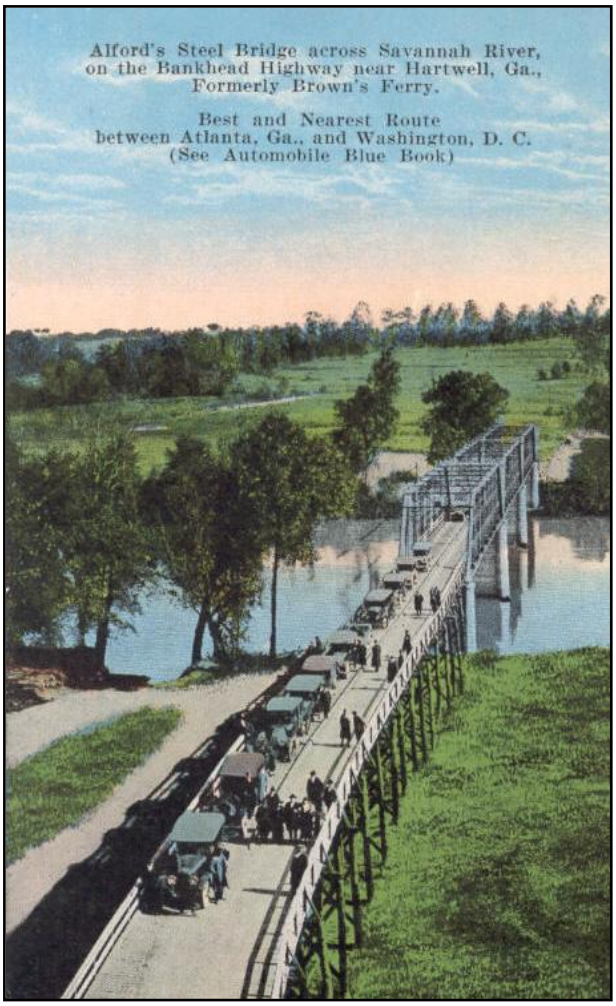
Appendix A

From Tourist Trails to Modern Highways

The Bankhead Highway, Capital Highway, Dixie Highway, and National Highway were all well-known automobile tourist trails founded prior to World War I. The routes followed cross-state travel routes previously established by the early byways and railroads. The tourist trails incorporated existing county roads, and were the first coordinated effort to establish marked long-distance interstate automobile routes. As such, they made a contribution to the state's highway development. The tourist trails, however, did not lead to large-scale highway improvements like paving until after 1919, when federal aid for highways became available to state highway departments.



A convoy of automobile tourists poses on Alford's Steel Bridge across the Savannah River near Hartwell. The postcard advertises the Bankhead Highway as the "best and nearest" route between Atlanta and Washington DC.

The Georgia State Highway Department historically approached the need for long distance highway travel from a different perspective than the trail associations. Engineers did not wish to promote, at least in a direct fashion, tourist destinations or scenic routes. In general, they wanted cross-state routes to follow the most direct path possible, to connect major centers of population, and to serve existing patterns of travel. State highway departments made few efforts to promote the tourist trails. In fact, quite the opposite. Department engineers, while recognizing the need for cross-state trunk routes, felt that the trail associations too often promoted branch and overlapping routes. In 1926, the American Association of State Highway Officials (AASHO) adopted a uniform system of US numbered highways to discourage the trail associations from placing their own highway markers in competition with state-designated routes.

Throughout the 1920s and early 1930s, the Georgia State Highway Department undertook a series of staged improvements that significantly changed the physical character of the tourist trails. Unimproved roads were graded and surfaced with sand-clay and top soil, and later widened and hard-paved with concrete

and bituminous concrete. The sections of highway near large population centers were usually the first to receive paved surfaces, while isolated rural areas were the last. State highway improvements included the construction of hundreds of bridges and culverts. More often than not, the bridges were standard, first-generation highway department designs with only a few concessions given to aesthetic details such as balustrades and paneled parapets. Before 1930, major river crossings were sometimes bridged with attractive open spandrel arch bridges.

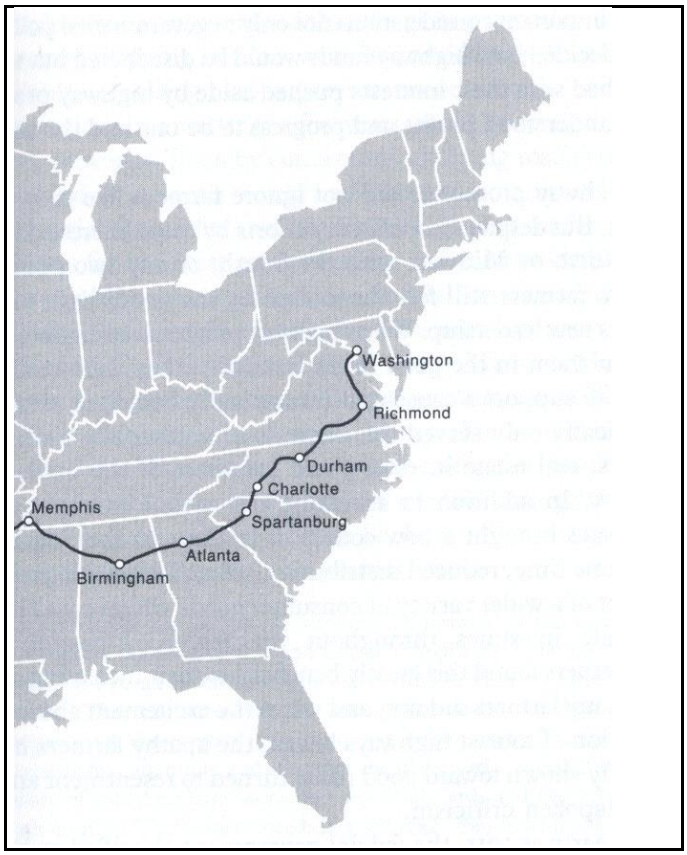
After World War II, Georgia's highway department undertook another series of major improvements to the US numbered highways to upgrade them for safe and efficient travel by modern automobiles and trucks. On heavily traveled sections of road, the highways were dualized. Design standards for gradients and curves often necessitated the realignment of the routes, and in many cases required the acquisition of entirely new right of way. Portions of the old routes were abandoned or retained as local roads or county highways. Numerous bridges were rebuilt or replaced to meet modern highway requirements for wider roadways and heavier loads. Because the post-1945 improvements were based on national standards established by AASHO, the new highways were similar to those in other states. Today, only short sections of the original tourist trails and early state highways remain without significant alterations.

History of Individual Routes:

Bankhead Highway (SR 8, old US 29 (Hartwell to Atlanta), old US 78 (Atlanta to Alabama line).

The Bankhead Highway was a transcontinental tourist trail promoted by the founder of the Bankhead Highway Association, Asa Rountree of Birmingham, Alabama. The trail, named after Alabama Senator John Hollis Bankhead, stretched from Washington, D.C., across the southern states, and ended in San Diego.

The section of the Bankhead Highway east of Atlanta followed much the same route as the National Highway (see below). In Georgia, the Bankhead Highway entered the state at the South Carolina border near Hartwell (Hart County) and passed through the towns of Athens and Winder en route to Atlanta. West of Atlanta, the Bankhead Highway passed through Austell, Douglasville, and Bremen before reaching the Alabama border. By the early 1920s, the route was a popular one from the Northeast to the upper South.



Map of the Bankhead Highway. Source: Preston, Dirt Roads to Dixie, 1991.

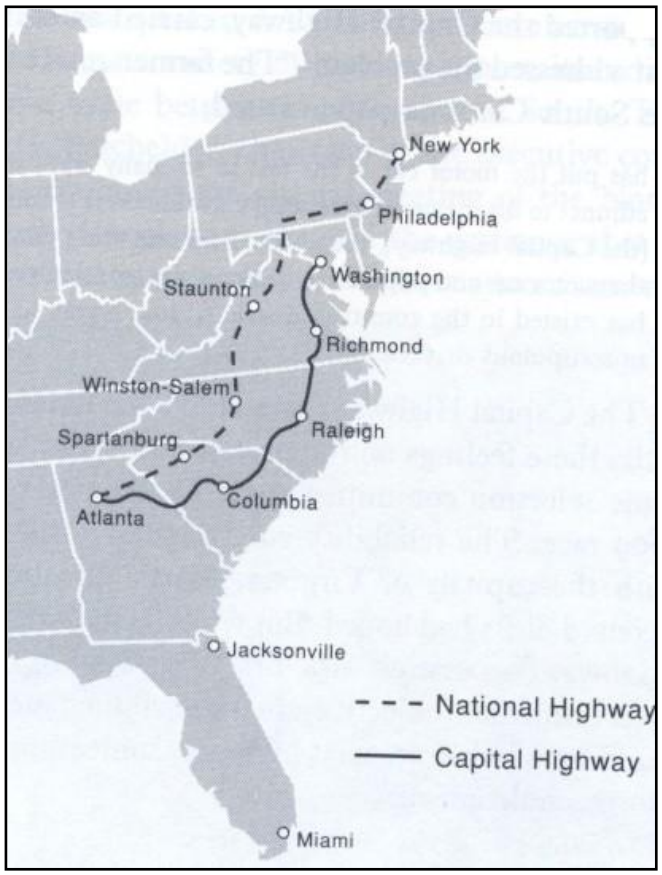
In 1919, the route of the Bankhead Highway was incorporated into the state highway system as SR 8. In 1926, the section east of Atlanta was designated US 29, and the section west of Atlanta to Alabama was designated US 78. During the 1920s improvements along the route proceeded in a piecemeal fashion. By 1927 the route had been paved only in the vicinity of Atlanta and Athens. Most of the remainder had been graded and top-soiled, except for an approximately 25 mile unimproved stretch from Lawrenceville, Gwinnett County to seven miles east of Winder, Barrow County. The route was not paved from border-to-border until about 1932.

Capital Highway (SR 10, old US 78 (east of Atlanta).

The Capital Highway Association was one of the oldest tourist trail associations in the South, founded in 1909 under the leadership of Leonard Tufts, who wished to use automobile tourism to promote his Pinehurst, North Carolina resort hotel. The trail was established in direct response to an automobile reliability contest sponsored by New York and Atlanta newspapers. The Capital Highway, however, failed to attract the contest sponsors, who chose to use the route of the National Highway instead. The Capital Highway connected Washington, D.C. to Atlanta and passed through the state capital cities of Richmond, Raleigh, and Columbia. In Georgia the route entered the state at Augusta's Fifth Street Bridge spanning the Savannah River. The highway then continued to Atlanta by way of Thomson, Athens, and Monroe.

In 1914, the Capital Highway was chosen by the Bureau of Public Roads (BPR) as its first, and only, long-distance object lesson road project, the Washington-Atlanta Maintenance Demonstration Road. The BPR attempted to coordinate the efforts of the individual county governments along the route by asking that they pledge to improve the road (i.e., grade and surface), and then allocate a certain sum per mile for the maintenance of the road. Under the plan, maintenance would only be undertaken under the supervision of a BPR engineer, who also would approve all expenditures for maintenance.

The Washington-Atlanta object-lesson road program lasted from 1914 to 1917, when the BPR engineers were withdrawn. It was only a partial success. The project encouraged the expenditure of more than $145,000 in road improvements, and as a result the Capital Highway became the best long-distance automobile route from the Northeast to the South prior to World War I. The project, however, also illustrated the problems inherent in coordinating the efforts of 49 separate county governments along the highway's route. Only 28 counties agreed to participate in the program, and most insisted on retaining control of expenditures. The failure of over half of the counties to support the highway left more than 300 miles of the road unimproved and unmaintained. In Georgia, the Washington-Atlanta object-lesson road ran into further problems because of rivalries over its route. BPR engineers finally agreed to two alternative routes: the main branch from Augusta to Atlanta through Washington, Athens, Monroe, and Stone Mountain, and a secondary branch through Warrenton, Coffinsville, and Lithonia.



Map of the Capital Highway and National Highway.
Source: Preston, Dirt Roads to Dixie, 1991.

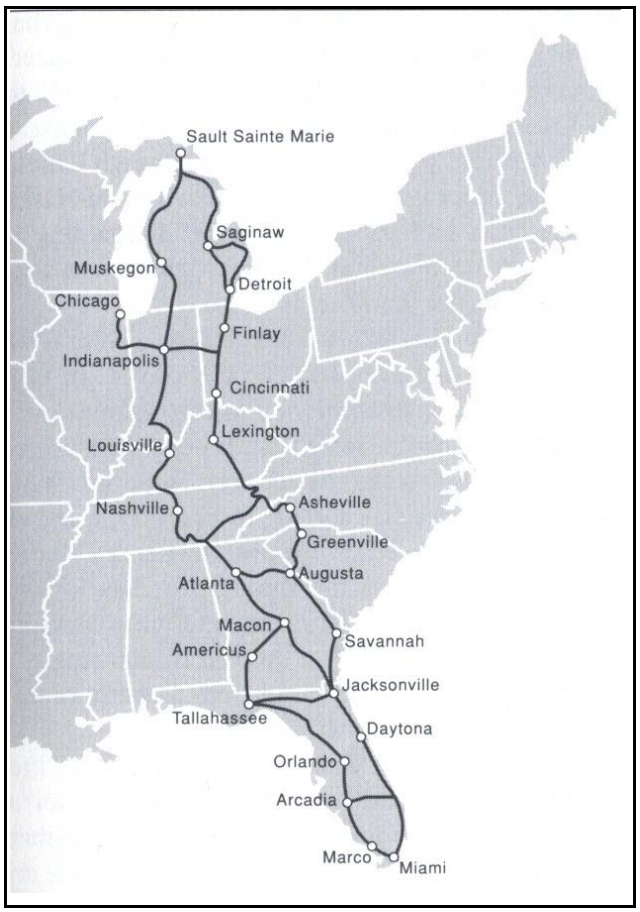
In 1919 the Capital Highway was incorporated into the state highway system as SR 10. In 1926, the route was designated US 78. At Augusta, US 78 connected with US 1, which followed the old route of the Capital Highway across the Savannah River to Columbia and northward to Washington, D.C. The state highway department reported in 1927 that the road still had unimproved sections in Gwinnett, Oglethorpe, and McDuffie counties. The unimproved sections were hard-surfaced between 1932 and 1937.

Dixie Highway (Western Branch following old US 41/SR 3 (Chattanooga to Macon), old US 19/SR 3 (south of Macon to Florida line) or US 341/SR 27, US 1/SR 4, and various local roads (south of Macon to Florida line north of Jacksonville, FL); and Eastern Branch following old SR 21 (Augusta to Savannah) and old US 17/SR 25 and various local roads (Savannah to Florida line north of Jacksonville, FL).

The Dixie Highway was founded in 1915 with a mission of establishing a connected tourist trail from the Midwest to the South. The highway was promoted by Carl Fisher and William S. Gilbreath, who were both prominent in the Lincoln Highway Association. Fisher had extensive interests in Miami, and he saw the highway as a means to attract tourists to his burgeoning Florida resort. The Florida land and tourist booms of the 1910s and early 1920s would make the Dixie Highway the most prominent of Georgia's tourist trails.

The Dixie Highway was not a single route, rather it consisted of several braided and constantly changing branches that began in northern Michigan and Chicago. The trail wound its way south through Ohio, Indiana, Kentucky, Tennessee, North Carolina, South Carolina, Georgia, and Florida. The various branches accommodated the competing interests of communities that sought to have their towns placed on the trail. As a result, throughout the late 1910s and early 1920s the Dixie Highway continually changed its map due to community pressure, as well as the need to update the route based upon improved road conditions (Preston 1991: 52-61).

The western branch of the Dixie Highway in Georgia was associated most closely with a series of roads that entered the state south of Chattanooga and passed through Macon before dividing into two routes, one to Florida's west coast, and another to Jacksonville and Florida's east coast. In 1919, these roads were incorporated into the state highway system under different route numbers. The western branch of the Dixie Highway was old SR 3/US 41 north of Macon, with a side route splitting off north of Cartersville and passing through Rome and Summerville (old US 41 West/SR 20/SR 1). South of Macon at Perry, the Dixie Highway divided again with the route to Jacksonville passing through Baxley, Alma, and Waycross (old US 341, US 1, various local roads), and the western route continuing along through Americus and Albany (old SR 3/US 19).



Map of the various branches of the Dixie Highway. Source: Preston, Dirt Roads to Dixie, 1991.

The eastern branch of the Dixie Highway entered the state at Augusta and followed the route of old SR 21 to Savannah, and then old SR 25/US 17 to the Florida line north of Jacksonville, Florida. The

eastern branch gained popularity in the mid 1920s after the state highway department began improvements to SR 25, also known as the Coastal Highway. A connector road linked the western branch with the eastern branch between Atlanta and Waynesboro south of Augusta.

In the early 1920s, the Dixie Highway Association recruited local civic groups to help promote road beautification. In 1922, the association attracted women's clubs interested in dedicating the Dixie Highway as a "Road of Remembrance" to World War I veterans. In Georgia, activities included the planting of pecan trees, crape myrtles, and spirea bushes, as well as erecting markers to veterans. One short stretch of the highway about two miles northeast of Macon on old US 41 became known as the "Memorial Mile" because of the extensive plantings and markers.

In 1919, the state highway department began efforts to improve and pave the Dixie Highway. The first of the department's initiatives was to coordinate with local counties to pave the section of road between Atlanta and Macon, along the present-day route of old US 41. Like other tourist trails, the Dixie Highway was improved in stages. The paving was completed in the southern part of the state in about 1930.
The Dixie Highway (old US 41) was the most heavily traveled cross-state route according to traffic counts taken in 1926. Outside of Atlanta, seasonal tourist traffic combined with farm-to-market and commuter traffic to raise totals above 1,500 automobiles and trucks per 12-hour period. In 1938, the Atlanta-Marietta section of the route was rebuilt, largely on new right of way, to become the state's first median-separated four-lane highway. After 1945, the route was significantly upgraded with the use of federal aid funds. Entire sections were dualized or relocated on new rights-of-way, such as in Bartow and Cobb counties north of Marietta (SR 3/US 41). Bypasses were also constructed around urban areas such as Griffin, Spalding County. The bypasses have left several relatively pristine sections of the Old Dixie Highway intact, including a section near Adairsville, Bartow County, and a section in Mitchell County. The sections include several well-preserved examples of 1920s state highway department T beam and slab bridges.

Dixie Highway portal marks the Dougherty-Mitchell county line.

National Highway (SR 8, old US 29 (north of Atlanta).

The National Highway gained prominence in the South in 1909 as the route chosen by the Atlanta Journal and New York Herald for a long-distance automobile reliability contest beginning in New York and ending in Atlanta. The name National Highway was chosen, in large part, to

gain national attention to the contest, and because the trail passed over a small section of the National Road in Maryland. In Georgia, the tourist trail crossed the South Carolina border near Hartwell (Hart County) and passed through Athens in route to Atlanta. The South Carolina and Georgia portions of the National Highway were later promoted by the Bankhead Highway Association (see above).

Other Tourist Trails of Note:

Throughout the late 1910s and early 1920s, numerous other tourist trails were promoted in Georgia. Most were little more than the pet projects of various local automobile associations, or those who wished to dedicate a tourist trail to advertise particular attractions or memorialize a historic figure. A comprehensive list of Georgia's tourist trails is not available, although references have been found to the following tourist trails: the Dixie Overland Highway (old US 80); the Appalachian Highway, Atlanta Highway, or Mountain Highway (old US 23); the Jeff Davis Highway (old SR 12 from Augusta to Atlanta, old US 29 from Atlanta to LaGrange and West Point); and the Johnston-Sherman Highway, another branch of the Dixie Highway from Chattanooga through Atlanta to Savannah by way of Eatonton (various local roads).

Historic Context for Dualized Highways in Georgia Prior to 19

Introduction

To understand how Georgia's pre-1957 dualized highways came into being and why they were designed and constructed in the way they were requires acknowledging the federal involvement that drove policy and design decisions. Dualized highways are the product of the maturation of roadway engineering and policies to improve the nation's highways and byways starting in the 1910s. Understanding what dualized highways are and how their various iterations came to reflect an unprecedented level of standardization is paramount to assessing the historical significance and National Register eligibility of Georgia's pre-1957 examples. That consideration has to be founded on placing the state's effort into a much broader context – a national context.

What is meant by the term "dualized highway?" It is a highway where opposing directions of traffic are separated by a median. Dualization is but one aspect of balanced design that evolved for all types of engineered roads, not just median-divided highways, starting in the 1920s. Dualized highways are not a distinctive property type. Rather, "dualized" describes one aspect of the roadway geometry shared by many types of highways like boulevards, expressways, bypasses, parkways, turnpikes/toll roads, freeways, interstates, etc., much like balloon-framing is a feature common to many different building types. Dualized highways can be two or more lanes, although historically four lanes are the most common. Medians can be dividing strips of concrete, asphalt, or grass, or they can be barriers. Since dualized highways are expensive to construct owing to their greater width, they were built only where and when traffic volume justified the considerable expenditure.

Dualization was an aspect of balanced-design highway geometry that was developed to service high volumes of traffic and reduce the risk of head-on collisions and side swiping while permitting faster vehicles to pass slower vehicles traveling in the same direction. Dualized highways vary from short sections with unrestricted access built to address a point problem or bottleneck (like under a railroad bridges with substructure units in the roadway) to their most highly developed form, the limited-access system or "superhighway" where all design features – right-of-way width, appropriate travelway and shoulder widths, median design, curvature, grade, and integrated bridge design – work together in a "balanced design," where every element is determined by design speed so that drivers do not encounter surprises.

Dualized highways have been planned and constructed in this country since the mid 1920s and were present in every state by 1950. Those built after 1944 show remarkable standardization and uniformity due to the tremendous influence of federal highway policy and financing and to nationwide adoption of design and materials standards, like 12'-wide travel lanes, improved shoulders, and spiral curves for smooth transition between curved and straight roadway sections. This uniformity was the result of the American Association of State Highway Officials (AASHO) working with the federal Bureau of Public Roads (BPR) between 1938 and 1944 to adopt a series of seven policies on geometric design ranging from highway classifications to sight distances. These policies explained major design principles, details and values for direct use by highway engineers, and offered clear, simply worded guidelines to produce uniformly designed highways, applying balanced-design principles to all highway classifications, whether dualized or not, based on design speeds. While the AASHO geometric policies were developed cooperatively by the BPR and the state highway official members of AASHO, the federal influence is as unmistakable as it was profound and ubiquitous. This is particularly apparent in a state like Georgia where there was often political reluctance to move forward and actually implement the latest thinking in the design of highways, especially in urban areas.[1]

Much like today, the geometric policies and balanced design were reinforced by federal-aid programs that encouraged state highway departments to spend federal funds on highway projects that met the nationally adopted technical policies. Consequently, starting in 1944 AASHO policies guided the design of dualized highways in Georgia, just like they did in every other state in the union. About the only variation among the states is when and how a particular state started applying the standardized principles of balanced design, particularly limited-access dualization, to its high-traffic volume roads. Some states such as New York and New Jersey led while most, like Georgia, followed and struggled to find the means to pay for and keep dualized highways functionally viable before 1957, often compromising on features such as access control and wide right of ways to save costs. Even planning and construction of the Atlanta Expressway, the Georgia State Highway Department's premier dualization effort of the era, was in step with national trends and clearly mirrors the very evolution of American highway policy and design in the twentieth century.[2]

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[1] For an overview and analysis of the significance of the federal-aid highway program and its influence on the federal-state partnership see, Bruce Seely, Building the American Highway System: Engineers as Policy Makers (Philadelphia: Temple University Press, 1987) and U.S. Department of Transportation, Federal Highway Administration, America's Highways, 1776-1976 (Washington, D.C.: U.S. Government Printing Office, 1976). Further information on the influence of the federal-aid program in Georgia can be found in Lichtenstein Consulting Engineers, "Historic Context for Transportation Networks," Historic Bridge Inventory Update, Georgia Department of Transportation, 2001.

[2] For more on Georgia's interstate highway development and the Atlanta Expressway, see Lichtenstein Consulting Engineers, "Historic Context for the Interstate Highway System in Georgia," prepared for the Georgia Department of Transportation, Office of Environment/Location (March 2007).

Evolution of Dualized Highways In America – The National Perspective

Dualized highways as a means of servicing traffic (making the efficient flow of traffic the dominant design consideration) were envisioned and planned in the country as early as 1908 with T. Coleman du Pont's multi-modal, public highway extending across his native Delaware being the earliest attempt at a dualized "superhighway." It was to be the "straightest, widest, and best road in the country" unlike anything that had ever been built, and it was to have central lanes for high-speed automobiles, of which he was an enthusiast, and a series of flanking lanes separated by grass medians for trolleys, heavy motor freight, horse-drawn conveyances, and pedestrians, all within a 200' wide right of way. One of du Pont's insights was incorporation of the railroad's concept of the urban bypass of towns. Construction was started in 1911, but the highway's great expense and delays caused by a few suspicious farmers reluctant to sell their property finally caused du Pont to scale back his plans and drop the multimodal concept. He reasoned that he could begin small to prove the worth of an all-weather highway, and then expand it into a dualized highway in later years. Actual construction, however, was limited to a two-lane, non-dualized, hard-surfaced highway.[3]

The 1919-1925 Bronx River Parkway in Westchester County, New York is perhaps the country's earliest designed, limited-access, dualized public highway of any length. It was built for automobiles; trucks were never allowed. The 15.5-mile-long road is located fully within the protected Bronx River Parkway Reservation that was started in 1913, and part of the development was to be a scenic parkway for pleasure use. The road was designed prior to 1916, but construction did not begin until 1919. It features limited-access, dualized travelways with two, 10'-wide lanes in each direction, some use of grass medians, elimination of grade crossings, and grades and curvature to promote safe, high-speed use. The road was designed for speeds of 25 and 30 mph. What is significant about the Bronx River Parkway from a highway engineering perspective is that its designers applied several railroad theories such as controlling right of way, and thus access, and eliminated grade crossings to a motor car roadway of some length. Subsequent Westchester County parkways of similar design, like the Saw Mill River Parkway and the Hutchinson River Parkway, both begun in 1924, were designed as through commuter routes (cars only), not for local or strictly pleasure

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[3] For more on the Du Pont Highway see, Lichtenstein Consulting Engineers, Delaware's Historic Bridges: Survey and Evaluation of Historic Bridges with Historic Contexts for Highways and Railroads (Dover: Delaware Department of Transportation, 2001), pp. 9-10. Also, Warren W. Mack, "A History of Motor Highways in Delaware," in Henry Clay Reed, ed., Delaware: A History of the First State (New York: Lewis Historical Publishing Co., 1947), pp. 535-550; Delaware State Highway Department, The Story of Roads in Delaware from the Days of "Beasts of Burthen" to "The Road of Tomorrow (Wilmington, Delaware: Clearinghouse of Delaware State Program, 1919).

usage, and they helped demonstrated to the nation the utility and advantages of dualized through highways based on integrated design and limited-access.[4]

As automobiles and trucks increased in numbers, size, and speed in the years immediately following World War I, the wisdom of Coleman du Pont's plan of dualization and urban bypasses became apparent. World War I spawned the birth of the over-the-road trucking industry as they had greatly ameliorated port congestion and demonstrated a versatility and reliability that would transform shipment of goods in the postwar era. This boom in motor vehicle usage, which included motor buses eclipsing trolleys, caught highway engineers off guard. Streets and roads that had once seen a dozen vehicles a day were suddenly seeing hundreds or even thousands, and those vehicles were not traveling at 15 mph but at 50 mph. Engineers and motorists quickly came to recognize that narrow roadways and at-grade intersections contributed to head-on collisions and side swiping, and that the number of accidents could be reduced by wider and better-designed roads, especially those in urban areas developed to service efficient transportation rather than access of adjacent property owners.

The most important advance in the design of dualized highways in the 1920s was the New Jersey State Highway Commission's (NJSHC) 1923-1932 Route 1 Extension – America's first superhighway. Located in an already congested urban setting, the 13-mile-long, limited-access highway was designed to be a through route between the state's main north-south highway and the 1927 Holland Tunnel, the first, all-weather, highway crossing of the Hudson River to Manhattan. The seminal effort marked the first time in this country that the economic theories of location and operation were applied to the planning and design of an unrestricted-use, vehicular highway, a concept that was not successfully repeated in this country until the Pennsylvania Turnpike, which was completed in 1941.

The Route 1 Extension owed more to railroads than to the landscape architecture approach of Westchester's parkways or city planning. It was conceived of by former railroad men who made the seemingly obvious connection between the through highway and a trunk railroad line that operated unimpeded and at maximum efficiency. The NJSHC's engineers were the first to design a highway based on the economic theory that a highway's grades, curvature, control of access, and speed of operation had a direct relationship with fuel consumption, wear-and-tear on vehicles, and lost time. They determined the cost of vehicle operation on a per mile basis, thus making it possible to calculate long-term, real costs, and therefore justify how an initially more expensive investment was ultimately cost-effective. The methods the engineers

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[4] US Department of the Interior National Park Service. National Register of Historic Places Registration Form: Bronx River Parkway Reservation (New York), 1990; Library of Congress, Historic American Engineering Record, HAER No. NY-327, 2003.

developed for analyzing the economic costs and benefits would be used by federal and state engineers in later years to identify, plan for, and justify the location and construction of urban expressways throughout the nation. New Jersey's superhighway set the precedent and the standard for the planning and design of subsequent high-speed, limited-access, through routes, including the Atlanta Expressway.[5]

By 1930, cities and states had the know-how to build expressways in urban areas, like Atlanta's congested central core, but they did not have the means to do so. Dualized highways, with their wide rights of way and greater acquisitions and construction costs, were simply not affordable, and the federal government, because of the powerful influence of rural states over federal highway policy, restricted the use of federal aid to cities with greater than 2,500 population until after 1944. This meant that most cities and urban areas that were planning dualized highways invariably ran into financial problems. Cleveland, Pittsburgh, and Philadelphia, for instance, drafted and revised expressway plans repeatedly through the 1930s, but they could not raise the money or political consensus to actually construct more than short sections, foreshadowing problems that would plague most large cities and states, including Georgia with its ambitious plans for the Atlanta Expressway, until the federal government stepped forward with federal aid for interstate highways in 1956. Another case in point is the Atlanta-Marietta Highway, Georgia's first dualized highway, which stopped at the Atlanta city limit because of federal-aid restrictions and left motorists to fend for themselves on already congested streets. It epitomizes a shortcoming of the nation's transportation policy prior to 1945.

The Federal Aid Highway Act of 1944 rectified the exclusion of federal aid to urban areas, and it was considered at the time of its passage a milestone in federal highway legislation. It provided for the first time a national program of highway improvements integrating urban roads into the existing primary and secondary rural roads. It significantly altered how the states and the federal government approached transportation planning because, at long last, the worst problem – urban traffic congestion – could start to be addressed in a systematic manner.[6]

Ironically, the dualized highway that received the most acclaim prior to the end of World War II did not directly serve a major city. The Pennsylvania Turnpike, built from 1937 to 1941, was a 160-mile-long superhighway through the countryside and mountains of southwestern Pennsylvania. It saved trucks five to six hours travel time

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[5] For more on the historic significance of the Route 1 Extension see, Lichtenstein Consulting Engineers, National Register Nomination, Route 1 Extension, Hudson and Essex counties, New Jersey, 2004.

[6] State Highway Department of Georgia, Twenty-Second Report of the State Highway Department of Georgia to the Governor and General Assembly of the State of Georgia for the Fiscal Years Ending June 30, 1947, and June 30, 1948 (Atlanta: 1948), pp. 28-29. Hereafter noted as Biennial Report.

between Pittsburgh and Philadelphia. The limited-access, grade-separated, dualized highway had all of the most advanced geometric practices — a 200'-wide right of way, two 12'-wide lanes in each direction, a 10'-wide grass median, shallow banked curves, no at-grade intersections, and no grade steeper than three percent. It was conceived primarily as a work relief project based on a scheme to take advantage of an abandoned railroad right of way. Controversial from the start, it was funded by more than $26 million in federal grants and loans against the wishes of the BPR, which opposed funding interregional highways or interstates through self-liquidating tolls. The turnpike's engineering was impressive, but even more impressive was the impetus the turnpike gave to the concept that the public would pay to support a network of dualized high-speed, limited-access through highways. Connecticut's Merritt Parkway also opened in 1938 as a toll facility. The parkway and Pennsylvania Turnpike, which earned $2.6 million during its first 11 months of operation, set the stage for the postwar era of dualized limited-access highways and significant political debates over how to pay for them. In the meantime, federal engineers were working with their counterparts in the state highway departments through the late 1930s and war years of the 1940s to develop national technical guidelines for dualized highways.[7]

Another important provision of the Federal Aid Highway Act of 1944 was the establishment of a program for BPR and the states to work together to identify a 40,000-mile-long National System of Interstate Highways to connect principal metropolitan areas, cities, industrial centers, and our borders. The map of the interregional highways that ostensibly became our interstate highway system was released in 1947, but it took until 1956 for Congress to pass the means to fund its construction (Figure 1). Until that time, cities and counties all across the country worked with their state highway departments using the newly available urban federal aid to start expressways and bypasses, some of which would be taken into the interstate highway system once it was officially established in 1956. The only section of high standard dualized highway in Georgia that was taken into the system after 1956 was the Atlanta Expressway, which forms the functional and historical nucleus of the state's present system.[8]

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[7] Swetnam, George. Pennsylvania Transportation, Pennsylvania Historic Studies No. 7 (Gettysburg: Pennsylvania Historical Association, 1964) pp. 71-75.

[8] Seely, pp. 187-191.

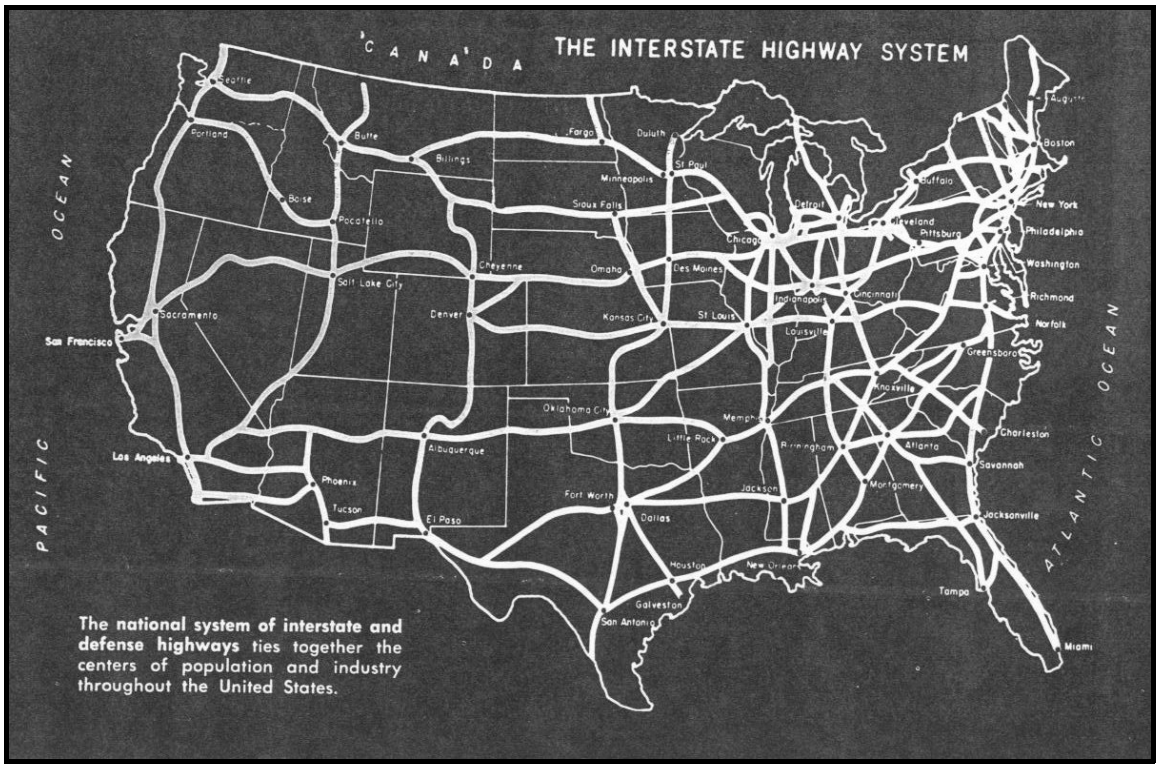

Figure 1. Map of the National System of Interstate and Defense Highways, 1956. The Federal Aid Highway Act of 1956 provided 90/10 federal funding for the system and finally allowed for states, like Georgia, to make real progress on high-standard, dualized highways. Source: USDOT, 1976.

Why Do They All Look Alike? National Influence: Federalism and Standards

A key component of state bridge and highway construction programs is federalism – the governmental system in which authority is shared between the states and the central authorities in Washington. It is this fundamental administrative and organizational structure that guided highway decision makers and made possible the coordinated efforts that led to the development of the majority of dualized highways, including all of the examples identified in Georgia from before 1957. The coordinated program of the federal government working with the states to finance and construct good roads started in 1916, when Congress established the federal-aid highway program. Under the program, which remains basically intact today, the expense for building or improving roads designated as federal-aid roads are shared by the federal and state governments. From 1916 to 1955, costs were split 50/50 for all federal-aid roads, but Congress increased the federal share to 90/10 for interstate highways beginning in 1956. Administration of America's highway policy through the 20th century stands as a premier example of federalism.

In theory under federalism, state highway departments have been responsible for planning, building, and maintaining roads and bridges, while federal engineers with BPR (now FHWA) have overseen and approved state construction plans, specifications, and estimates, and inspected finished work. In reality, however, a somewhat different relationship developed between state and federal highway engineers, one in which the states were not exactly equal partners. In the early years most state highway agencies lacked the knowledge and technical expertise about road design and materials. On the other hand, the BPR staff in Washington knew a great deal about such matters and thus tended to lead the way in developing design and materials standards, like those for safe dualized highways and then encouraging the states to use them. This was accomplished by the BPR working cooperatively with committees within the American Association of State Highway Officials (AASHO), (established in 1914) as a venue for the promulgation of well-founded design and materials policies and guidelines. The states then used the AASHO-approved policies and guidelines on projects involving federal funds. While BPR engineers remained the primary sources of technical data informing committee deliberations, the joint-effort approach meant that BPR did not dictate standards to their state counterparts but rather cultivated a sense of partnership.

This approach gave each state latitude, within limits, to develop its own approach to road design and materials standards. BPR and ASSHO never sought to impose uniform national standards, and they tolerated sometimes dramatic variation in standards among the states, compromising on items where state officials could justify variations for local conditions or precedent. For example, an urban state like New Jersey, could build many high-standard dualized highways for its heavily traveled arterial federal-aid routes, whereas a western state, like Utah, could build long stretches of minimally acceptable gravel roads that carried very little daily traffic on its primary highways. BPR officials judged this flexible approach critical to maintaining a shared commitment (partnership) to the federal-aid program.

Federal Engineers Establish National Design Policies for Dualized Highways

Joseph Barnett, a civil engineer who began his career on the Westchester County parkways, had as much as any individual to do with the standardized geometry of the dualized highway in this country. He joined the BPR as a senior engineer in 1933, and he quickly became its dualized and high-speed highway specialist. Barnett was a pioneer for “balanced design.” As Senior Highway Engineer in the BPR’s Division of Design, Barnett was in a perfect position to address what he perceived as the need to bring order to the design of dualized highways. He concerned himself with all details of dualized highway design from guide rails to controlled highway access. He and his staff even tackled one of the most difficult problems of high-speed highway design – developing a set of practical spiral curve design tables (spiral curves allow for a smooth transition between curved and straight sections of roadway).

From 1937 until 1966, Barnett was the Secretary of AASHO's Committee on Planning and Design Policies that profoundly influenced the standardized design of dualized highways throughout the nation. Between 1938 and 1944, Barnett authored, and the committee approved, a series of seven policies on geometric balanced-design highways, ranging from highway classifications to sight distances. The policies explained major design principles, details, and values for direct use by highway engineers, and offered clear, simply worded guidelines to produce uniformly designed highways. Much like today, the guidelines were reinforced by federal-aid programs that encouraged state highway departments to spend federal funds on highway projects that met the technical policies. AASHO policies guided the design of dualized highways in Georgia, as they did nearly every other state and explain why American dualized highways share so many common geometric characteristics.[9]

The influential AASHO geometric policies were officially adopted in 1944 at the same time Congress provided the first significant nationwide funding to urban highways. These policies addressed such topics as design speeds, grade, curvature, and the width of roadways, shoulders, medians, and offered guidelines for when a highway should be dualized based on level of traffic. Most state highway departments, including Georgia's, chose to incorporate the AASHO policies in their own standards and specifications. Therefore, most dualized (as well as two-lane) highways designed after World War II, including all of those known to have been built in Georgia, reflected highway designs shaped by technical policies developed by federal engineers and promulgated through AASHO.

Another area of vital influence for federal engineers was their leadership in research and planning that was used to justify the need for and cost of dualized highways. Herbert Sinclair Fairbank, a civil engineer who joined BPR in 1910, spent the next 50 years leading programs of applied research in highway planning, materials, and design. Beginning in 1934, Fairbank headed efforts in every state to collect traffic counts gathered by origin-and-destination studies, and in 1938, each state was mandated to conduct traffic planning surveys in an effort to have decisions based on objective technical, not political, grounds. The results of these surveys identified the areas of greatest need being exactly those urban areas excluded from federal-aid assistance, prompting a shift in emphasis at BPR from rural roads to urban, limited-access through routes and bypasses.

In response to burgeoning interest in a series of cross-country toll roads and recognition that the greatest challenge facing road builders was increasing urban traffic

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[9] USDOT (1976), pp. 188-190; Bruce Seely, "Why Roads Look as They Do: Highway Standards in Historical Perspective," Transportation Research Board Annual Meeting, Section 398: Historic Contexts: Key to Assessing Highways, January 10, 2001.

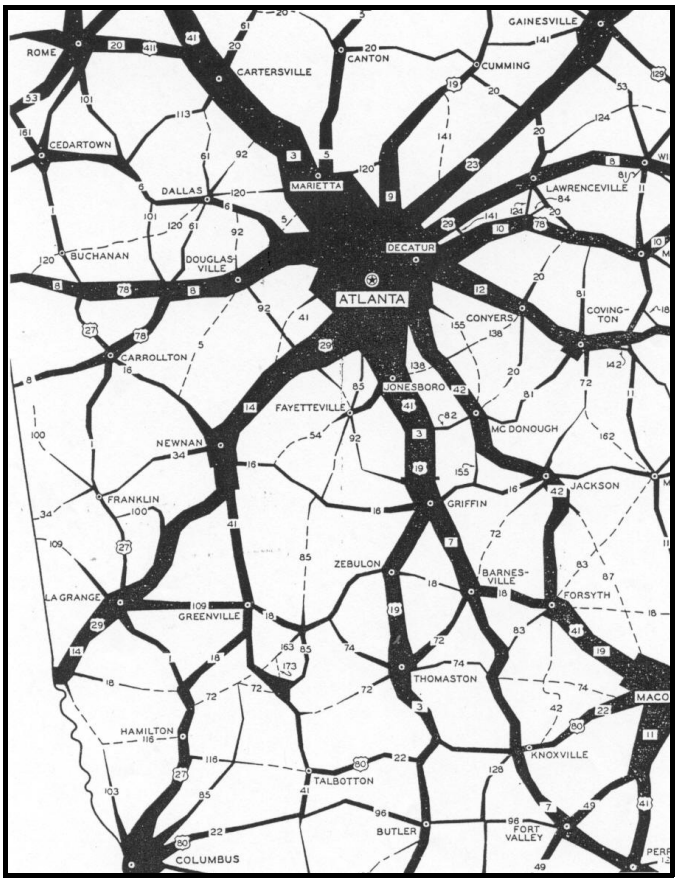

Figure 2. Traffic Flow Map, 1940. Origin-and-destination studies provided the statistical data for the state highway department to prepare traffic flow maps. Source, Biennial Report.

congestion, BPR issued a 1938 report, *Toll Roads and Free Roads* (anonymously authored by Herbert Fairbank), that proposed a system of about 25,000 miles of free roads connecting and running into the nation's cities. Although the war in Europe quickly distracted attention from highways, President Roosevelt appointed a National Interregional Highway Committee in 1940 to study this and other ideas. The committee's 1944 report – *Interregional Highways* – endorsed the BPR's vision of high-standard, high-speed express highways to and through the nation's cities, and states used the war years to plan postwar urban expressway and bypasses. BPR's Joseph Barnett reviewed or discussed expressway plans for Atlanta and nearly 100 other cities during the war. With the war's end, city and state highway departments moved beyond the surveys of the late 1930s and began more serious planning. In Georgia, planning studies began in urban areas with populations over 50,000, with the earliest and most significant the 1947 Lochner Plan for Atlanta, which would give shape to the hub of Georgia's interstate highway system.In order to comply with federal program requirements, the Georgia State Highway Department established several new divisions. The Division of Highway Planning was established in 1936, and traffic counts had been gathered at 14,000 traffic stations statewide by 1941 (Figure 2).[10]

The Federal Aid Highway Act of 1944 rectified the exclusion of federal aid to urban areas, and it was considered at the time of its passage a milestone in federal highway legislation. It provided for the first time a national program of highway improvements integrating urban roads into the existing primary and secondary rural roads. It significantly altered how the states and the federal government approached

[10] Biennial Report (1945-1946), p. 77.

transportation planning because, at long last, the worst problem – urban traffic congestion – could start to be addressed in a systematic manner.

State Context: Tendencies and Patterns in Dualized Highways, 1935-1956

The Georgia State Highway Department was a follower, not a leader, in dualized highway design and construction in the pre-interstate highway era. The Department's efforts were in step with, and often some years behind of, national efforts because of funding problems and the reluctance of state lawmakers to support limited-access, a feature critical for the safety and efficiency of any high-speed highway. All pre-1957 Georgia dualized and two-lane federal-aid states highways were built under the premise of implementing a national program and applying federal aid in ways that met Georgia's highway needs within parameters established by the BPR and AASHO guidelines. The federal-state partnership influenced the financing and design of each of Georgia's dualized highways. Quite simply, without federal aid and federal guidance, these roads would not have been built.

A state planning survey completed in 1947 estimated that Georgia required $456 million to bring the existing road system to a desirable level, more than ten times the amount typically spent in a postwar fiscal year. There was simply no room in Georgia's postwar state highway budget to contemplate a significant program of new dualized highways without Washington paying for it. Federal and state officials in charge of Georgia's highway program did not judge a system of dualized highways to be a statewide priority in comparison to improving existing primary and secondary roads systems that had to be accomplished on a pay-as-you-go basis prior to 1957. While some states, like North Carolina and Pennsylvania, forged ahead with new dualized highways in the postwar years, Georgia did not. Limiting factors included the state's absence of a dominant cross-state route or corridor, its agricultural economy, and its politics, which strongly favored rural interests and traditionally held out against raising excise taxes, bond issues, or toll financing – the most common methods of paying for the expensive dualized highways.

Highway officials did, however, judge some few sections of Georgia highway worthy of dualization to increase traffic capacity or to relieve specific areas of congestion in or near urban areas. No place was this more evident than in greater Atlanta, and solving the metropolitan area's legion traffic congestion problems continued to dominate what limited dualization activities the Georgia State Highway Department undertook after World War II. Consequently, because of the complexity of the problem and the effort involved in its remedy, with the exception of two, World War II military base access roads that were built to federal geometric standards as part of an identified federal priority between 1941 and 1944, Georgia's dualization efforts after the war, as they had before the war, remained focused on solving urban vehicular traffic congestion problems in the region's historic and ever-growing transportation hub – Atlanta.

The Department built approximately 150 miles of dualized highway from 1935 to 1956, much of it in short, discontinuous sections (a table of all roads will be inserted here). The state's effort did not represent a comprehensive statewide approach to dualization; sections were built as conditions and opportunities permitted, and only the 22-mile-long Atlanta Expressway represented the highest type of limited-access highway. Rather, pre-1957 dualized highways in Georgia are represented by about 20 segments of highway ranging from less than one mile to 25 miles long beginning in 1935 with the oldest being the 17.4-mile long Atlanta-Marietta Highway built 1935-38. Most, particularly especially those built after World War II, were undistinguished projects initiated in response to BPR-sponsored planning surveys, the availability of 50/50 matching federal aid, and specific congestion or safety concerns. A few highways, such as the Atlanta-Marietta Highway, the wartime military base access roads at Fort Benning and Camp Wheeler, and the 1948-59 Atlanta Expressway, stand out as notable in the state context because they chronicle the Georgia State Highway Department's implementation of national trends and federal programs.

Georgia's First Dualized Highway: The Atlanta-Marietta Highway, 1935-1938

The Georgia State Highway Department designed the 17.4-mile-long Atlanta-Marietta Highway on a new alignment to promote safety and relieve traffic congestion on a busy segment of US 41 from northwest Atlanta to north of Marietta. The Department touted the highway as "the most advanced design" for "high-speed" traffic with two, 20'-wide concrete roadways and a 4'-wide raised median strip that could be crossed in an emergency but separated traffic in ordinary conditions (Figure 3). Construction was funded by the 50/50 federal-state, federal-aid formula, and it did not extend into Atlanta proper because of the pre-1945 restriction of using federal funds for highways in cities. It did, however, bypass Marietta. As compared to the typical two-lane rural highways that had been the Department's staple since the late 1910s, the Atlanta-Marietta Highway was an important accomplishment because it introduced dualization to Georgia. It also illustrated the worst shortcomings of early dualization efforts and a real lack of foresight; the highway did not control roadside access nor did it eliminate at-grade intersections, which by 1935 were known to be crucial to the effectiveness of any highway designed to service high-speed traffic.

The failure to anticipate new commercial development along the highway turned out to be a significant miscalculation as roadside development negated any safety advantage to its design. As one state engineer framed the problem, there was this "big beautiful wide right-of-way, . . . and it had been naively hoped [roadside] developments would be reasonable and to the same quality and standards as the highway, but it was not to be." The 10'-wide lanes with no inside shoulders and narrow outside shoulders were already substandard compared to many areas of the country where 12' lanes and shoulders had been common since the late 1920s, including on many of Georgia's two-lane highways. In short, the highway was not a balanced design. State engineers soon

A view of the Atlanta bound traffic on the Marietta-Atlanta Highway at its afternoon peak hour. (600 cars pass this point in 15 minutes.)

Figure 3: Traffic levels on the Atlanta-Marietta Highway soon led to plans to widen the roadway and add turning lanes, but state engineers had identified lack of limited access as the highway's greatest shortcoming by 1945. They would lobby heavily for some form of limited-access legislation for more than a decade before getting the General Assembly to agree in 1956. Source: Biennial Reports, 1940.

realized that they had not built to high enough design standards, a mistake they would do their best to subsequently avoid.[11]

Military Base Access Roads, 1941-1945

In 1941, BPR identified poor access roads to the nation's war-industry factories and military bases as a significant deficiency, and the 1941 Defense Highway Act authorized $150 million for construction of military-related access roads, and by late 1941 each state was asked to shift emphasis from meeting local needs to focusing on this national priority of highways built to service traffic to bases and plants. In 1942, the Georgia State Highway Department was approached by the federal BPR and the War Department to design and construct three dualized highways. Two of them, the 2-mile-long Macon-Camp Wheeler (SR 19/US 23) road (Figure 4) and the 11-mile-long Columbus-Fort Benning (SR 1/US 27) road (Figure 5), were completed by war's end in 1945. The third, from Macon to Warner Robins Air Depot (SR 11/US 41), was planned and graded, but only one side was paved during the war. It was not dualized until 1953. The new dualized highways were realignments of existing US-numbered routes, and they were intended to serve the general public after the war.

The design of Georgia's dualized base access roads reflected a significant level of federal BPR input. At BPR insistence, they were built to a higher standard design than the Atlanta-Marietta Highway and were the prototypes for the dualization of sections of other US-numbered routes that would be built by the Department in the immediate postwar years. The wartime dualized highways were four lanes composed of two, 22'- or 24'-wide concrete roadways with grass medians and stabilized shoulders and were thus significantly wider than the Atlanta-Marietta Highway. They also featured grade separations at some cross streets. The war base access roads represent essentially the geometric guidelines developed by the BPR's engineer Joseph Barnett and officially adopted by AASHO in 1944 and used throughout the nation through the 1950s (Figure 6). Historically, the military base access roads were the earliest examples of the "balanced design" concept applied to dualized highways in the state, and they were prominently featured in the State Highway Department's reports as significant accomplishments that had greatly benefitted the war effort. Additionally they set the precedent for the state's postwar federal-aid highway dualization projects from 1946 to 1956. In anticipation of that effort, state

[11] T. D. House, "Control and Protection of State Highway Rights-of-Way," Proceedings of the Second Annual Georgia Highway Conference (Atlanta: Georgia State Highway Department, 1953), pp. 129-131. Biennial Report (1937-1938), pp. 14, 16, 23.

Figure 4. Macon-Camp Wheeler Road, 1944. The road was one of two Georgia military-base access, dualized highways built to AASHO's balanced design standards with a design speed of 55 mph. In contrast to the 1935-38 Atlanta-Marietta Highway, this dualized highway had wider medians and roadways. Source: Biennial Report, 1944.

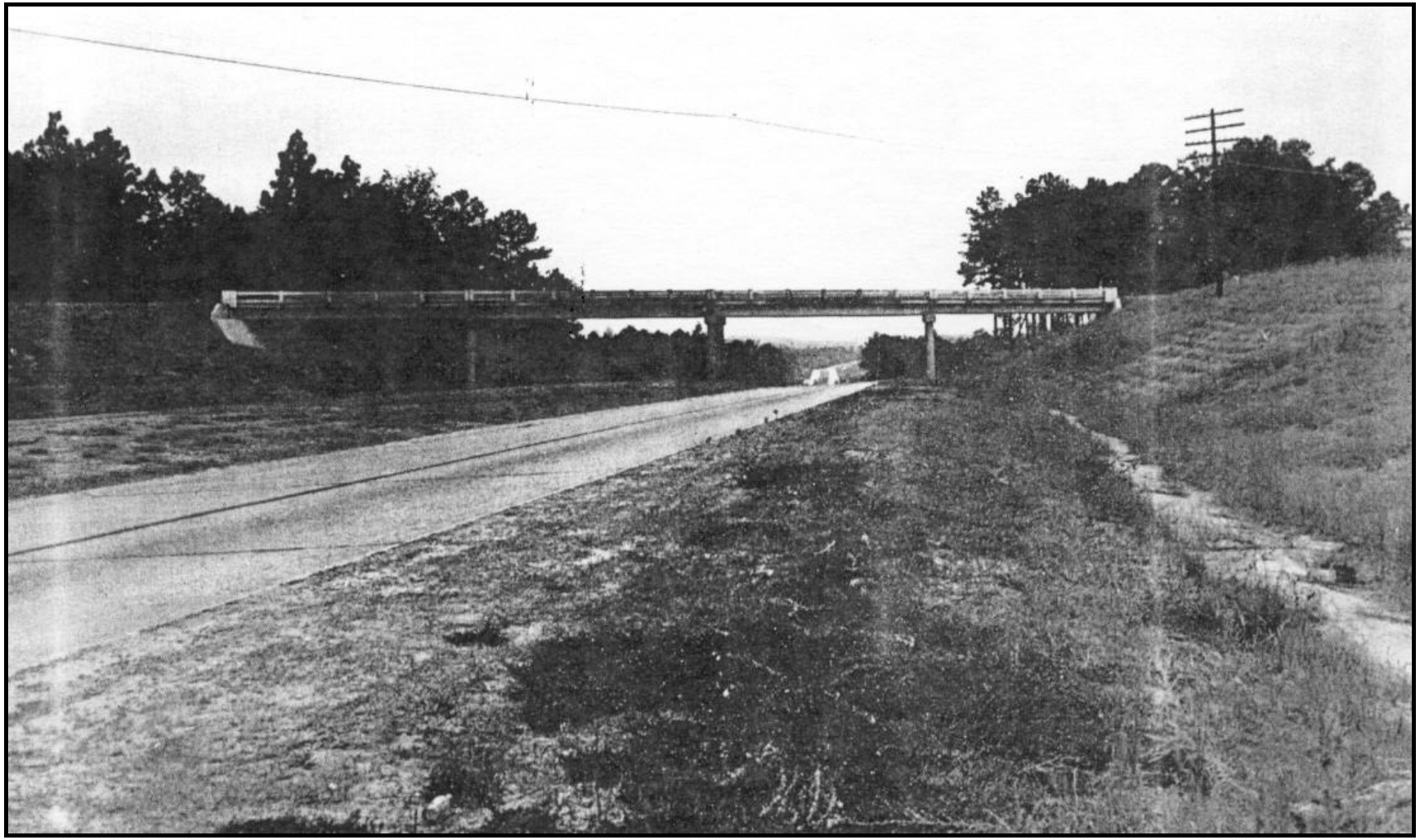

Figure 5. View of dualized SR 1/US 27 at Fort Benning, 1944. Source: Biennial Report, 1944.

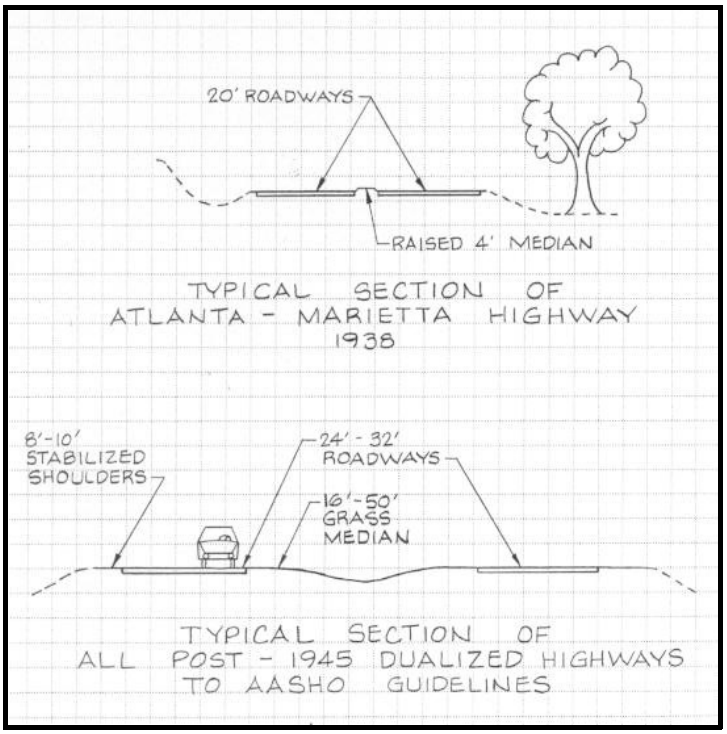

Figure 6. Typical roadway sections of Georgia's dualized highways.

engineers prepared standard plans and specifications for highway design based on the AASHO guidelines and the experience of building the wartime access roads. The standard plans and specifications were in place and ready to be applied when the war ended in 1945.[12]

Dualized Highways Piecemeal, 1946-56

After World War II, the Georgia State Highway Department applied the same military base access road geometric policies and balanced design standards to various lengths of dualized throughout the state. The total length of dualized highways in Georgia increased from about 30 miles in 1945 to 150 miles in 1956, a very modest increase in comparison to the more than 6,600 miles of Georgia highway then classified as federal-aid primary. The dualized sections were improved piecemeal, section by section, as federal funding became available and were a reaction to existing traffic volume and point problems. They were not built to be a stimulus to new development, although commercial strip development often followed. This work was never part of a coordinated, comprehensive effort to build an interconnected system of high-speed, dualized highways. Biennial reports coupled with the few post-war examples outside of Atlanta demonstrate that the Department did not consider these relatively short and isolated sections of dualized roadway a significant accomplishment. Rather, the Department thought of them as business as usual.

A significant consideration is the fact that, with the exception of the Atlanta Expressway, the post-war dualization projects were not built as discrete highways; they were construction sections in existing routes. Section end points were chosen based on a number of factors including those points where the

[12] Biennial Report (1942), p. 19; (1944), pp. 94, 100; "Georgia Short on Manpower," Engineering News-Record (Mar. 11, 1943), pp. 105-06.

dualized sections could conveniently merge back with non-dualized sections, where traffic counts justified dualization, where lengths of highway could be improved with available funds, and where the work could be completed by a single contractor during a construction season. The construction sections were typically very short (less than four miles) and built to address particular point problems, as in realigning and dualizing three miles of US 80 to bypass Statesboro in 1948. A common practice was to stage out construction by building in sections over a number of years. The 21 miles of US 41 north of Marietta were dualized this way from 1949 through 1953 (Figure 7). Several other shorter sections of dualized highway were in urban areas where they were intended to alleviate congestion. The new roadway sections could be dualized highways on new alignments, or they could incorporate the existing road that was improved by adding a parallel roadway and median.

Since Georgia's pre-1956 dualized highways were built to well-established AASHO geometric policies used for World War II access roads and adopted nationally in 1944, they have no details or construction techniques particular to Georgia, and they cannot be seen as a significant technological change or historic event in highway design or construction in the state context. Most of these highways were built with 22'-, 24'- or 32'-wide roadways and grass medians. The Georgia State Highway Department was designing and building what every other state was designing and building on their US-numbered highways with federal aid during this period.

While engineers of the various divisions of the Georgia State Highway Department planned and oversaw the construction of the dualized sections, the influence of the federal BPR was dominant and evident in all aspects of the state's operation. In order to be able to comply with the changing federal emphasis on urban and high-standard, dualized highways, the Department established several new divisions, including the Division of Highway Planning in 1936, the Division of Right of Way in 1945, and the Division of Urban Projects in the summer of 1947. There were 34 different jurisdictions in Georgia that met the definition of urban in 1947. The Division of Highway Planning carried out studies and surveys aimed at providing the origin-and-destination data, economic analysis, and other information necessary as a prerequisite for federal-aid construction projects. Funds for planning came directly from the BPR, and all work complied with BPR requirements. The Division of Right of Way handled acquisition of right of way in advance of the construction program. Chief right of way engineer R. E. Adams noted that his greatest concern in complying with the federal-aid program was securing the necessary 200'- to 300'-wide rights of way preferred by federal engineers for dualized highways. The Division of Road Design under the direction of State Road Design Engineer J. A. Kennedy

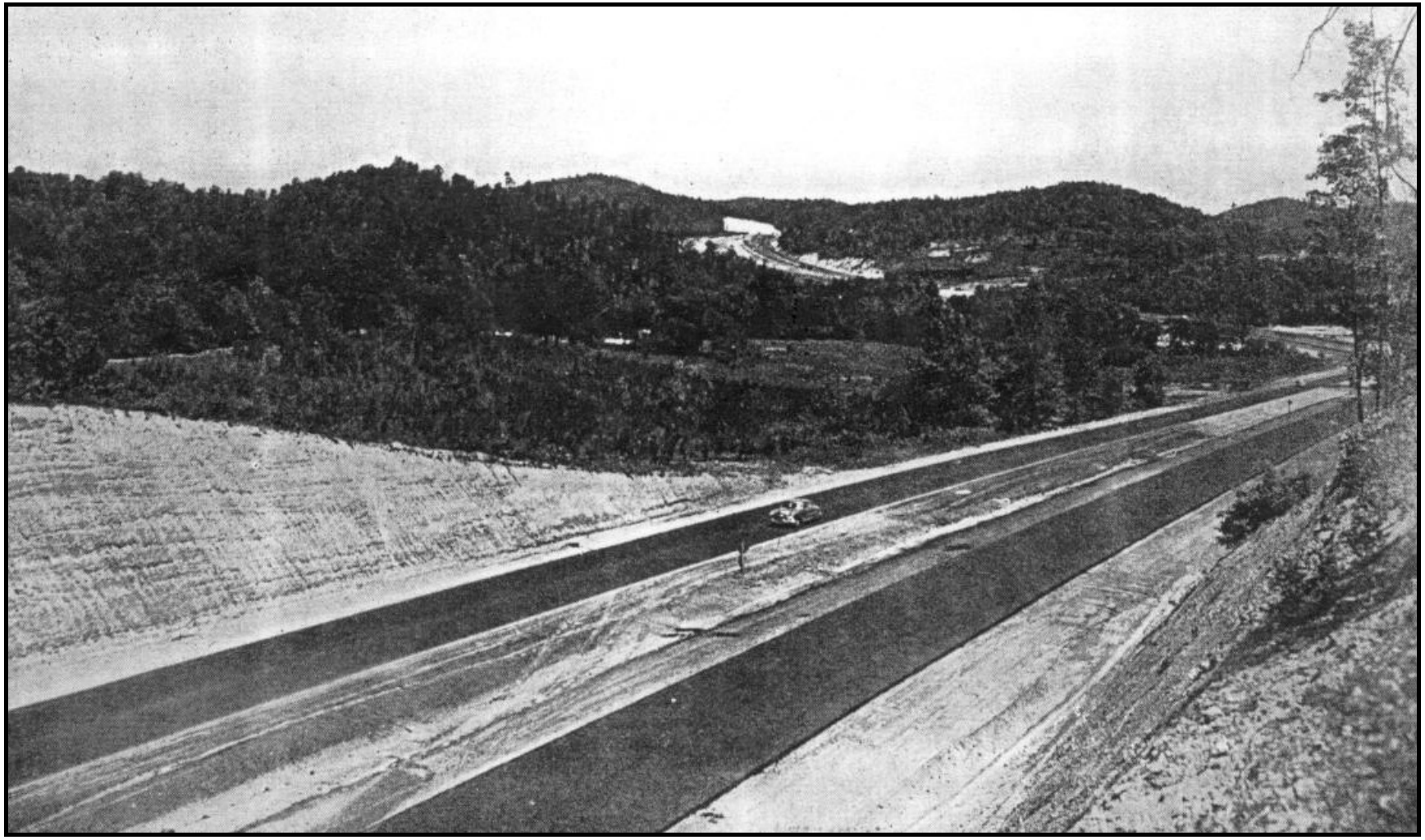

Figure 7. SR 3/US 41 between Marietta and Cartersville, 1954. One of about 20 sections of federal-aid primary highway dualized by the state highway department from 1946 to 1956 based on AASHO highway classification and geometric policy adopted nationally in 1944. Source: Biennial Report, 1953-54.

prepared the plans for dualization projects, and here again the federal influence was evident. In 1950, Kennedy stated that any project involving federal funds involved the cooperation of the BPR. Preliminary plans were prepared by his division and delivered for a field inspection by a state engineer accompanied by a representative from the BPR division office in Atlanta. Plans were changed as recommended by the field visit, final plans drawn up, and blueprints made. The blueprints were then sent to the BPR for review and approval. Upon final BPR approval, the plans were turned over to the Division of Contracts and Office Management to advertise for bids. This protocol attests to the close partnership between federal and state engineers and the application of standardized solutions and designs to Georgia's highways, dualized and otherwise.[13]

Georgia's Struggle for Limited Access

Even as federal and state engineers worked to dualize a few sections of federal-aid primary highway, they realized *from experience* that dualization without limited-access tended to result in roadside development that diluted and eliminated any advantage of roads developed to service traffic, with the painful case-in-point being the 1935-1938 Atlanta-Marietta Highway. It was clear by the end of the war that high standard, high-speed, dualized highways had to be limited access, but there was opposition from businessmen, politicians, and property owners, who feared that restricted access would hurt established roadside businesses, unduly limit development opportunities, and lower property values. Such opposition was common nationally, but it was particularly strong in Georgia and other states in the south and west with traditions of resistance to the expansion of state power.

Georgia State Highway Department officials started lobbying the state legislature for some sort of "reasonable" roadside access control in 1945. This decision was clearly based on the experience of the Atlanta-Marietta Highway and concerns that future high-speed dualized highways would meet a similar fate. One of the jobs of the Division of Right of Way was to research and develop a statewide plan for limiting roadside access, along with managing the acquisition of right of way for state roads, including wide, dualized highways. Although the right of way division presented a strong case for limited access, the legislature repeatedly failed to act favorably, primarily in response to vocal businessmen and property owners who opposed the law. Furthermore, legislators from rural counties saw little reason to solve what was considered basically an urban problem.[14]

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[13] Biennial Report (1949-1950), pp. 81, 115; (1951-1952), p. 143.

[14] The State Highway Department's case for limited-access is laid out in the Biennial Report (1954), pp. 117-120. Property owners' reaction to the driveway permitting process is described in C. W. Leftwich, "The Problem of Highway Maintenance and the Training of Maintenance Personnel,"

The federal government, as in times past, eventually forced Georgia's hand. In 1950, the BPR put into effect a regulation that required states to have "some effective control of access" on busy federal-aid highways. To meet this requirement, Georgia established a permitting process whereby adjacent landowners had to apply to the Department to build driveways accessing state highways. In general, permits were not denied and enforcement was lax, but it gave the Department a greater say in the location and width of driveways, particularly at dangerous or problem points. The Department even went to the extraordinary effort of adopting a range of standards for driveways and had these standards printed and made available to the public. Even so, property owners continued to put up a "howl" that they were being discriminated against and state engineers found themselves going to great pains to explain the necessity for even this modest level of access control. The Department's planners and engineers grew increasingly concerned that the state's investment in higher capacity, higher speed highways was going to waste without strictly controlled access of adjacent properties.

In response to the continued resistance to limited access, the Department co-sponsored a series of annual highway conferences at Georgia Tech beginning in 1952, and it used this forum to make its case. National highway experts were invited to the conference, and they spoke directly on the benefits of limited access to the audience of state legislators and the many attending state highway department employees and university engineering students. In 1953, for instance, Pyke Johnson, head of the Automobile Safety Foundation, condemned "the flock of hot dog stands, juke joints, service stations and other structures, liberally interspersed with billboards" as a significant highway safety problem, and he encouraged southern states such as Georgia, which appeared to be behind national trends, to adopt limited-access laws to fight roadside development. A. E. Johnson, Chief Engineer of the Arkansas State Highway Department and President of AASHO, spoke on the topic of "Control of Access - What, Why, Where and When" in 1954. He correctly predicted that Georgia's lack of limited access would require the eventual bypassing of the recently improved US-numbered highways because of uncontrolled roadside development that would soon render the highways functionally obsolete. Johnson's conclusion no doubt rang true with long-term state highway engineers who were already planning to relocate sections of US 41 north of Atlanta for the fourth time in as many decades. In the final outcome, Georgia resisted controlling roadside access and did not pass limited-access legislation until 1956 when the federal government

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Proceedings of the Second Annual Georgia Highway Conference (Atlanta: Georgia State Highway Department, 1953), pp. 125-126.

provided the financial carrot of ninety percent funding for limited-access interstate highways built to the highest geometric standards.[15]

The passage of the 1956 Federal Aid Highway Act that set up funding mechanisms to build the long-envisioned National System of Interstate and Defense Highways, now simply identified as interstates, found Georgia well behind other states in high standard, high-speed dualized highway mileage. Georgia was among the last states to have limited access. Thirty-five of 48 states had limited access by 1955, and nationally about 20 percent of what makes up the interstate system is composed of dualized highways that existed prior to 1957. The mileage was taken into the interstate system because it was designed and built to the high geometric and materials standards that matched or could be economically improved to meet federal interstate guidelines for limited access and balanced design. Georgia had no such highways except for the Atlanta Expressway, the state's only and most historically important high-speed dualized highway.

The Atlanta Expressway

Georgia's only pre-1957 limited-access dualized highway was the Atlanta Expressway. It was Georgia's most impressive, most expensive, and highest profile highway project of the decade following World War II, and it is the one Georgia dualization project that was covered in the national technical literature. The State Highway Department called the expressway "the outstanding urban project in the state," and truly it was as it showcased what could be done in Georgia's area of worst traffic congestion. All other dualization projects in the state paled in comparison with the metro Atlanta project that became the nucleus from which the state's interstate highway system would eventually be built. Its construction to high geometric standards was only possible through a special set of circumstances and legislation agreed to by the state, county, and city that limited access.

The expressway was based on the synthesis of survey data that was gathered over several years. Between 1936 to 1945, Atlanta was the focus of an increasingly intensive series of traffic surveys sponsored by the State Highway Department and the federal BPR. In the late 1930s, the Department's Division of Planning first set up 44 traffic stations in a circumference around the city and interviewed drivers. This was followed by more in-depth surveys including

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[15] See, for example, Pike Johnson, "The Road Ahead," Proceedings (1953), pp. 5-11; R. E. Adams, "Right-of-Way Acquisition and Needed Changes in Present Laws," Proceedings (1953), pp. 32-36; T. D. House, "Control and Protection of State Highway Rights-of-Way," Proceedings (1953), pp. 129-131; Roy A. Flynt, "The Meaning of 'Interstate Highways' and 'Limited-access'," Proceedings (1956), pp. 112-124; Biennial Report (1956), pp. 124-125.

house-to-house interviewing; numerous origin-and-destination studies; a parking survey to determine the cost, duration, and length of walk for drivers from their cars to destination points; and a truck survey to gather information on truck company operations and street use. The studies quantified the prevailing opinion that Atlanta had "to relieve traffic congestion or suffer the serious consequence of strangulation." Atlanta's street pattern, particularly the lack of so few through streets in the downtown area, was cited as the cause of the worst of its traffic congestion.[16]

Late in 1944, the Georgia State Highway Department, in cooperation with the City of Atlanta, Fulton County, and the BPR, turned to H. W. Lochner & Company, a newly founded transportation planning firm in Chicago, to prepare a comprehensive highway and transportation plan for the Atlanta metropolitan region that incorporated city streets, mass transit, and expressways. Such studies were a common immediate postwar activity undertaken with BPR involvement in metropolitan regions all across the country, and the Atlanta plan spells out how the federal plan for interstate highways adopted in 1944 would be implemented in the metropolitan region (Figure 8).

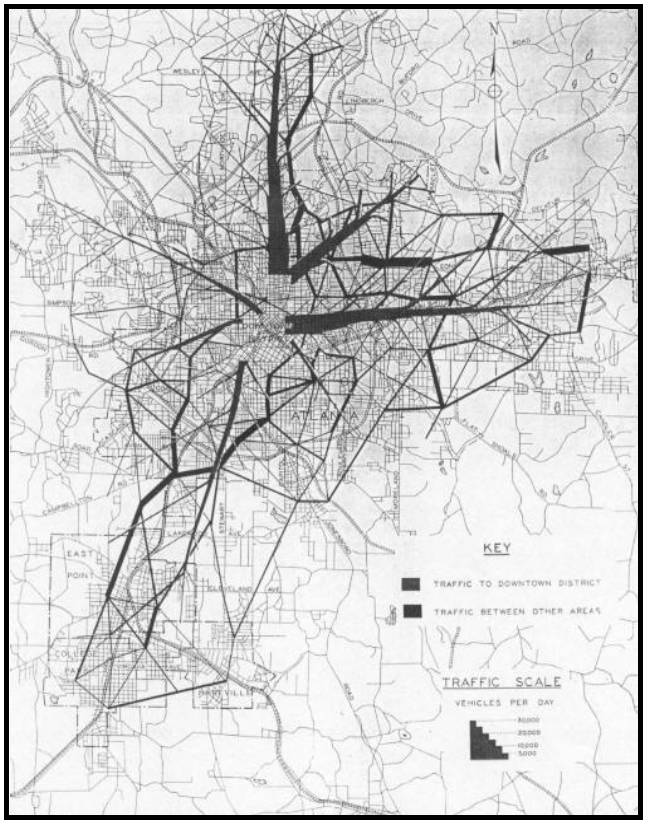

Figure 8. H. W. Lochner's plan for Atlanta's expressways used traffic counts and origin-and-destination studies to analyze the city's traffic patterns and identify locations for expressways to serve existing traffic. It formed the nucleus of what would become the interstate highways. Source: H. W. Lochner, 1946.

The Lochner plan, completed in early 1946, identified "urban portions of the interstate highways ... [as] major arteries radiating from Atlanta toward Spartanburg, Chattanooga, Birmingham, Montgomery, and Macon" and a sixth route toward Augusta identified by the State Highway Department (Figure 9). The primary link of this radiating

[16] Mose E. Cox, "Planning the Atlanta Expressway System," Proceedings (1954), p. 27; Biennial Report (1942), p. 55; (1944), pp. 4-5; H. Jay Wallace, "Elevated Highways over Railway Lines," Roads and Streets (August 1944), pp. 85-88.

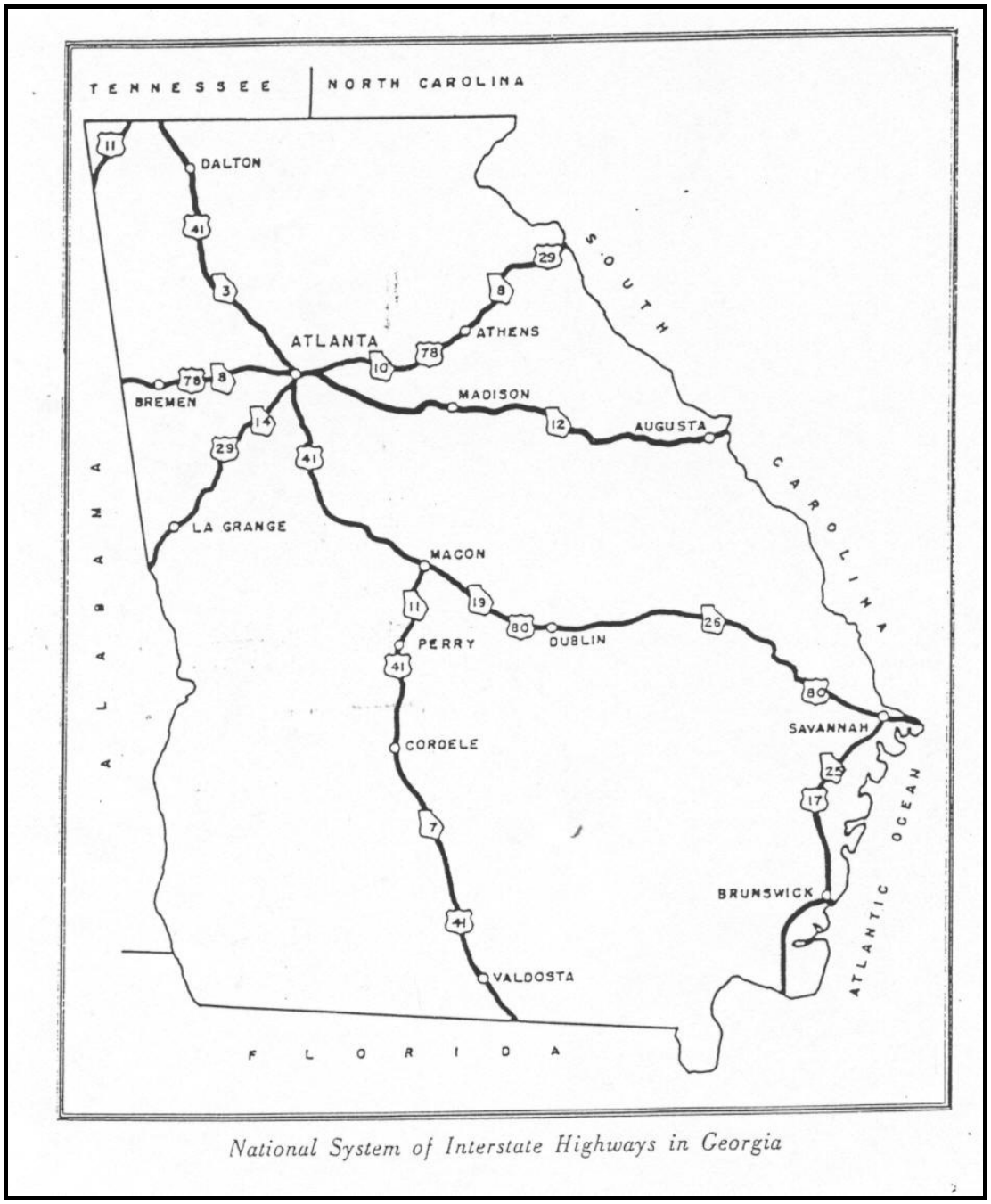

Figure 9. The Georgia State Highway Department designated these highway routes to the National System of Interstate Highways that was established by the Federal Aid Highway Act of 1944. The system was not the same as what is know today as the interstate highways, although it follows the same basic pattern of connecting the state's cities. It was essentially the previously designated US-numbered routes (established in 1926), but upgraded to the AASHO geometric policies, also officially adopted in 1944. These guidelines called for the dualization of section of the system that had a maximum traffic counts of more than 800 vehicles per hour. Source: Georgia State Highway

Department, Biennial Reports. system was to be a connector route planned as a below-grade, limited-access expressway through the heart of city and extending around the north, east, and south sides of the central business district. The goal was to locate the radiating interstates along existing traffic flows in order to be able to serve the greatest feasible number of vehicles within the urban core. The expressways were to conform to the "most modern highway design standards as developed by the Federal Interregional Highway Committee."[17]

The plan, which included motor bus and passenger train components, was intended to resolve the region's transportation needs through the year 1970, and it addressed improvements to the existing city streets, including widening of major thoroughfares, the use of one-way streets, the elimination of on-street parking, and the construction of off-street parking – all supporting the efficient use of the expressways. The Lochner plan advised that the expressways were not tourist facilities built to carry the seasonal pilgrimage around or through the city, but rather "utilitarian highways to serve primarily the traffic moving about the metropolitan area or traffic either with origin or destination in the urban center."[18] This was no doubt a point made to distinguish the expressways from the Department's typical efforts to upgrade sections of the existing state highway system like US 41 north of Marietta or the downtown Griffin bypass. The observation was also based on the fact that Atlanta's population was growing rapidly and that residences and businesses located on the city's outskirts were generating "a great deal of highway traffic, and in time will cause dispersal of population." The expressways were meant to serve development trends already apparent to the planners; the expressways were not the root cause of suburbanization, although they might contribute to the trend once built.

The Atlanta plan represents a major reorientation in thinking about the region's transportation systems by making the highway and not the railroad the dominant system. The plan envisioned Atlanta as a trucking terminal with expressways radiating from the city center hub (just as the railroads had done) and connecting to major cross-state and interregional routes. The plan was hailed as a solution to the worst of Atlanta's traffic congestion and safety problems.[19]

Based on Lochner's plan, the state legislature granted Fulton County the right to build limited-access highways, a concession in the statewide struggle over

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[17] H. W. Lochner & Company and De Leuw, Cather & Company, Highway and Transportation Plan for Atlanta, Georgia, prepared for the State Highway Department of Georgia and the Public Roads Administration, Federal Works Agency (January 1946), pp. xiii, 14.

[18] Ibid., p. 9.

[19] Ibid., p. 14.

limited-access. Significantly, the lawmakers did not extend the same, limited-access policy to other population centers with congestion problems like Chatham, Bibb, or even Cobb counties. State highway engineers then proceeded to design the expressway using AASHO balanced-design geometric policies. "The first impression of this expressway is one of spaciousness," said G. Donald Kennedy, the executive vice president of the Portland Cement Association, an organization that proudly noted the decision to use 8"-deep, air-entrained concrete pavement for strength and speed of construction. The wide right of way, over 300' wide in places, allowed for up to six, 12'-wide traffic lanes (three in each direction), a 14'-wide median strip, and space for interchanges, acceleration and deceleration lanes, and lighting standards (Figures 10, 11). "A second impression is one of broad scope," stated Kennedy. The sight distances were long and wide, and the curvature and gradients adjusted to the speed of traffic. The design speeds were 50 mph for the portion of the expressway closest to downtown and 60 mph in the outlying sections. The most difficult technical problem for the planners was fitting the expressway into Atlanta's existing street patterns and eliminating all grade crossings through liberal use of overpasses, underpasses, and depressed highway sections.[20]

The Atlanta Expressway was to be the most "modern" highway ever in Georgia, but its construction was as much a financial and political challenge as a technological problem to be solved, just as similar projects in urban areas all across the country. Georgia in this respect was very much in step with the national trend. The Federal Aid Highway Act of 1944 initiated appropriation of funds for urban highways on a 50/50 federal/state matching basis (Georgia's apportionment was about $1.5 million per year from 1944 to 1954), but even with state match, "the funds available from these sources were so limited that no real start could be made on such a large and expensive undertaking." Fulton County and the City of Atlanta made up the estimated difference approving bond issues of approximately $28 million in 1948. Debt financing was a politically contentious issue, but the revenue generated by the local bonds finally provided the means for some progress to be made. In 1946, Lochner estimated the total cost of the expressway at about $48 million, but by 1959, when the expressway was completed, the actual costs had risen to $70 million with the eastern and western sections of what would become I 20 yet to be built.[21]

Construction on the Atlanta Expressway began in 1948, but higher than anticipated right-of-way acquisition and construction costs, public relations

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[20] G. Donald Kennedy, "National Trends in Modern Highway Design," Proceedings (1954), pp. 9-18; Biennial Report (1949-1950), pp. 107-108.

[21] Cox, p. 29; Lochner, p. xiii; Biennial Report (1948), pp. 29-30.

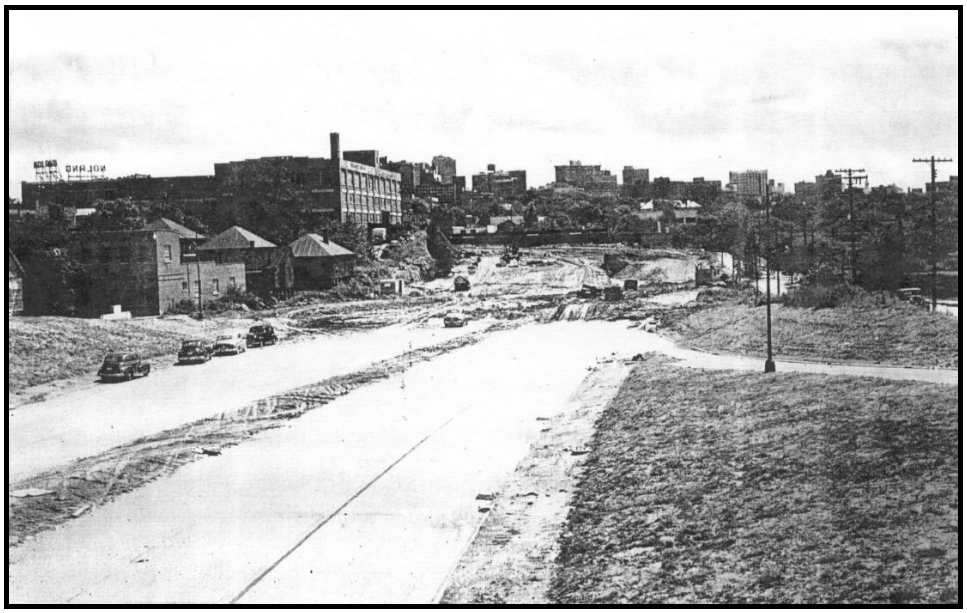

Figure 10. Construction view of the Atlanta Expressway, 1954. The section of expressway in downtown was more expensive than anticipated. Funding and right-of-way acquisition problems delayed opening until 1959. It was finally the huge infusion of federal aid in 1956 as part of the interstate highway system that allowed the state to finish the expressway. Source: Biennial Report, 1954.

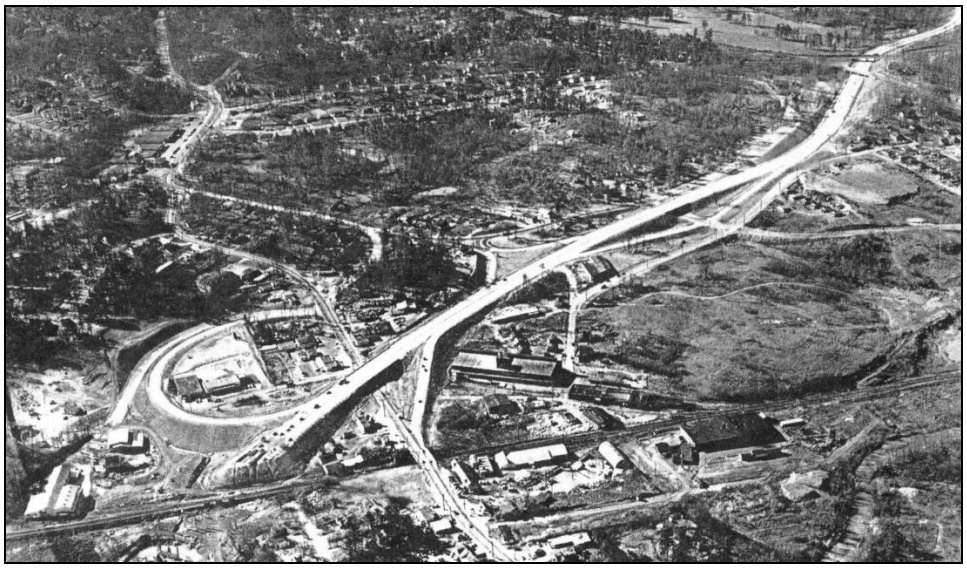

Figure 11. Aerial view of the northeast leg of the Atlanta Expressway, ca. 1954. The northeast leg (I 85) originally terminated at Piedmont Road. Source: Biennial Report, 1954.

problems, and refinement and changes in the highway design stymied notable progress for most of the years prior to 1956. There was a spurt of construction activity between 1948 and 1952, with completion of the section from Baker Street north to Lindbergh Drive on the northeast leg and to near Paces Ferry Road on the northwest leg. The southern leg from University Avenue to the Clayton County line was also completed. By 1952, however, funds were running short, so the city and county had to approve an additional $12.7 million in bonds to keep the project going. There were difficult and politically controversial decisions to make about the alignment of the downtown connector, and the region's explosive growth caused the engineers to rethink the roadway geometry and recommend additional lanes. That decision caused further delays and, of course, higher costs. It was only with the passage of the 1956 Federal Aid Highway Act and its infusion of funds for interstate highways that the money to complete the downtown connector arrived, and it was completed in 1959 (Figure 12).

By the time the downtown connector opened, the state's highway planners and engineers were already raising concerns that the Atlanta Expressway was at capacity despite having been upgraded from a four-lane to a six-lane facility with eight lanes for the downtown connector. Traffic volumes on the expressway's north leg topped 65,000 vehicles per day and 8,000 vehicles per hour during the morning rush. Amazingly, the daily count in 1958 was greater than the Lochner plan projection made in 1946 of the traffic volumes in 1970. The numbers were a sure sign of continued problems ahead and the need for improvements, which followed in fairly quick order. Today, the Atlanta Expressway has been altered and widened beyond recognition of its original design as the state strives to accommodate ever-increasing volumes and weight of traffic.[22]

The Atlanta Expressway brought Georgia into the age of the high-standard dualized highway. It was a historically important first step for the state toward the development of a comprehensive system of limited-access expressways to serve the city, the state, and the southeast region. Its planning and geometric design set the precedent for the tremendous amount of dualized highway work that would follow as a result of the 1956 Federal-Aid Highway Act and the establishment of the interstate highway system.

Railroad Grade-Crossing Elimination Bridges

Bridges and viaducts related to railroads are not a distinct property type, rather they are examples of the same bridge technologies that were used to cross any type of natural or manmade feature. Additionally, the railroad grade-crossing

[22] Biennial Report (1958), p. 115; "Expressway Progress to Halt as Building Funds Run Out," Engineering News-Record (April 24, 1952), pp. 34-37.

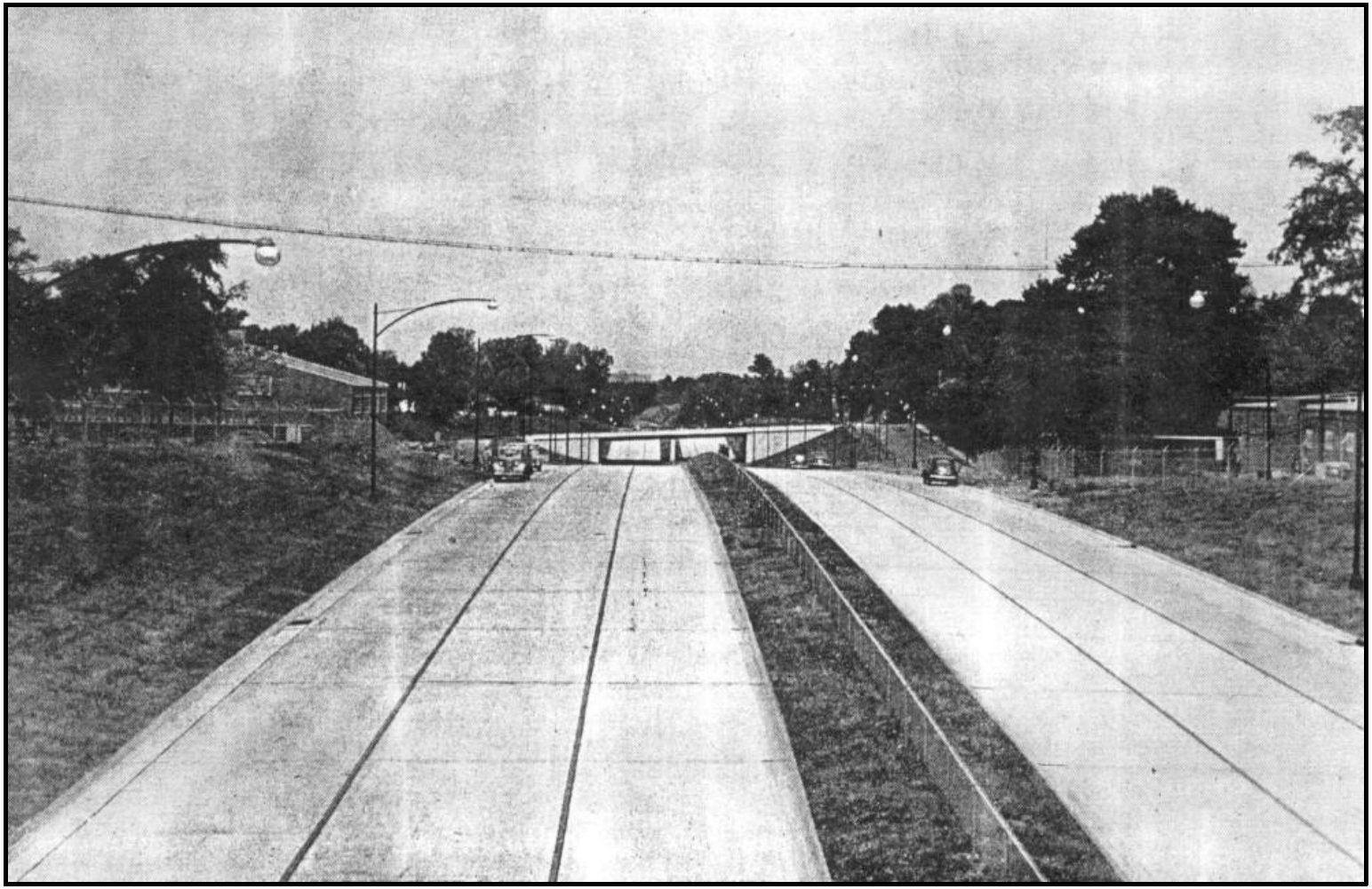

Figure 12. View of a six-lane section of the Atlanta Expressway as it appeared when this section first opened in 1954. All of the original grade-separation bridges carrying local streets over the expressway proper have been replaced. Source: Biennial Report, 1954.

problem was neither new or particular to dualized highways, nor even to the age of the motor vehicle. Eliminating intersections of tracks and vehicular roadways has been a part of the history of the development of railroads since America's earliest railroads of the 1830s. The Central of Georgia Railroad's 1853 and 1860 brick arch viaducts at Savannah are among the earliest and most important in the nation. As the dominant transportation system of the 19th and early 20th centuries, railroads sought to find ways to safely and efficiently integrate their operations with the existing and then ever-expanding network of highway and byways. Bridges or viaducts carrying the highway or byway over or under the railroad were an effective means of eliminating potentially deadly crossings, and such structures were exceedingly common in America by 1890. Cities and state regulators continued working with the railroads to jointly construct such bridges and viaducts through the first half of the 20th century.

Addressing the need to eliminate grade crossings at railroads was a matter that received a great deal of attention, especially in the Progressive era of the 1890s to 1910s, as the problem became acute as cities grew and so did railroad traffic. In 1919 alone, nearly 14,000 persons died nationally from being struck by trains. Problems at grade crossings were hardly limited to urban centers as farmers with wagons and teams were also at risk crossing trackage. The potential dangers of horses and other draft animals bolting in front of trains or just the reverse, stalling on the tracks, were well known in the 19th century. At-grade crossings that had poor visibility, whether from curves in the railroad or road, variations in roadway and track elevation, or even adjacent buildings or roadside vegetation, were notorious trouble spots.[23]

As part of line construction and to honor easements or covenants, railroads often built roadway overpasses when their trackage passed through cities, towns, or farmland, dividing property or existing roads and streets. As rolling stock became heavier and locomotives more powerful and faster, railroads became increasingly concerned with the elimination of at-grade crossings, where practicable, to increase safety and remove delays. Some Georgia railroads, such as the Southern Railway, considered grade-crossing eliminations an important component of improving the efficiency of their trunk lines, and between 1901 and 1919, the company eliminated over 100 crossings on the main line between Atlanta and Richmond, like the 1906 T-beam bridge at Nelson Street in downtown Atlanta at their warehouse facility.[24] But it was just as likely that railroad companies were cajoled or ordered by state and local officials to

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[23] For a general discussion of the grade-crossing problem, see John R. Stilgoe, Metropolitan Corridor: Railroads and the American Scene (New Haven, 1983), pp. 167-188.

[24] The Southern Railway's grade crossing improvement plan is described in "Second Track Construction on Southern Railway," Railway Age Gazette, vol. 63, no. 19 (Nov. 9, 1917), pp. 841-848.

participate in jointly paying for grade-crossing elimination bridges and viaducts, especially in urban areas like Atlanta and Macon where addressing railroads entering the city core was a primary focus of urban planning and civic projects. Atlanta, with its several, historically significant 1921-1935 solutions to integrating the city fabric with the railroads, stands as one of the nation's premier centers of grade-crossing eliminations.[25] And while many of the urban grade-crossing elimination campaigns are cloaked in City Beautiful aesthetics, primary functions remained the safe and efficient operation of each transportation system.

Safer grade crossings received nationwide publicity from the 1890s through the 1930s, and as motor vehicle traffic increased dramatically following World War I, the problem became more pressing as neither transportation system could operate efficiently. The Georgia State Highway Department from its inception in 1916 identified the grade-crossing problem as a priority, as did highway commissions or other regulatory bodies in every state in the union. Grade-crossing elimination bridges were built on federal-aid highways as evidenced by the approximately 25 railroad overpasses built before 1930 that survive in localities all across the state. In 1920, the Georgia state highway commissioners emphatically stated that "the complete elimination of all grade crossings is so important, at least on the state system of highways, over which greatest movement of traffic will take place, that a law should be enacted requiring the railroads to construct either overhead crossings or underpasses, where the grade crossing cannot be completely done away by relocation of the highway." No such law was forthcoming, but railroads did continue to erect signals and signs and sponsored public education campaigns to "Stop, Look, and Listen." Although railroad officials usually preferred this less costly means of providing for safer crossings, they were sometimes left no option but to build viaducts and bridges, especially in densely populated urban areas, like Atlanta and Macon. The continued reluctance of the railroads to fund grade eliminations finally resulted in the revision of Georgia's grade-crossing laws in 1927. The new law required railroads to help defray the cost of the grade eliminations as determined by the Department, yet limited each railroad's annual contribution to a rather meager $40,000.[26]

Federal highway programs have participated in eliminating grade crossings since the first federal-aid act in 1916. Federal and state engineers established a priority of realigning roads to eliminate unnecessary crossings and building overpasses or underpasses, if prudent and economically feasible, with any

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[25] Atlanta's viaducts have been the subject of a previous survey, the Atlanta Viaduct/Bridge Study (Jaeger Co., 1994), prepared for the Georgia Department of Transportation.

[26] Biennial Report (1920), p. 28; (1928), pp. 156-62.

federal-aid highway. There was not a specific amount of federal funding restricted to the use of grade-crossing improvements until 1933 and the Roosevelt administration's goal of using public works projects, including highway construction, to put people to work. New Deal programs took advantage of the BPR's existing system for distributing federal money to the states and funded several new programs within that framework. One earmarked federal grants to continue the effort to eliminate dangerous at-grade crossings with the goal of putting as many people to work as possible. To that end, the work week was set at 30 hours and the use of power tools was limited to encourage hand labor. The federal money was provided in the form of outright grants because of the states' inability to meet their financial match. The BPR even removed its traditional restriction on the use of federal aid on urban streets for this particular funding source in 1936, realizing that some of the nation's most dangerous crossings were inside the incorporated boundaries of cities and towns. And while the primary goal of the federal programs implemented through BPR and the states remained making work for the nation's unemployed, a secondary goal was to fill gaps in the federal-aid system and eliminate engineering hazards. Under the New Deal emergency relief grant program, some 2,641 grade-crossing bridges and viaducts had been constructed or started by the end of 1936, but that effort represents only a small fraction of the infrastructure improvements all across the country that resulted from Depression-era work relief programs. It is estimated that the funds passed through BPR to the states were responsible for some 78,000 bridges.[27]

The 1996 Georgia Historic Bridge Inventory identified nearly 200 road-over-rail bridges built between 1891 and 1956. Of that total, it appears that about 75 railroad overpasses built between 1933 and 1943 survive.[28] Only 19 of the 200 grade-separation bridges are associated with dualized highways, an indication that the construction of dualized highways prior to 1957 did not result in a substantial increase in the number of grade-separation bridges being built. This is not surprising since none of the pre-1957 dualized highways was limited access, except for the Atlanta Expressway, and most of the expressway's original overhead bridges have been replaced. The Department did, however, adopt a more systematic way of addressing highway-railroad grade crossings in 1947. The Division of Planning made a comprehensive list of crossings and rated the hazards at each based on the level of traffic, the geometry, and accident records. These ratings were used to prioritize crossings and determine the type of

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[27] Seely, pp. 88-93.

[28] Figure is based on query of 1996 Georgia Historic Bridge Survey findings. The survey does not include railroad over highway bridges.

protection (signals, barriers, etc.) or elimination (bridge or realignment of highway) that was economically justified.[29]

Dualized highways in Georgia prior to 1957 did not reflect changing perceptions about grade-crossing separations with railroads, since separation of the two had always been considered desirable by the Department's engineers. Rather, the most notable change in bridges during the mid-20th-century was that they increasingly reflected balanced design for safe, high-speed travel. Balanced design was found in bridges on both dualized and non-dualized highways with higher design speeds. The bridges were more often matched to the lane and shoulder widths of the travelways so that they did not "pinch down." Bridges were also paired (a separate structure for each direction of traffic) thus maintaining uniform median widths. The bridges were designed to fit the alignment and profile of the highway, rather than fitting the highway to the alignment of the bridge (the latter was the practice in early road building where bridges often met streams at right angles to achieve the shortest crossing). The bridges were more often skewed and given a vertical or horizontal curvature to conform to the overall highway alignment and grade, and thus match the design speed. All of these factors were intended to increase the safety of the highway and increase drivers' confidence in the roadway. In most cases, the bridges fit so seamlessly with the highway, that except for railings, motorists had no idea that they had crossed a bridge.

There are three, less than one-mile-long sections of dualized highway that were built in conjunction with the with New Deal grants for grade-crossing elimination bridges. Since each of the bridges, all constructed between 1940-41, were located in urban areas in Moultrie, Waycross, and near Savannah, that had been surveyed for traffic data and exceeded the 800 vehicles per peak hour volume threshold, BPR mandated that the new section of highway be dualized, but the short sections of dualized highways transitioned back to traditional two-lane section (Figure 13). Railroad crossing separations had been a goal of the Department and federal government since the late 1910s.[30]

Summary

Tentative is an appropriate description of highway dualization efforts in Georgia prior to 1957. Actual construction was limited to less than 150 miles of discontiguous dualized highway, most of it in sections of less than four-miles long on the most heavily traveled sections of US-numbered highways. There were

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[29] Biennial Report (1948), p. 91.

[30] Biennial Report (1937-1938), pp. 25-27; (1939-1940), p. 89.

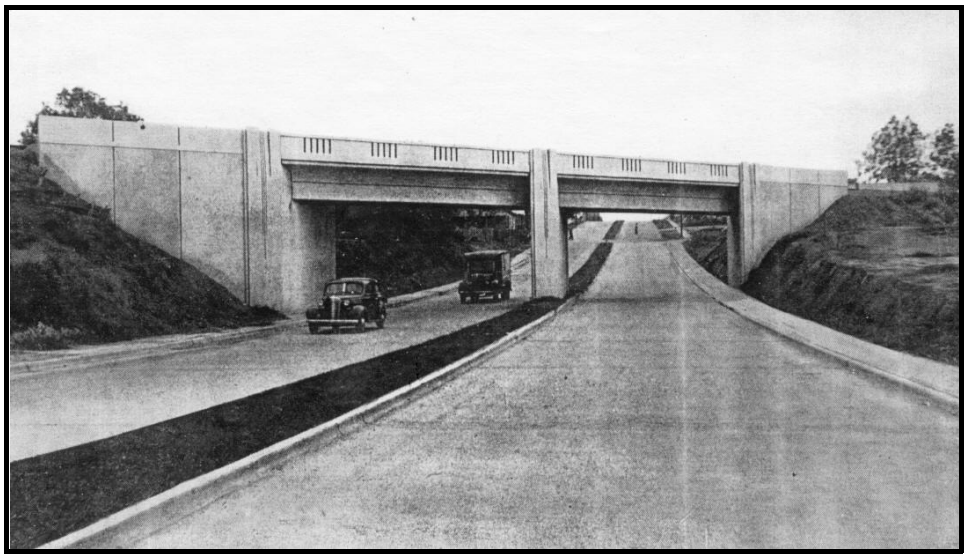

Figure 12. View of dualized highway and Atlantic Coast Line Railroad overpass on old SR 35 in Moultrie, ca. 1941. Source: Biennial Report, 1942.

some important pioneering efforts in the state context. The 1935-38 Atlanta-Marietta Highway was the state's first dualized highway, but it illustrated the limitations of a design that had poor geometry and lacked balance because of narrow lanes, narrow median, at-grade crossroads, and uncontrolled access. The military base access roads introduced state engineers to federally developed concepts of balanced design and gave them practical experience with the design features developed and promoted from the federal level. The Columbus-Fort Benning and Macon-Camp Wheeler access roads became the models for postwar dualization in Georgia. Other than the Atlanta Expressway, no more sophisticated highway designs than these would be built in Georgia prior to the interstate highways in 1957.

Highway historians have identified the decade from 1946 to 1955 as one that saw large amounts of money spent on highways but also as a period that lacked the same overall sense of direction that had been evident in the highway improvement campaigns of the late 1910s to 1930s. As events in Washington, D.C. slowly moved toward the political consensus necessary to establish and fund the interstate highway system, state highway departments sought out different means to address their state's most pressing highway needs. While some states turned to toll roads, still others concentrated on urban bypasses or expressways. Georgia continued mainly in the old patterns of improving existing state highway sections using a large measure of federal aid and relying on federal and AASHO guidelines for design practices. The result from 1945 to 1956 was mostly a patchwork of dualized highway sections with no historical or technological distinction.

When it came to dualized highways, the tendencies and patterns in Georgia were to work as the junior partner in the national-state partnership known as federalism. Prior to 1957, Georgia was generally reactive, not proactive, when it came to high-standard dualized highways. The Department reacted to the findings of BPR-sponsored traffic planning surveys; it reacted to the way the federal government allocated federal-aid to various classifications of highway; and it reacted to the design policies and recommendations of AASHO. The Department did not take an advanced approach to the development of high-standard dualized highways, and thus, with the exception of the Atlanta Expressway, most of its dualization efforts were never part of a unified plan to the development of a national or even state system of dualized highways, nor were they a homegrown response to local concerns about local highways. They were merely another manifestation of the Department's role in carrying out the federal-aid highway program – a role that the Department had been playing since 1916. Historically, there were some areas where the Department had been proactive and influential, even taken a step ahead of its federal partners, like in the development of low-cost, continuous, steel stringer bridges in the late 1920s and early 1930s under State Bridge Engineer Searcy B. Slack, but the dualized highways of the mid-1940s to mid-1950s were not one of these areas. Most of Georgia's pre-1957 dualized highways became obsolete for their originally intended purpose of carrying through traffic once the parallel interstate highways opened.

Georgia lawmakers' failure to support limited-access legislation prevented the Department from doing anything of true significance with its dualized highways with the exception of the Atlanta Expressway in Fulton County. A good deal of the Department's most creative talent went into the Atlanta project, but it proved larger, longer, harder, and more costly than had been anticipated, an experience frequently repeated in cities throughout the United States. The political, technical, and financial challenges were enormous, and the expressway's completion required special state legislation and an unusual level of cooperation among officials of the federal, state, county, and city governments. The expressway soaked up the state's urban federal-aid apportionments, leaving little to improve roads inside the limits of other Georgia cities. By all measures it was <u>the</u> highway that best conveyed the postwar achievement of the Georgia State Highway Department. The Atlanta Expressway was the only true precursor to Georgia's interstate highway era, and the only section of pre-1957 dualized highway that was physically incorporated into the interstate highway system. The expressway had a significant impact on the physical landscape, social fabric, and historical development of metropolitan Atlanta. The expressway illustrates just how far the Department's engineers had come from the pioneering, but in many ways ill-fated, Atlanta-Marietta Highway of the mid 1930s to the doorstep of Georgia's interstate highway-era in 1956.

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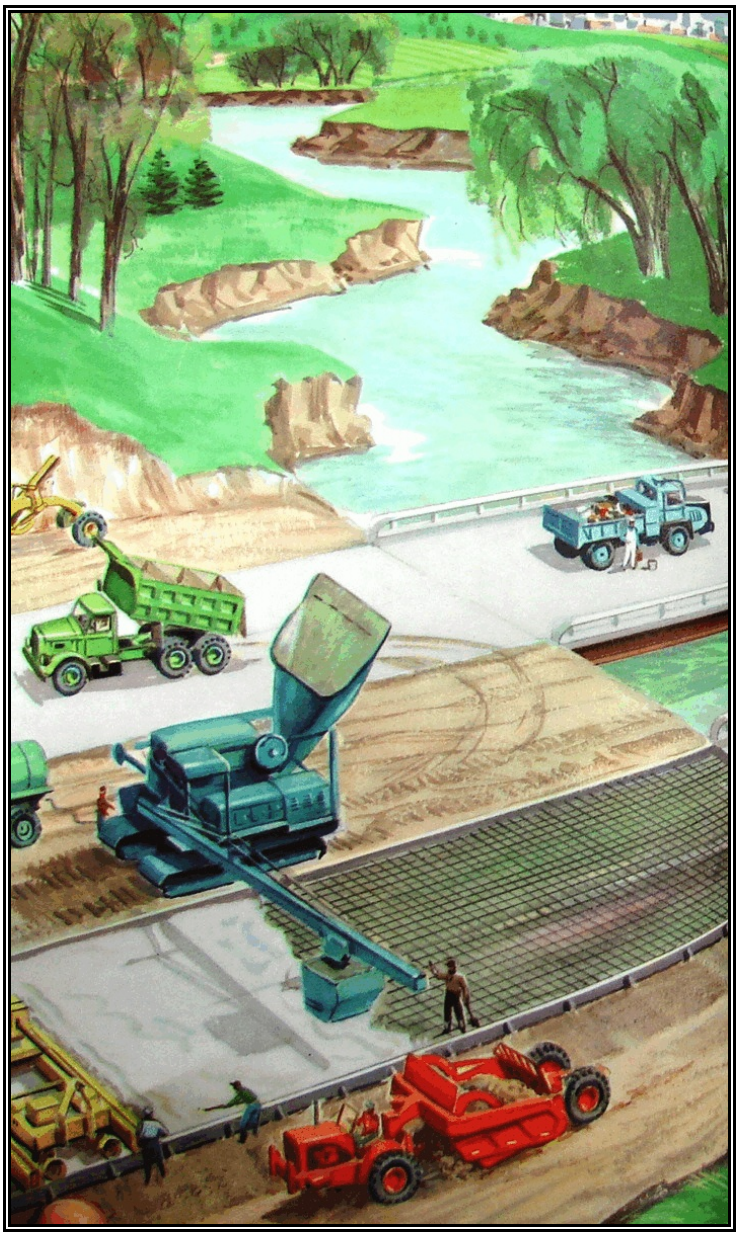
Georgia Historic Bridge Inventory Update

HISTORIC TRANSPORTATION CONTEXT, 1955-1965



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Detail from Cummins ad, Dixie Contractor (1956).

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GEORGIA DEPARTMENT OF TRANSPORTATION

GEORGIA HISTORIC BRIDGE INVENTORY UPDATE FOR BRIDGES BUILT FROM 1955 THROUGH 1965

Historic Contexts

Overview

In order to evaluate the National Register eligibility of the 1955-65 non-interstate highway bridge population, two historic contexts have been prepared: (1) *Historic Transportation Context, 1955-65*; (2) *Historic Context for Bridge-Building Technology in Georgia, 1955-65*. Both contexts are updates to prior studies of Georgia's pre-1955 highways and bridges, and, as such, build upon many of the same historic themes and associations. Of particular significance is the continued influence of the federal-aid highway program and its implementation by the State Highway Department of Georgia (SHD, predecessor to the Georgia Department of Transportation). Uniformity and standardization of roadway and bridge designs were long-term goals pursued by federal and state engineers starting with the establishment of the federal-aid highway program in 1916. This goal was largely fulfilled by the 1950s and continued into the 1960s and beyond, placing Georgia bridge-building practices well within the mainstream of national trends, including the use of standardized bridge types, designs, and specifications.[1]

The contexts assist with evaluating and understanding the historical significance of each of Georgia's more than 1,800 non-interstate highway bridges built from 1955 through 1965. They provide the background necessary for considering each bridge as an example of its type and design, as well as its association with state and local community planning and development, keeping in mind that bridges don't stand in isolation but are links in roadway systems. For these reasons, the transportation context focuses on trends in the development of the state's non-interstate highways, while the technology context focuses on a range of standardized bridge types.

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[1] For information on Georgia's pre-1955 highways and bridges, see Georgia Department of Transportation (GDOT) and the Georgia Department of Natural Resources, *Historic Bridge Survey* (1981); and Lichtenstein Consulting Engineers, *Historic Bridge Inventory Update, Historic Contexts* (1995, revised June 2001). Congress established the federal-aid highway program in 1916, and it has continued with modifications ever since. The state legislature established the State Highway Department of Georgia in 1916, in large part to comply with the provisions that a professionally staffed department implement the federal-aid program at the state level.

Foreword: How the Interstate Highway System Impacted the Development of Georgia's Other Roadway Systems

The non-interstate bridges in the 1955-65 study population are on state highways (US and SR-designated routes), county roads, or city streets, exclusive of bridges that carry or cross over interstate highways (I-designated routes).[2] The focus of the transportation context is these non-interstate roads and bridges; nonetheless, it is important to keep in mind that the interstate system is the dominant transportation story of the period. That story strongly influences and, in most instances, overshadows the contexts of the other road systems, where most work was the improvement or replacement of existing roadways and bridges, not the construction of modern freeways on new alignment. The interstate system had a profound impact on everyday patterns of travel, movement of goods, and land use in Georgia and throughout the nation. It also had a significant impact on the improvement of other classes of road because of the need to upgrade those roads and bridges that fed the interstate routes.

Although the interstate system was first contemplated nationally in the late 1930s, it was not fully funded until the Federal-Aid Highway Act of 1956 when Congress adopted a 90%-10% federal-state funding formula with revenues raised through the federal fuel tax and other excise taxes on motorists. Significant to the story of all of Georgia's other highway systems after 1956, the formula meant that the federal government paid the lion's share of building high-speed limited-access freeways – the most expensive highways to build, especially in cities. The new 90-10 formula unencumbered state highway budgets allowing for widespread improvements to non-interstate roads and bridges. Prior to 1956, the costs of federal-aid projects had been split 50-50, and most states, including Georgia, struggled to make their federal match, let alone make significant progress on freeways. Before the 90-10 formula in 1955-56, for example, Georgia received only $33 million in federal aid for its $32 million match – a $1.03 return on every dollar. After the 90-10 formula in 1961-62, Georgia received $73 million in federal aid for its $27 million match – a $2.70 return on every dollar.[3]

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[2] For procedural reasons, a separate historic context was prepared for Georgia's interstate highway system. See, Lichtenstein Consulting Engineers, *Historic Context of the Interstate Highway System in Georgia*, GDOT (January 2007). The Federal Highway Administration signed an agreement with the Advisory Council on Historic Preservation exempting the interstate highway system from Section 106 in February 2005. Under the agreement only a select list of interstate features, including bridges, of national-level significance will be considered historic, i.e., eligible to the National Register. No bridges or features of national-level significance were identified in Georgia.

[3] Biennial Report (1955-56), p. 39; (1961-62), np; (1965-66), pp. 54-55. Years reported are fiscal years starting on July 1.

As a result of the Federal-Aid Highway Act of 1956, the SHD was able to pay for the reconstruction and improvement of most state-owned routes with a special emphasis on eliminating the sharp curves and narrow roads and bridges built during the improvement campaigns of the 1920s and 1930s. It is unlikely that Georgia could have afforded all of these improvements without the fiscal relief provided by the 90-10 federal funding of interstate construction. After 1956, federal and state dollars also flowed in greater amounts to counties and cities for improvement of their roads and bridges through a variety of revenue-sharing programs, including the federal-aid secondary program, the SHD's county contract system, and the Georgia Rural Roads Authority (GRRA). Local roads officials were required to follow the specifications and standards established by SHD engineers in order to receive those funds, thus even local projects came to look very much alike in all corners of the state.

HISTORIC TRANSPORTATION CONTEXT, 1955-1965

A. Georgia's Highways Respond to the Automobile Age

The highway improvement campaigns of the 1950s and 1960s have rightly been interpreted as part and parcel of America's "love affair" with the automobile. Historians use terms like "the automobile age" and the "car culture" to describe society as a whole as it accelerated into the postwar period. Indeed, the automobile influenced everything from architecture to music and family structure. As well, Americans came to rely on their elected officials and state highway departments to provide smooth riding surfaces and well-maintained roads and bridges, and they vocally complained when they didn't. As a result, the topic of highways was a central issue in postwar politics and government.

Georgians, as did all Americans, embraced automobiles and modern highways. The number of registered vehicles in Georgia increased fourfold from about ½ million in 1945 to over 2 million in 1966. Furthermore, the average Georgia motorist who was driving about 6,000 miles per year in 1950 was driving over 10,000 miles per year by 1970. Much of this change in driving habits occurred in the Atlanta metropolitan region and other Georgia cities with their expanding populations, placing enormous pressures on street systems, many of which had been last improved in the days of the Model T. Simply put, more people were spending more time in their cars and driving farther. This had a decisive impact on trends in road and bridge construction, especially demands to increase the capacity and safety of highways in and around cities.

All levels of Georgia government sought to respond to the public's insatiable appetite for automobile travel by improving roads and bridges. A simple equation was that as more people drove, they used more fuel and paid more fuel taxes, increasing the revenues available to pay for highway projects. Georgia state highway revenues grew from $38 million in 1955 to $96 million in 1965. At the same time, fuel sales increased from about 1 billion gallons in 1956 to 1.7 billion gallons in 1965. This did not, however, equate to a cash-rich highway program; on a per-mile basis, Georgia still had one of the smallest highway budgets east of the Mississippi River. Highway officials constantly reported that they had insufficient resources to complete all of the needed projects. Traffic was wearing out or exceeding the capacity of roads and bridges faster than the SHD could improve them. In 1960, for example, the SHD estimated that it would take 20 years at existing funding levels to bring the state highway system up to then-current standards.[4]

The fundamental fact of Georgia's highway development was that government was almost always in the mode of responding to the demand for better roads and bridges, rather than building ahead of it. In contrast to the growing number of automobiles, total

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[4] Biennial Report (1956), pp. 39, 71-73. Biennial Report (1966), pp. 54-57.

***Figure 1**. Charles A. Marmelstein, state bridge engineer, 1956 to 1967. Source: Georgia Highways (1958).*

highway mileage remained relatively constant, increasing by little more than 3% from 96,000 linear miles in 1955 to 99,000 linear miles in 1965. With the major exception of the new interstate highways, this meant that existing routes were being asked to handle the heavier traffic volumes. Engineers spent most of their non-interstate efforts working to replace, upgrade, or maintain existing roads and bridges.[5] Each year the SHD oversaw hundreds of projects including upgrading pavements, widening old roads, straightening or modifying poor alignments for safer higher speed travel, improving intersections, and adding safety features such as shoulders, medians, guide rails, and signs. Thousands of narrow, sharply aligned, or under capacity bridges were replaced, bypassed, or improved.

As a result, the period from 1956 to 1966 was the most prolific decade of highway bridge building in Georgia's history. No fewer than 2,500 bridges were built – an average of over 250 bridges per year or about one new bridge each work day. The SHD's bridge division, headed by state bridge engineer Charles A. Marmelstein (Figure 1),[6] amassed an impressive record of accomplishment that testifies to its ability to complete an astounding amount of work efficiently and economically in response to the transportation demands of the automobile age. Their work from those years accounts for about one in five of all highway bridges in service in Georgia in 2007.[7]

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[5] Georgia's 1,100-mile interstate highway system accounted for about a third of the new highway mileage built from 1955 to 1965.

[6] Marmelstein was born in Savannah in 1898 and received a B.S. in civil engineering from the University of Georgia in 1921. His first job was as a draftsman for the North Carolina State Highway Department, but he returned to Georgia in 1922 as an engineer with Truscon Steel of Atlanta. He joined the SHD in 1923 as a resident engineer recruited by State Bridge Engineer Searcy B. Slack. Marmelstein rose from bridge construction supervision to bridge design to assistant state bridge engineer in August 1933, and he was named state bridge engineer in June 1956 replacing Clarence Crocker. Marmelstein retired in 1967.

[7] GDOT, National Bridge Inventory (NBI) Data, April 2007.

B. Georgia's Roadway System Classification & Its Impact on Roads and Bridges

A key to understanding the evolution of Georgia's postwar highways is understanding the roadway classification that determined standards for new construction and informed decisions about whether to retain or replace old roads or bridges. By 1949, the SHD had classified every Georgia roadway into one or more of seven systems – (1) the National System of Interstate and Defense Highways, (2) the Georgia State Highway System, (3) the Federal-Aid Primary System, (4) the Federal-Aid Secondary System, (5) the County Road System, also known as the Post Road System, (6) the City Street System, and (7) the Forest Highway System. Classification was used to determine a route's eligibility for federal or state aid. Within each classification further distinctions were made based on traffic counts, topography, and setting, determining specific standards for new construction and improvement (Table 1, p. 9).

***Figure 2**. A factor in the ability to set higher geometric standards after WWII was the availability of larger, more powerful machines for grading and moving earthwork, allowing for economical construction of cuts and fills, as shown in this view of US 23/441 in Rabun County in 1960. In the 1920s and 1930s, this would have been too costly because of the heavy labor and time involved. Source: Biennial Report (1959-60).*

Engineers strove to bring all roads and bridges within a particular classification up to minimum standards as defined by the SHD's Geometric Design Standards, first published in 1949 and updated about every five years thereafter. The standards incorporated national guidance from the federal Bureau of Public Roads (BPR) and the American Association of State Highway Officials (AASHO), so that Georgia's standards were not significantly different from those of other states. They defined more than two dozen variables including design speed, curvature, gradient, stopping sight distance, number of lanes, width of lanes, surface type, width of shoulders, safe bridge loads, signage, and other geometric and safety features. Heavy-volume, urban arterial highways had the highest standards while low-volume rural roads had the lowest. For example, an urban route on the federal-aid primary system with greater than 4,000 average daily traffic count (ADT) was required to meet a standard of two 24'-wide concrete travel lanes with 40'-grass medians and 10' surface-treated shoulders. In contrast, a rural highway on the federal-aid secondary system with low traffic counts (less than 400 ADT) was required to have a 24'-wide bituminous pavement and unimproved 5'-wide grass shoulders.[8]

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[8] SHD, Geometric Design Standards for Use on Location and Design, (Atlanta: 1949, revised July 1, 1953 and April 1, 1961); "Turning an Old Road into a New One" and "Athens

Two important bridge design standards were live-load capacity and roadway width. During the study period, a bridge on a rural county road with less than 99 ADT could be retained if it met minimum acceptable standards of a 6-ton live-load and roadway width of 12'. Any new bridge on that same low-volume county road would, however, have to meet a live-load rating of H15 (i.e., a theoretical design vehicle equivalent to a 15-ton truck) and roadway width of 24'. On the other hand, a high-volume rural state highway bridge had to meet minimum acceptable standards of H20-S16 live-load (i.e., a design vehicle equivalent to a 36-ton semi-truck) and 28'-wide roadway plus full shoulders to retain any bridge and for all new construction. Obviously, these standards meant that old, light, narrow bridges would be more likely to survive on low-volume county roads but would be programmed for replacement on more heavily traveled state highways. These standards also had considerable bearing on the selection of bridge types for new construction, with, for example, a standard precast reinforced-concrete slab bridge designed for H15 on a low-volume county road having no application on a high-volume state highway where H20-S16 was required.

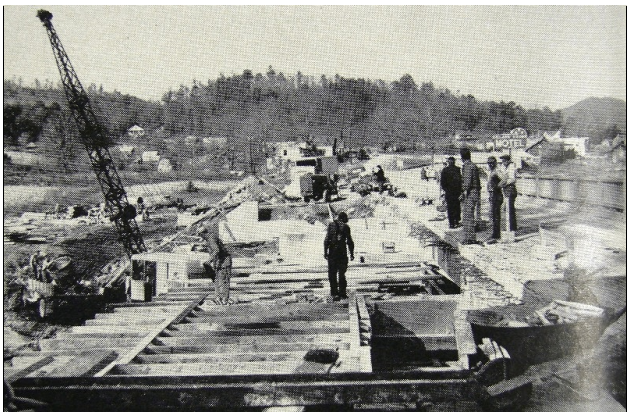

***Figure 3**. Widening the Betty's Creek bridge on US 23-441 near Clayton in 1958. Many older bridges were widened to bring them up to the geometric standards for their classification. Source: Biennial Reports (1957-58).*

After 1949, the SHD's efforts were geared toward upgrading the state highway system to the geometric standards, which meant that many older bridges were either replaced, widened (Figure 3), or by-passed. With increased federal and state funding in the late 1950s and 1960s, the pace of this type of bridge work accelerated. Of particular concern were the many long, narrow bridges in the coastal areas that were vital links in the state highway system. Built in the late 1910s to 1930s, most of these bridges no longer met the new geometric standards. Widening or replacing them was a priority but very costly.[9]

Bypass," Georgia Highways (Nov. 1958)

[9] A sidebar to the standards story was its impact on ferries, which were considered bottlenecks on all but very low-volume classifications. In the 1930s, Georgia had about 20 ferries in operation, but due to the concerted efforts of the SHD, ferry services were replaced with bridges so that only four remained in operation in 1958. The four were (1) Old Campbellton Ferry over the Chattahoochee River at the Douglas-Fulton county line; (2) Bridge's Ferry over the Ocmulgee River on SR 83 on the Forsyth-Monticello county line; (3) Dames Ferry over the Ocmulgee River on the Forsyth-Gray county line; and (4) Underwood Ferry over the Flint River. "Georgia Ferries End Colorful Chapter in Highway History," Georgia Highways, Vol. 1, No. 1 (Jan. 1958), np.

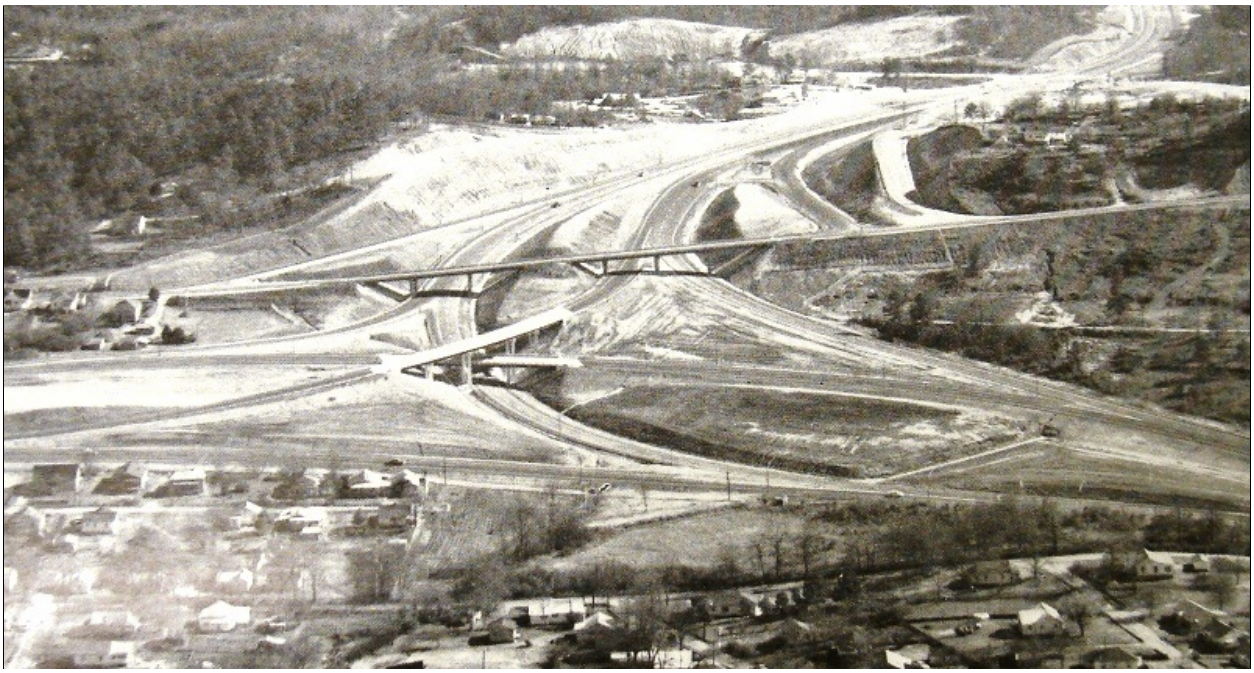

***Figure 4**. The three-level interchange of US 27, US 411/SR 20, SR 1E, and SR 101 at Rome, completed in 1960. Source: Biennial Report (1961-62).*

Interchanges were another area of bridge work impacted by the standards. Limited-access freeways were required to meet the highest geometric standards, and this meant controlling traffic access at interchanges. The SHD had been building interchanges since the late 1930s, but the number of interchanges expanded greatly after 1956 with the interstate highway program. Typical interchange designs included diamond-shaped and cloverleaf, but some more complex directional interchanges were required where major highways intersected. A notable example was Georgia's first three-level interchange (Figure 4), built in 1958-60 at the junction of US 27, US 411/SR 20, SR 1E, and SR 101 just inside Rome's southeast city limit.[10]

[10] "Work on Rome-Cartersville Road Moves Rapidly," Georgia Highways (Aug. 1958), pp. 12-13.

TABLE 1. GEORGIA HIGHWAY SYSTEMS AND BRIDGE STANDARDS, 1955-65

System	Description	Bridge Standards
National System of Interstate & Defense Highways	Interstate highways were, with the exception of the pre-1956 Atlanta Expressway, built under the Federal-Aid Highway Act of 1956. The original authorization was for approximately 1,100 miles of limited-access highways in Georgia. The interstate highway system is also part of the Georgia State Highway System.	H20-S16 live loads. Mandatory 12'-wide travel lanes with full shoulders carried through all bridges less than 150' long.
Georgia State Highway System	Established in 1919. State-owned and maintained highways connecting population centers and serving as cross-state routes. In 1956, there were over 15,000 miles on the system. As a result of the construction of the interstate highway system and additional roads taken over from counties, the system had grown to about 17,000 miles in 1965.	Design standards based on ADT, rural/urban, and federal-aid system (see below).
Federal-Aid Primary System	Established in 1916. About 7,100 miles of arterial highway inclusive of the interstate highway system, US-numbered routes, and many SR-numbered routes. All roads on the primary system are also part of the state highway system.	Design standards based on ADT and rural/urban. Max. standards similar to interstate highways. Min. standards of H15 and 24'-wide to retain for low-volume roads. Min. new construction standards of H20-S16 and 28'-wide.
Federal-Aid Secondary System	Established in 1938. About 13,100 miles of secondary highway eligible for federal aid including about 6,800 miles on the state highway system and the remainder on the county and city systems.	Standards based on ADT and rural/urban. Min. new construction on most low-volume rural roads set at H15 and 24'-wide. Bridges rated at H10 with 18'-roadways could be retained for traffic volumes less than 400 ADT.
County Road System (Post Road System)	All roads not on the state highway system and not within the boundaries of a municipality. The longest of the roadway systems, measuring about 73,000 miles. Owned and maintained by the County Commissioners of Roads & Revenues.	Min. standard of 6-ton and 12'-wide to retain a bridge with less than 100 ADT. New bridge construction standards were a min. of H15 and 22'-wide.
City Street System	About 7,400 miles, owned and maintained by cities and municipalities. After 1946, some city streets were included in the federal-aid systems if they served as connectors to federal-aid routes outside of the city limits.	For major urban streets, a min. of H20-S16 for new bridges and H15 to retain a bridge. Standards for minor urban streets the same as the county road system. Standards same as the federal-aid system for those streets included on the primary and secondary systems.
Forest Highway System	About 360 miles that were eligible for a special category of federal-aid reserved for improving roads within U.S. forests. The forest highway program was established in 1917 as part of the federal-aid highway program.	State standards apply to forest highways on the state highway system. Local forest road bridges are typically either designed by federal engineers for heavy loads (i.e. log trucks) or are local access constructed at the discretion of local units of the U.S. Forest Service.

C. The Significance of the Federal-Aid Highway Program

Essential to an understanding of the highway construction programs of every state in the U.S., not just Georgia, is the basic administrative structure that has guided decision-making for most of the 20th century. The fundamental point is that American highway administration is a premier example of *federalism*, the governmental system in which authority is shared by the states and the central government in Washington. This means that power and authority have been shared by officials in state highway departments and the federal Bureau of Public Roads (BPR) and its successor agency the Federal Highway Administration (FHWA). The federalist system of highway administration came into being in the early decades of the 20th century and was firmly established by the 1940s. It has had a profound impact on the patterns of road and bridge construction since federal highway officials have worked with their state counterparts to share technical knowledge and develop nationally applicable technical guidelines, including those for bridges.

The BPR was created in 1893, but a coordinated program of federal funding did not take shape until 1916 when Congress established the federal-aid highway program. Under this program, state highway departments have been responsible for planning, building, and maintaining roads and bridges, while federal engineers have overseen and approved state construction plans, specifications, and estimates, and inspected the finished work. The SHD was established by Georgia in 1916 in direct response to the federal-aid highway program, but Georgia, and indeed most southern states, initially created politically weak highway departments out of traditions that were suspicious of centralized power and favored “local control of local affairs.” The federal government, however, used a “carrot-and-stick” approach to overcome these traditions. In order to receive the ever-increasing federal-aid funds, states were required to build-up the professional staff of their highway departments and give them technical control over the state highway systems, as well as to develop their own dedicated sources of highway revenue – primarily motor-fuels taxes – to make the federal matches.

Importantly, standards for construction were identified as a state concern under the federalist structure. Federal engineers were expected only to inspect and approve state decisions. In reality, a very different relationship developed among federal and state engineers. The simple fact was, especially in the early years of the federal-aid program, that most state engineers and their agencies lacked knowledge and expertise about road and bridge design and materials, while the BPR staff in Washington knew a great deal about such matters. The BPR adopted a variety of cooperative mechanisms for disseminating the knowledge and ideas developed in federal labs. By 1905, for example, BPR engineers were issuing their findings through the committees of the American Society for Testing Materials (ASTM). And after 1916, the BPR supported the creation of committees within the American Association of State Highway Officials (AASHO, renamed AASHTO in 1968) as the nation’s leading venue for the development and adoption of construction and materials guidelines for state highway projects. The BPR also initiated state planning functions, paying for traffic surveys

starting in the 1920s, and formally setting aside a percentage of federal-aid funds to support planning divisions in every state highway department starting in 1936. Georgia's state engineers, like those in most states, were heavily involved in AASHO committees and activities. State Highway Engineer Morris L. Shadburn, for example, served on the AASHO committee that devised the interstate highway numbering/marking system in 1957-58 and then served as AASHO president in 1965. Such a cooperative structure meant that the leadership of the BPR did not dictate standards or procedures to their state counterparts but fostered instead a genuine sense of partnership.[11]

Under the federalist system of highway administration each state had latitude, within limits, to develop its own approach to road and bridge design and materials standards. The BPR never sought to impose uniform national standards, and tolerated variation in standards among the states, compromising on items where state officials could justify variations for local conditions and precedent. State bridge engineers, for example, determined what bridge types and designs to favor based on the price and availability of materials and labor, climate, the engineers' individual preferences, and other factors. BPR officials judged this approach critical to maintaining a shared commitment to the federal-aid program. Uniformity remained a long-term goal pursued through ASTM and AASHO, while each state highway department developed its own specifications book so that it was rare that construction practices in one region of a state varied greatly from those in another.

[11] For a definitive overview of the federal-aid highway program and its profound influence on highway and bridge construction, see Bruce Seely, Building the American Highway System: Engineers as Policy Makers (Philadelphia: Temple University Press, 1987); "Former Engineer Shadburn Dies Suddenly in His Home," The Survey, Vol. 6, No. 1 (Jan. 1971), p. 1.

D. Georgia Highway Politics and Its Impact on the Patterns of Road and Bridge Building

While no Georgia road or bridge projects standout as individually significant for political reasons, they collectively reflect important and complex patterns in state politics that shaped highway policy and the funding and geographical distribution of projects. A significant pattern, dating to the late 19th century and continuing particularly strong in Georgia through the 1950s, was state support of roads programs that mostly benefitted rural and small town interests. One such program, established in 1955, was the Georgia Rural Roads Authority (GRRA), which spent more than $100 million on rural roads and bridges. Due to the civil rights movement, the 1960s saw an erosion of the power of conservative rural interests in Georgia's state government. Starting in the 1960s, state highway policy and department organization evolved to reflect the changing political realities eventually resulting in more road and bridge projects in cities and suburbs.

The State Highway Board and the Balance of Power

The state highway board that governed the SHD was the nexus of political decisions impacting roads and bridges in Georgia. Prior to 1963, the board had three members appointed by the governor. One of the members served as chairman directing SHD operations and working closely with the chief engineer, the department's highest ranking professional employee. In 1963, the board was reconstituted with ten members appointed by the state legislative delegations of each of Georgia's congressional districts. This was to make the board more accountable to the legislature, better representing all regions of the state in highway matters, and limiting the power of the governor's appointees. The measure also established the position of director of the SHD, an appointed chief executive to oversee the department's day-to-day operations. The governor appointed the first director to a four-year term, but subsequent directors were appointed by the board.

Underlying the power of the state highway board was the fact that it had discretion over where to use federal and state highway revenue. Although the federalist system established a balance of power between the federal and state governments, federal officials were generally reluctant to earmark funds for specific projects, rather they set general policies about how to distribute funds to each of the states and roadway classifications. It was then left to states to set priorities and develop specific projects within the federal guidelines.

With the advice of the SHD's senior engineers, the state highway board established policy, allocated the budget, and earmarked funds for specific projects. The board approved engineering recommendations for which roads to include or exclude on the federal-aid and state highway systems. Generally speaking, the most heavily traveled and established routes remained on system, but there could be considerable modification made to right-of-way and alignment as the roads were progressively

upgraded to higher standards. There was constant political pressure to move local roads and bridges into higher classifications so they could be improved using state or federal funds, and the board was closely attuned to the desires of political leaders and their constituents. It was an accepted practice for board members to use their influence to advance their political careers and those of their allies. State engineers were particularly concerned with objective data – such as traffic counts – to justify recommendations for which projects to fund, while the board tempered those recommendations with its own political calculations.

The board relied heavily on state engineers to manage costs through close supervision of project details. This relationship between the board and engineers reinforced the standardized approach to road and bridge construction, since the cost of a standardized design was far more predictable than individualistic designs. Standardization also provided engineers a defensible position from which to base their decisions if there were ever any questions about the necessity, quality, or cost of the work recommended to the board. It also served as a check on contractors if a standardized design cost significantly more at one site than another.

One of the most interesting facets of Georgia highway politics was that elected state officials had a specific history of periodically upsetting the balance of power established by the federal-aid program. The best known instance of this was Governor Eugene Talmadge's June 1933 declaration of martial law and the forcible removal of the state highway board and chief engineers from their offices by military guard. This event was precipitated by Talmadge's insistence on installing his own hand-picked men, as well as a desire to divert highway funds and avoid compliance with federal minimum-wage laws. Talmadge eventually had his way, although the BPR temporarily withheld Georgia's federal aid and many talented engineers, such as state bridge engineer Searcy B. Slack, left state service.

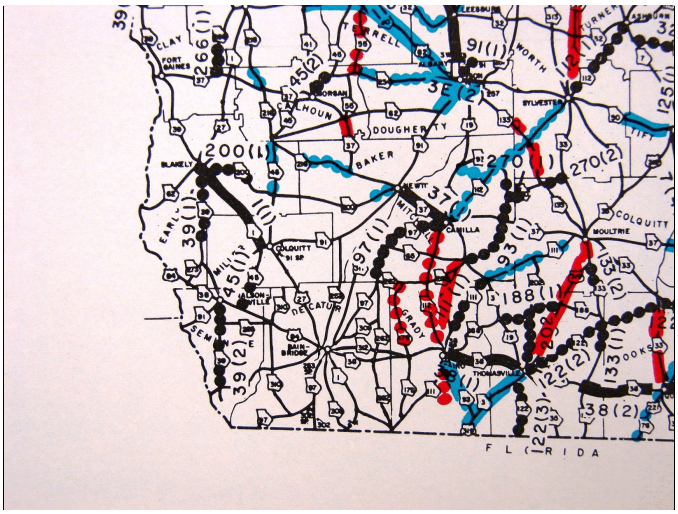

***Figure 5**. Southwest corner of Georgia from SHD Project Map, 1960. Project locations are highlighted by black, red, and blue dots, representing phased projects from 1960 to 1962. The map reflects state politics: notice that Decatur County (southern tier, second from left) has no projects. This was the home of former Governor Griffin who had opposed Ernest Vandiver for Governor in 1958. Source: GCGM (1960).*

An impact of the Talmadge administration was that every election cycle from 1937 to 1963 the board was dissolved, thus allowing the newly elected governor to appoint all of its members. Over a short period, a mutually beneficial pattern of patronage developed with board

members expected to use their influence to steer projects toward the home districts of the politicians who had supported the governor's election. Control of the SHD became an openly accepted spoil of gubernatorial politics until the board was reorganized and made more accountable to the state legislature in 1963. Spoil ranged from moving SHD division offices to provide jobs in counties that had supported the governor to depositing SHD funds in favored local banks. It was taken for granted that the roads and bridges in the governor's home county would receive extra funding and that the governor's opponents risked losing funding (Figure 5). Since so much was at stake, it was rather predictable that the SHD was politicized, especially around election time. The tension between professional highway administration, with its goal of objective standards for improving all of the state's highways, and gubernatorial politics was a defining feature of Georgia highway administration during the study period.

The Influence of the County-Unit System of Elections: An Emphasis on Rural Roads and Bridges

Underlying the highway politics was the influence of the county-unit system of elections that favored rural counties. The county-unit system was distinctive to Georgia and was used to decide the winners of statewide Democratic primaries from 1898 to 1962.[12] The county-unit system gave the eight most populous urban counties three votes, the next 30 most populous town counties two votes, and the rest of the 121 rural counties one vote, with the winner of a county's unit votes decided on a plurality of the individual votes cast in the county. The winning strategy under the county-unit system was to campaign to Georgia's least populous rural and small-town counties in order to carry the county-unit vote, even though the population of actual voters was significantly less. It was a strategy that was used very successfully by the Populist faction of the state's Democratic Party, since carrying the county-unit primary almost guaranteed winning the general election in a one-party state. The purpose of the county-unit system was to ensure rural hegemony, and it reinforced efforts to disenfranchise African-Americans. In 1962, the system was struck down by federal courts that ruled it an unconstitutional voting rights infringement because citizens' votes did not carry equal weight.

An effect of the county-unit system was that state road and bridge projects were used as favors to reward rural counties that delivered their unit votes to winning candidates. Gubernatorial candidates always campaigned on promises to use state funds to improve rural roads and bridges, and they delivered on those promises, especially in the late 1940s to 1950s when the Talmadge and Griffin administrations expanded rural secondary road and bridge improvement programs, which was a very positive benefit to the economic development and quality of life in the rural parts of the state. However, the rapid growth of Georgia's cities, and their need for financial aid to address that

[12] The county-unit system was enacted into state law by the Neill Primary Act of 1917, but it had been in use since 1898. For more on the importance of the county-unit system of government in Georgia politics and civil rights, see The New Georgia Encyclopedia, On-line http://www.georgiaencyclopedia.org/nge/Article.jsp?id=h-1381 [August 8, 2008].

growth, went largely unheeded by state government. Most urban projects were contingent on the availability of federal-aid, which was mostly in the form of interstate funding after 1956. A further irritant to Georgia's urban areas was that some rural counties were well known to have exceptionally low property-taxes, "phony" homestead exemptions, and lax tax-collection procedures. These counties relied on their power under the county-unit system to secure needed operating revenues from the state rather than their own tax base.[13]

The county highway contract was a common practice used to reward rural counties for their unit votes, and the one most subject to abuse. Each year the state highway board allocated funds to Georgia's counties through a contract that paid them to do work on non-state roads and bridges. The county under the terms of the contract was to do this work itself, with its own machinery, but in practice counties often had the work done by contractors (who were in the worst cases one-in-the-same as the local officials). Many rural counties also diverted the funds to non-road purposes, such as schools, and those counties did not receive the intended benefit of better roads and bridges. Some rural counties relied almost exclusively on the county contracts to fund all of their non-road operations. It was widely acknowledged that the board passed out county contracts as political favors, and conversely withheld them to punish political opponents. The disparity between rural and urban counties under the county contract system was striking. Emanuel County, for example, received $114,000 in county contracts in 1962 and spent $133,000 total on its roads and bridges. Fulton County, on the other hand, received $155,538 in county contracts and spent over $8.4 million on roads and bridges, while reporting that over one-half of its 1,200 miles of county roads remained unpaved.[14]

In 1962, a federal court struck down the county-unit system as unconstitutional. The end of the county-unit system, which was finally carried out in March 1965 after the appeals process had run its course, was among the most significant civil rights reforms in Georgia's history. It had the effect of shifting the balance of political power, giving urban areas more representation and political opportunity. A secondary effect was that the state highway board's practice of awarding county contracts as political favors

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[13] Numan V. Bartley, The Creation of Modern Georgia, 2nd ed (Athens: University of Georgia Press, 1990), pp. 161-63; 201-05; Arthur K. Bolton, "Legislators Continue Efforts to Expedite Tax Equalization Acts," Georgia County Government Magazine (GCGM) (Jan. 1962), p. 7; Griffin Smith, "President's Message: Facing Up to Urbanization," GCGM (Sept. 1965).

[14] "Roads and Politics," Atlanta Journal (Feb. 2, 1967); Mr. Jim's Scrapbook, 1958, Record Group 27-6-6, Georgia Archives; "County Road Expenditures," GCGM (March 1962), insert; "Fulton County Budgets $1,175,00 for Its 1,200-miles Network of Roads," GCGM (July 1963), p. 18. The county contract system was not legal for disbursement of federal-aid, but the SHD had poor accounting controls, and some counties co-mingled the funds. More than once the BPR warned the SHD that federal dollars had been inappropriately diverted to county-contract projects. In 1959, for example, the SHD lost $50,000 in federal aid because Burke County had spent the funds under a county contract.

withered and, not surprisingly, state aid to improve urban roads and bridges slowly increased, as well as state support for urban mass transit.[15]

The Highway Funding Challenge: Reinforcing the Use of Economical Designs

Every road and bridge project during the study period can be traced back to one or more federal, state, or local highway programs that funded it. Due to increases in federal and state funding, a record amount of work was completed in Georgia from 1955 to 1965, but there was never enough funding for all of the needed projects nor all of the projects desired by the SHD's political leadership. Engineers were under constant political pressure to manage costs and stretch the available program funds as far as possible. This climate reinforced the use of economical designs that offered the state good value for its money.

One of the most obvious solutions to the highway funding problem was to increase user taxes, especially the fuels tax. Georgia's tax rate increased from 3¢ per gallon in 1955 to 4½¢ per gallon in 1956, but this was a modest rate compared to a national average that was at least 50% greater over the same period (Georgia's tax rate regularly ranked in the bottom tenth of state rates). Tax increases were not especially popular with Georgia voters or their elected officials, and several attempts to increase the rate were rebuffed by the state legislature.

Georgia's highway program was on a pay-as-you-go basis because the state constitution prevented the government from directly issuing bonds. Local units of government could win legislative and voter approval to issue bonds for specific projects – like Fulton County's successful bond issue for the Atlanta Expressway in 1947 – but gaining approval was a time-consuming and uncertain process. In 1939, Governor Eurith D. Rivers found a way to circumvent the state constitution by establishing a state hospital authority empowered to sell bonds to build hospitals. The authority was on paper "independent" of the state, although its directors were appointees of the governor. The state "rented" the hospitals from the authority, which then used the rent to pay back the bonds. It was an ungainly arrangement that resulted in high interest payments, but it allowed Georgia to borrow money for capital projects for the first time since Reconstruction. Based on this precedent, the state legislature in the 1940s to 1960s established authorities for parks, ports, schools, government office buildings, roads, and bridges. In general, the authorities completed many worthwhile projects. Not until 1972 was a constitutional amendment ratified by voters to allow the state government to incur debt openly.[16]

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[15] Harold P. Henderson and Gary L. Roberts, eds., Georgia Governors in an Age of Change From Ellis Arnall to George Busbee (Athens: University of Georgia Press, 1988), pp. 177-78.

[16] Biennial Report (1955-56), pp. 83-84; Bartley (1990), p. 191; "State Authority Financing Attracts Attention of Commission on Efficiency and Improvement," GCGM

One of these authorities, the Georgia State Bridge Building Authority (GSBBA), was a significant means by which the state secured funds for the construction of bridges. It was established in March 1953 with an initial bond limit of $30 million. Bridges built with GSBBA funds were "leased" to the SHD for fifty years with the rent used to repay the bonds. The SHD's bridge engineers designed and supervised construction, so GSBBA bridges were physically no different than other state-built bridges, only the funding source was different. The GSBBA funded the construction of 94 bridges in 1953-54 ($16 million) and 126 bridges in 1955-56 ($14 million). The GSBBA was renamed the Georgia State Highway Authority (GSHA) in 1961 with expansion of its powers to fund highways as well as bridges. Its bond limit was increased from $30 million to $100 million, and then to $130 million in 1962. The funds were used to improve the state highway system, primarily by realigning, reconstructing, or widening the pavements and replacing or widening the bridges on US and SR-numbered routes. Some funds were also used to upgrade the SHD's maintenance yards and equipment.[17]

Another way to pay for much-needed highways and bridges was with tolls. More than 1,000 miles of toll roads were built in the U.S. from 1946 to 1960, mostly in northern states (exceptions in the southeast were Florida, Virginia, and West Virginia), but the turnpike movement lost momentum with passage of the Federal-Aid Highway Act of 1956 because federal funding could not be used on toll roads. Toll roads were occasionally discussed in Georgia during the mid 1950s, but the idea had little of the necessary political support among conservative rural interests to become a reality. A Georgia Toll Road Authority was established and actually surveyed a route along US 41 from Cartersville to the Tennessee state line in 1953-54, but nothing came of the effort. More successful was the Georgia State Toll Bridge Authority, established in March 1953 as a means of issuing $6.6 million in bonds to build the Sydney Lanier Bridge, a vertical-lift movable bridge over the Brunswick River in Glynn County. The bridge opened to traffic in 1956 and was made toll free in 1962. It was replaced by a high-level cable-stay bridge in 2003.[18]

The Georgia Rural Roads Authority: Highway Politics and Scandal, 1955-58

By the late 1940s, many of Georgia's rural residents were coming to expect that their local roads and bridges should be improved and better maintained, especially in light of what they enjoyed on the state highways. In 1948, Governor Herman Talmadge made improving secondary rural county roads and bridges a priority. His administration greatly expanded the state highway system to include more rural secondary roads and bridges

(September 1963), p. 21. The State Supreme Court upheld the constitutionality of the authorities to repeated challenges by fiscal conservatives.

[17] Biennial Report (1955-56), pp. 77-78, 109; (1959-60), p. 77; (1961-62), n.p.

[18] Biennial Report (1955-56), pp. 79-80; (1965-66), p. 64; "Coastal Highway Travelers Now Freed of Toll Stop on Sidney Lanier Bridge," GCGM (January 1963), p. 13; "What Is Your State Doing About New Roads," Dixie Contractor (Jan. 19, 1955), p. 16.

that could be then improved with federal and state aid, thus relieving the counties of the responsibility. The state highway board under Talmadge also increased the amount of direct aid by county contracts. These programs had by 1955 paid for improvement of about 20% of Georgia's more than 70,000 miles of rural county roads and bridges.

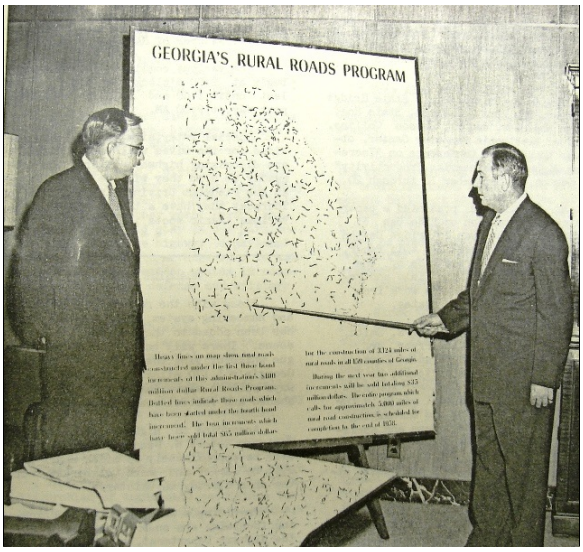

***Figure 6**. Governor Griffin (right) displays a map of GRRA projects. Source: GCGM (1956).*

Governor S. Marvin Griffin, who took office in 1955, sought to build on the Talmadge record. The General Assembly established the Georgia Rural Roads Authority (GRRA) at Governor Griffin's request with authorization to issue up to $100 million in bonds for the improvement of rural roads and bridges not on the state highway system (Figure 6). The authority was composed of a five-member board appointed by the governor, and from the outset the GRRA was Griffin's pet project. The SHD recommended projects to the GRRA, but the GRRA was independent and could accept or decline. Furthermore, the SHD was required to lease GRRA roads and bridges for fifty years to repay the bonds, even though the counties continued to maintain and own the roads and bridges.[19]

The GRRA was authorized to reimburse the SHD for engineering, but in reality a very different relationship developed in which regional GRRA offices were set up to handle the engineering and contracting. These offices hired their own staffs and did not report through the usual chain of command of the SHD, although they were located in SHD division offices. According to some observers, many GRRA employees were hired for their political connections, padding the payrolls. Shockingly, there were hints that GRRA employees drank on the job, accepted gifts from contractors, used state equipment for private purposes, and filled personal cars at the state gas pumps. In one documented case, the GRRA paid to pave the private parking space of a member of its board. And although having spent nearly twice as much on county roads as the Talmadge administration, the Griffin administration in fact paved about 3,000 miles less. A 1960 *Reader's Digest* exposé reported, "Never in Georgia history had so many stolen so much." Still, Governor Griffin became known as the "good roads" governor, and in later years, he considered paving rural roads his single greatest accomplishment in office. The GRRA resurfaced and widened some 12,000 miles of county roads, including the construction of some 250 bridges from 1955 to 1958. Many of these bridges were the

[19] Biennial Report (1955-56), pp. 25-26, 75-76; (1957-58), pp. 25-26, 78-79; (1959-60), pp. 23-24; (1961-62), n.p.

SHD's standard precast reinforced-concrete slab bridges designed for low-volume rural road classifications (Figure 7).[20]

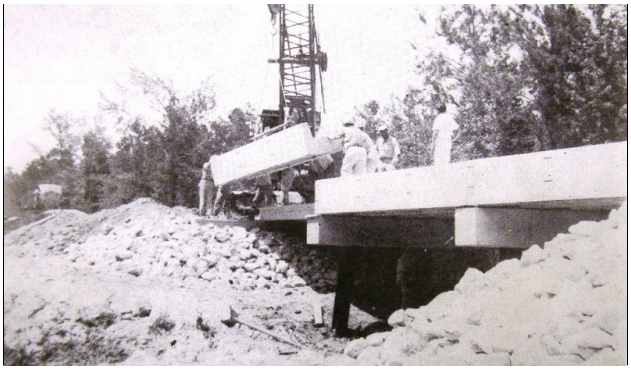

***Figure 7**. A precast reinforced-concrete slab unit is swung into position on a GRRA project, Waverly Hall-Talboton road over Hinton Creek. Source: Biennial Report (1957-58).*

The GRRA was but one component of the troubles that plagued the SHD during the 1955-58 Griffin administration. The *Atlanta Constitution* gave considerable coverage in 1958 to a scandal involving about $250,000 in state highway funds transferred to the City of Baxley, and then used by the mayor to award street paving contracts to himself. The mayor was an honorary member of Governor Griffin's staff. In another instance, the SHD was in open violation of state law for paving the streets in a new residential development in the governor's home county of Decatur. The developers were well-known associates of the governor. And to make matters worse, SHD employees were arrested for accepting bribes for tipping off truckers to the schedule of weight-checking stations.[21]

The scandal swirling about the SHD played a significant role in the 1958 gubernatorial election that pitted Lieutenant Governor Ernest Vandiver against State Highway Chairman Roger H. Lawson, Sr. Lawson had been appointed in 1957 by Governor Griffin with the intent of using the chairmanship as a spring board to higher office. In early 1958, Governor Griffin came out in favor of increasing the GRRA's borrowing authority by $50 million, and Vandiver knew that this money would be used to influence county-unit votes in favor of Lawson. He began working immediately to defeat the bond measure. Vandiver was able to use the disgrace surrounding the GRRA to claim that the $50 million was nothing more than "a political slush fund." This convinced a slim majority of the house of representatives to vote against the bill, and handed Governor Griffin the only major legislative upset of his term in office. Shortly after the house vote,

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[20] Henderson and Roberts (1988), p. 106; Roy F. Chalker, "Address to the Georgia Contractors Association," Mar. 13, 1958, as reprinted in Georgia Highways (Apr. 1958), pp. 1, 5; Biennial Report (1955-56), p. 42, p. 106; Lester Velie, "Strange Case of the Country Slickers vs. The City Rubes," *Reader's Digest* (April 1960), p. 108, as quoted in Henderson and Roberts (1988), p. 108. In November 1954, the BPR had discharged to the SHD responsibilities relative to plans and specifications for the federal-aid secondary program with a categorical approval meaning that federal engineers did not have to review and approve each project. BPR did retain responsibility for final inspection. In 1957, the task of preparing federal-aid secondary plans was transferred from the SHD to the GRRA field offices in an effort to relieve SHD engineers so they could concentrate on developing plans for interstate highways.

[21] Mr. Jim's Scrapbook; Harold Paulk Henderson, Ernest Vandiver, Governor of Georgia (Athens: University of Georgia Press, 2000), pp. 72-73.

Lawson withdrew from the race, and Vandiver became the frontrunner for governor. Vandiver would later say that defeating the GRRA bond bill won the election.

Naturally, Governor Vandiver's administration swept clean the GRRA and replaced Lawson. Vandiver appointed Jim L. Gillis, Sr. as the new chairman of the SHD in 1959. Gillis immediately fired about 400 employees on the grounds of saving $1 million. Most of the terminations, however, were in the GRRA's field offices and were politically motivated. The Vandiver administration did not dissolve the GRRA but the General Assembly agreed to the governor's request in February 1959 that the GRRA board be made one-in-the-same as the state highway board and agreed to pay the GRRA's bonded debt from general appropriations rather than state highway funds.[22]

***Figure 8**. Jim L. Gillis, Sr., chairman of the SHD (1948-55, 1959-63) and director (1963-70). Source: Biennial Reports (1965-66)*

The Jim Gillis Years, 1959-1970

The GRRA scandals were the spark for gradual but significant changes in Georgia highway administration. Leading this effort was James Lester Gillis, Sr. (Figure 8), a fixture in Georgia politics and highways from the late 1930s to early 1970s. Born in Soperton in 1892, he served for nearly 40 years as chairman of the Treutlen County Democratic Party and 20 years as a Treutlen County road commissioner. Rising through the party ranks, he was appointed to the state highway board in 1937, serving out a term that ended in 1939. He was re-appointed by Governor Talmadge in 1948 and made chairman in 1950, a position he held until forced to resign by Governor Griffin in 1955. Gillis backed the successful candidacy of Ernest Vandiver for governor in 1958 and was rewarded with re-appointment to chairman in 1959. After the reorganization of the board as a 10-member body in 1963, Gillis was selected as the first director of the SHD. Governor Jimmy Carter requested his resignation in late 1970, which the 78-year-old Gillis provided. Although a product of the county-unit system of government and identified with its inequities, Gillis oversaw reforms that tightened controls over county contracts and brought an end to the scandal-ridden practices of the Griffin administration. He presided over the development of Georgia's interstate highway system, and he gradually modernized the SHD's administrative practices. He was a very crafty politician, serving with five governors, and he had a deep working knowledge of the state and its roads and bridges. His scrapbooks and papers, now preserved at the Georgia Archives, are an amazing chronicle of the SHD in the 1950s to 1960s.

[22] Mr. Jim's Scrapbook; Biennial Report (1963-64), p. 65.

***Figure 9**. During the late 1950s to 1960s, federal and state programs provided increasing funds to improve city streets and bridges. Shown here, widening 4th Street in Columbus. Source: Georgia Highways (1958)*

Gillis knew how to use highway projects to reward his political allies, but he also knew how to adjust to shifts in power. After the end of the county-unit system, Gillis balanced the SHD's funding priorities to better serve areas of the state that had growing populations, like Atlanta's booming suburbs, and the coastal counties, like Glynn, that saw phenomenal growth due to beach resorts. He advanced projects in cities, especially interstates, and he made it possible for cities to negotiate directly for state contracts (Figure 9), whereas in the past only counties had that privilege.[23]

Gillis worked amicably with the SHD's professional staff including chief state highway engineer Morris L. Shadburn, who served from 1948 to 1967.[24] While Shadburn saw to the engineering, Gillis was first and foremost a politician who understood the importance of personal relations. He was known to just about everyone as "Mr. Jim," and he relished his role as point-of-contact for the local officials and businessmen who came to Atlanta "hat-in-hand" to ask for his support of road and bridge projects. Presiding in the front office on the first floor of the state highway building, Gillis kept a long row of chairs in the outer hall that were often full to overflowing with visitors waiting

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[23] "Local Politics Intervenes: $1.5 Million Road Near Douglas Goes Nowhere," Atlanta Constitution (Mar. 7, 1966), Office of Public Relations, News Clipping, Record Group 27-6-6, Georgia Archives; "What Could Happen to Your County's Population during the 1960-70 Decade," GCGM (Nov. 1962), pp. 17-19; "Georgia's Road Pattern, GCGM (Sept. 1963), pp. 12-13; "Highway Politics, Urban Style," GCGM (Oct. 1963), p. 35; "Board of Managers Speak Out on County Contracts," GCGM (Jan. 1965).

[24] "Former Engineer Shadburn Dies Suddenly in His Home," The Survey, Vol. 6, No. 1 (Jan. 1971), p. 1; "M. L. Shadburn," Proceedings of the Fourth Annual Georgia Highway Conference (Feb. 7-9, 1955), pp. II-III. Hereafter cited as Georgia Highway Proceedings. Morris L. Shadburn (1897-1971) was a native of Buford and a graduate of Georgia Tech in engineering in 1917. After service in WWI, he briefly joined the SHD but soon left to work as a consulting engineer on water control projects in Louisiana and Mississippi, including the seawall in Gulfport. He returned to Georgia in 1930 as an engineer with the Atlanta office of the Pennsylvania Dixie Cement Corp. Shadburn rejoined the SHD in 1933 as an assistant division engineer and worked his way up to state highway engineer in 1941. After returning to private consulting from 1943 to 1948, he was reappointed by Gillis and continued to serve until reaching the mandatory retirement age of 70 in 1967.

their turn. He was the personification of the SHD, and thus came under heavy criticism for actively supporting candidates for state office. His work for Carl Sanders in 1962 as an "unofficial" campaign director was thought unseemly by some. He canvassed the rural county courthouses on behalf of Sanders and used county contracts to reward counties for their support in the election. Nonetheless, Gillis remained relatively untainted by scandal and his supporters and opponents alike generally commended him on doing a fine job of directing the department's activities.[25]

[25] Biennial Report (1963-64), p. 11; GCGM (Sept. 1962), p. 6; "James L. Gillis and the Kettlehead Drums," GCGM (Nov. 1964); "Mr. Jim Resigns Post," The Survey, Vol. 1, No. 12 (Dec. 1970), p. 1; Doug Hudson, personal communication with P. Harshbarger (July 1, 2007).

E. Administrative and Organizational Reforms at the SHD: Changing Approaches to Road and Bridge Planning, Design, Construction, and Maintenance

The late 1950s to mid 1960s were years of reform at the SHD. These reforms, which included building up the department's maintenance forces, tightening of contract controls, and updating of employment practices, were intended to improve the efficiency and quality control of road and bridge work. The expanded programs and the public's demand for improved highways placed enormous pressure on the SHD to complete the work as cost-effectively and quickly as possible. The pace of work was hectic, especially with the interstate program in high gear. Doug Hudson, a bridge engineer in the SHD, recalls the "crazy times" when the bridge division was understaffed and put in long hours. He also said, however, that the politics tended to stay in Jim Gillis's office and not significantly impact the staff who worked upstairs in the state highway building. From his perspective as a staff engineer, political pressure, if any, came in the form of controlling costs and designing roads and bridges that were economical and low maintenance, thus stretching the department's budget as far as possible and complementing the standardized approach to bridge design and construction.[26]

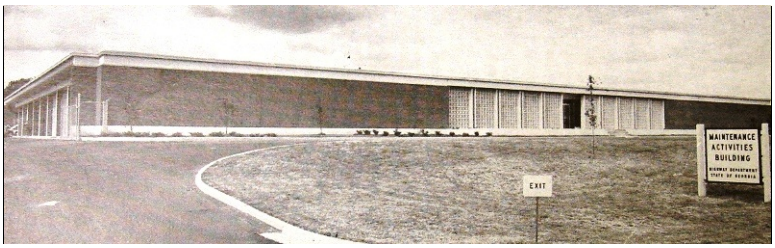

***Figure 10**. The 1964 maintenance activities building in Forest Park was among the facilities constructed to enhance the SHD's maintenance capabilities. Source: Biennial Report (1965-66).*

Building Up State Maintenance Capabilities

When appointed chairman in 1959, Jim Gillis recognized that the existing funding system emphasized new construction over maintenance. The winter of 1957-58 had been particularly severe with prolonged rains and freezes causing serious damage to roads and bridges. Many of the damaged facilities had not been repaired. Georgia spent far less on maintenance than other states in the region and Gillis and the senior engineers wanted to address this. Georgia spent about $668 per mile maintaining state highways while Tennessee spent $1,931, Alabama $1,174, and South Carolina and Florida both well over $1,000 per mile. It showed in the condition of Georgia's roads and bridges, and Gillis made it a priority to remedy the disparity.

Gillis began building up the SHD's maintenance capabilities by increasing the staff and budgets of the district field offices. He lobbied for a special $100 million bond issue for reconstructing worn out state roads and bridges. In 1961, due to balanced budgets and good economic growth, Governor Vandiver supported Gillis's request for the bond issue, which easily passed the state legislature. As a result, in 1962 the SHD's maintenance

[26] Hudson, 2007.

spending surged over the $1,000 per mile mark for the first time, placing it on par with neighboring states. The money was also used to build twenty maintenance garages and warehouses. A major push of the program was upgrading the remaining 2,000 miles of dirt roads on the 15,000 mile state highway system. This was accomplished by 1964 when the SHD reported that the system no longer had any dirt roads.[27]

Increasing the Pace of Work & Tightening of Contract Controls

Among the challenges Gillis and senior state highway engineers faced was criticism of the slow pace of work. The Second Street Bridge project in Macon was typical. This bridge had been programmed since the late 1940s, but one delay after another kept the project from progressing including lack of money, right-of-way negotiations, engineering manpower shortages, and relocation of utilities. An editorial in the *Macon News* (Jan. 10, 1963) quipped... "what we'd like to know is what has been delaying the job for so long. Is there a saboteur in the State Highway Department, some unidentified clerk who hates Macon and keeps forgetting to drop Bibb County's name in the pot when it comes time to let bids? It would seem so. How else explain the fact that a bridge everybody has been saying for a long time is going to be built never seems to get built?" The bridge project was started finally in 1963 and completed in 1966.[28]

In response to this type of unfavorable press, the SHD looked for ways to complete projects more efficiently. The state highway board welcomed an intensive outside study beginning in 1963 by the Commission for Efficiency & Improvement in Government, also known as the Bowdoin Commission after its chairman William R. Bowdoin, a prominent Atlanta banker.[29] The commission was formed by the reform-minded Governor Sanders to look at all aspects of state operations, not just the SHD. The state highway board approved the use of federal planning funds to hire a consultant firm, Highway Management Associates of Madison, Wisconsin, to offer technical advice to the commission. The commission's final report proposed a number of practical administrative reforms, the most important of which were pre-qualifying of contractors and tightening of contract administration to minimize problems with non-competitive bidding, laxity of inspection, and performance on contracts. Most of these reforms were adopted by the SHD, with the desired results.

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[27] Biennial Report (1955-56), pp. 25-6; (1963-64), p. 51; Office of Public Relations, News Clippings, Record Group 27-6-6, Georgia Archives; Chalker (1958), pp. 1, 5.; M. L. Shadburn, "Georgia," SASHO Proceedings (1963), p. 22.

[28] "Editorial," Office of Public Relations, News Clipping, (Jan. 10, 1963), Record Group 27-6-6, Georgia Archives.

[29] Henderson and Roberts (1988), p. 175. The Bowdoin Commission members were leading businessmen and professionals appointed by Governor Sanders. The commission avoided partisan politics by identifying obvious weaknesses in state government and offering reasonable remedies. Sanders used his influence to see that the commission's recommendations were implemented to the greatest extent possible.

***Figure 11**. Contractors gather to listen to bids for road and bridge work. Source: Georgia Highways (1958).*

The Bowdoin Commission was especially critical of the SHD's habit of granting contractors' requests to push back project start dates and extend deadlines. In 1962, for example, about half of the SHD's projects started late, and about one-fifth required deadline extensions. The commission also suggested using a calendar rather than work-day method of calculating project time because this would better hold contractors to deadlines. As a result, the SHD tightened its rules for contract extensions with higher fines for work not completed on schedule. It handed out over 30 citations to contractors making unsatisfactory progress in June 1964, and more road and bridge projects, especially interstate projects, began to be completed on time.[30]

Another reform that had the effect of increasing the pace of road and bridge work was pre-qualification of contractors beginning in June 1965. Pre-qualification was an application process by which contractors proved that they had the capability to complete the jobs on which they were bidding. It also set limits on the amount of work that a contractor could have at one time based on an analysis of the contractor's capital, organization, and past achievement. State bridge engineer Charles A. Marmelstein headed the pre-qualification effort, investigating systems in other states before adopting a model successfully used in Virginia.[31]

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[30] "Proposals for the Highway Department: A Good Report for Jim Gillis," GCGM (Mar. 1965), pp. 10-12. The calendar-day method was a stricter method of counting project time since it forced the contractor to agree to complete the project by a certain date. The work-day method allowed contractors to take into account days lost to poor weather, holidays, etc. Thus a project scheduled for 6-month completion under the calendar-day method was to be completed in 6 months. A project scheduled for 6 months under the work-day method could take considerably longer. Problems in the SHD's contract administration had been evident for many years, see, for example, "State Highway Programs Get Going," Dixie Contractor (Aug. 17, 1955), p. 16.

[31] Biennial Report (1965-66), p. 25; SHD, A Pocket Look at Your Highway Department (Atlanta, 1967); Office of Public Relations, News Clippings, (1963-64), Record Group 27-6-6, Georgia Archives; C. J. Collings, "Prequalification of Contractors," SASHO Proceedings (1965), p. 33. Some contractors strongly objected to pre-qualification on the basis of the additional paperwork and the capacity limits. It caused significant frustration when contractors working across several states found the pre-qualification rules and limits different from one state to the next.

Employment Practices & the Impact of the Civil Rights Movement

To meet the demands of the interstate program, as well as the growth in other federal and state road and bridge programs, the SHD grew from approximately 5,000 employees in 1955 to a peak of about 9,000 employees in 1973. The large number of new employees created organizational challenges, especially the need for more formal programs of recruiting, training, and quality control, including impressing on employees the need to maintain state standards and specifications. The expansion of the SHD also coincided with the civil rights movement and its efforts to extend opportunities for minorities. As a result, a greater diversity of individuals became involved in the planning, design, and construction or roads and bridges, but as with much of southern society, the changes at the SHD were not made willingly or easily, and were largely a result of federal oversight.[32]

***Figure 12**. To better accommodate the growing workforce, the State Highway Building in Atlanta, constructed in 1931, was modernized and expanded with a major five-story addition that opened in 1957. Source: Biennial Report (1957-58).*

The SHD was not a center of the civil rights movement, like Georgia's education system, but it was subject to many of the same federal rulings that brought an official end to discrimination and segregation. Beginning in 1956, all SHD contracts involving federal aid were required to include a clause on non-discriminatory practices, but these provisions were ignored for many years by most southern state highway departments and contractors. In September 1963, at the urging of Attorney General Robert Kennedy, federal attorneys issued a powerfully worded letter to the SHD ordering it to enforce affirmative action. Contractors on federal-aid projects were henceforth required to sign affidavits that they did not discriminate. They also were made to post signs and place the non-discriminatory wording on all advertising and job employment notices.

The SHD had always hired minorities, but primarily as maintenance laborers for African Americans, and as clerical help for women. Title VI of the federal Civil Rights Act of 1964 officially ended discriminatory practices in all agencies that received federal funding, yet it was more than a decade before significant effects began to be seen at the SHD with more minorities taking on professional engineering and administrative functions. The top management of the SHD professed to live up to the letter of the law, but did not pro-actively seek to develop new opportunities for minorities during the 1960s. Governor Carter's administration was the first to demonstrate a concerted effort

[32] Biennial Report (1957-58), p. 28; (1959-60), p. 99; (1963-64), p. 101; "Thompson-Street Co. Underway with Ga. State Highway Building," Dixie Contractor (Dec. 21, 1955), p. 32; Georgia Highway Proceedings (1962). The theme of the conference was quality control.

to appoint minorities to leadership roles in state government, but as late as 1976, fewer than 9% of the SHD employees were minorities and less than 6% were women and almost all of them were still in maintenance or secretarial activities. The department did not adopt its own affirmative action plan until 1976.[33]

The Impact of Engineering Manpower Shortages

One of the SHD's most pressing employment problems was a shortage of qualified engineers in the face of the expanded demands of federal and state highway programs, especially the interstates beginning in 1956. The shortage caused a reorganization of the bridge division and the adoption of new computer technology to cut down on the man hours required to complete design calculations, but no significant changes in the types of bridges being built, in part because the department had no resources to devote to trying out and refining new bridge technologies. The department's senior engineers were also unwilling to go against the long-standing policy of limiting the amount of work it sent out to consulting engineers. Consultant engineers were used only for certain projects that might have caused a bottleneck or involved some highly specialized work, such as movable bridges.

***Figure 13**. SHD engineers examine the standard aluminum railing posts for a bridge on the US 1 expressway in Augusta. Source: Georgia Highways (1958).*

The source of the engineering manpower shortage was twofold – the aging of the SHD's senior engineers and the inadequate number of new engineering graduates entering state employment. SHD employees had been placed on the merit system in 1950 and taken into the state retirement system in 1953. These reforms, which were generally meant to insulate rank-and-file employees from political reprisals and provide an inducement to long-term civil service, also meant that they could retire after 35 years service or at age 60, which ever came first. Compulsory retirement was at age 70. Hundreds of the department's most-senior engineers who had joined during the building boom of the 1920s qualified for retirement in the 1950s and 1960s. Due to the Depression and WWII, the 1930s and 1940s had been lean years for the SHD, so there were few engineers with long-term service to step up and take the places of the retirees. Furthermore, it was becoming increasingly difficult to attract entry-level engineers for a variety of reasons, among them competition with consulting firms, which generally paid better, and the difficulties college civil engineering programs were having attracting students because of competition with other specialities, especially electrical,

[33] Office of Public Relations, News Clipping, (Aug. 14, 1963), Record Group 27-6-6, Georgia Archives; Cook (2005), p. 309; GDOT, "Affirmative Action Plan," (Atlanta: 1976).

nuclear, computer, aerospace, and chemical engineering, which offered many new and exciting opportunities to young professionals.[34]

To counter the engineering manpower shortage, the SHD sought out ways to attract and retain engineers. It established a civil engineer training program in 1951, rotating trainees through all of the SHD's units, and upon completion promising them a permanent assignment of their choice. A co-operative three-month internship program was initiated with Georgia Tech and the University of Georgia with a peak number of 50 summer interns in 1958. The department also hired a recruiter to visit college campuses, and it started a special "junior" engineer program that allowed engineers to work while they completed their college degrees; 40 students were hired as junior engineers in 1957. Although these programs showed results, it was some years before the new recruits had the experience to independently complete the most technically demanding jobs, like designing bridges.[35]

Another avenue for meeting manpower shortages was using new technologies to save labor. Aerial mapping began in 1950 and the savings were so significant that the SHD purchased its own plane and camera in 1952. According to the department's records, aerial surveys saved 70% over on-the-ground surveys and 40% of drafting time for roadway plans. By 1960 all new roadway and bridge work started with aerial survey and the SHD had purchased a plotter that could efficiently transfer aerial photographs to plans. Other technologies used to save time in the field included the tellurometer, a surveying device for measuring distances using microwaves, and radio communications with in-car and hand-held sets.[36]

The bridge division, like all of the engineering divisions, struggled with engineering manpower shortages. To address this, state bridge engineer Charles A. Marmelstein reorganized the Atlanta bridge design office on a squad-type basis in 1957. Each squad of four to six engineers was headed by a senior bridge engineer who also undertook the training of the less-experienced personnel so they could become more efficient. By all reports, the system worked very well. More problematic was that engineers who supervised bridge construction in the field tended to be young. Senior management was concerned that they lacked in-depth knowledge and were sometimes spread too thin over large jobs. Hal Rives, the assistant state bridge engineer, pointed out that contractors took advantage of inexperienced men, and common mistakes on bridge jobs were the improper curing of concrete, the inappropriate placement of reinforcing steel, and the re-use of formwork from other jobs resulting in differences in dimension, especially of wingwalls and railings. After 1960, the SHD instituted more rigorous

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[34] Biennial Report (1955-56), pp. 91-92; (1957-58), p. 110.

[35] Biennial Report (1955-56), pp. 92-93; (1957-58), pp. 96-97; Chalker (1958), pp. 1, 5; "Georgia Engineer Recruiting Program," Georgia Highways, Vol. 1, No. 2 (Feb. 1958), pp. 12-13.

[36] Biennial Report (1959-60), p. 99

training for its field engineers, which began to pay dividends with fewer problems in the quality of the finished work.[37]

Computerization Saves the Day

The key to the SHD's successful completion of so many bridges with so little engineering manpower was the use of computers to cut-down on time consuming calculations and data collection that had traditionally tied up engineers for hours on end. The workhorse of the SHD's early computerization efforts was an IBM 650 magnetic drum processing machine, which used punch cards to enter data (Figure 14). The SHD was the third state highway department in the nation to have a computer, bested only by California and Texas.

***Figure 14**. SHD management was so pleased with the results of computerization that the IBM 650 was deserving of this "glamor" shot in the first issue of the in-house magazine Georgia Highways (1958).*

The finance department purchased the IBM 650 in 1956 to help it with payroll, but it quickly found other applications. By 1958, it was being used regularly to calculate horizontal distances for surveys, earth quantities for highway construction, maximum slopes for earth fills, super-elevation for curves, bridge skews, moments in continuous-design bridges, grades for proposed roadways, and to check contractors' bid calculations. Many of the SHD's programs were sufficiently well-regarded to be adopted by other state highway departments in the region. The savings from computerization were direct and immediately evident; the SHD reported that the computer was able in 84 minutes to perform the same earthwork calculations that typically took 56 engineering man-hours. Computerization also extended to automated controls of ever larger and more powerful construction machinery. In 1962, the SHD employed for the first time a fully computer-automated central-mix concrete plant for use on the construction of I-285 at the Dunwoody-Chamblee interchange.[38]

Computerization played a significant role in allowing state bridge engineers to design a record number of standardized bridges during the late 1950s and 1960s. Charles A. Marmelstein was nationally recognized among his peers as a leader in the use of

[37] Hal Rives, "Things to Do and Things Not to Do When Building a Bridge," Georgia Highway Proceedings (1960), pp. 105-10.

[38] "The Story Behind the Figures," Georgia Highways (Dec. 1958), pp. 1-3. "Highway Miracle: Zip, Whizz! Concrete Mixed," Office of Public Relations, News Clipping, (Aug. 31, 1962), Record Group 27-6-6, Georgia Archives; "Georgia Highway Department to Use Mechanical Brain to Save Man-Hours," Dixie Contractor (Dec. 21, 1956), p. 50.

computers for bridge design. In the late 1950s, he was chairman of AASHO's National Committee on Electronics for Bridge Design, and in September 1957, he was a featured speaker at the "Increasing Highway Engineering Productivity Conference" at the Massachusetts Institute of Technology. Bridge engineer Doug Hudson, who was hired by Marmelstein in 1947, describes bridge design work prior to the computer as "overwhelming." Calculations, especially for bridges on the interstate system, were very time consuming because of the variations in skew and curvature required to fit the bridges to the geometric standards. Working with slide rules and desk calculators, it could easily take an entire week to work out the curvature of a single bridge. With the computer, on the other hand, Hudson stated that all he had to do was fill out a one-page input sheet, leave it in the in-box in the afternoon, and in the morning all of the calculations would be complete.[39]

The first computer program developed by Marmelstein's staff was one for building skewed bridges on horizontal curves. IBM representatives came to Atlanta in 1956 to give a week-long workshop on computer programming, and subsequently Marmelstein assigned bridge engineers Russell Chapman and Jose Nieves to attend programming school at IBM headquarters in New York. Three-months later Hudson recalls the two announcing that they had completed and proofed the horizontal-curve program. It worked like a charm.

Another program was for calculating the bending moments in continuous-design bridges. The division had been designing continuous bridges since the 1930s for reasons of economy of material, but compared to the computer-aided design the old approach was limited. Prior to the computer, the engineers relied heavily on continuous designs using standard lengths, widths, and right-angle skews (e.g., the two-span continuous steel stringer units of 20'-20'). For any continuous-design bridge that had a non-standard length, width, curvature ,or skew, however, the calculations were always done using assumed values that could only be checked when the design was complete. Doug Hudson remembers these complex calculations often having to be done three or more times before finding values that were acceptable. He said it was "miraculous" to have a computer program that could do this work literally overnight, enabling engineers to quickly select the size beam that would do the job adequately at the lowest cost, saving thousands of dollars.[40]

By the early 1960s, the computer had shown its worth in performing calculations for standardized bridge types, and programmers were now ready to take on more complex problems. The SHD was a national pioneer in the development of the Critical Path Method (CPM) of progressing highway projects using computers. CPM used a logical sequence of steps to figure an average, reasonable time for completing a complex

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[39] Biennial Report (1959-60), p. 93; Office of Public Relations, News Clipping, (Aug. 14, 1963), Record Group 27-6-6, Georgia Archives; Hudson 2007.

[40] "Engineers Attend Conference," Georgia Highway Happenings (Oct. 1957), p. 11; "The Story Behind the Figures," Georgia Highways (Dec. 1958), p. 2; Biennial Report (1957-58), pp. 107-10; Hudson (2007).

series of interrelated tasks. CPM was developed by the Dupont Company in 1956 as a way of planning and tracking defense department projects. In the late 1950s, the U.S. Navy used CPM to speed the Polaris missile program, which finished two years ahead of schedule. Georgia was the first state highway department in the nation to use CPM in 1962, and state engineers found it very useful spotting possible bottlenecks in project progress. The one big advantage to CPM was that each project task was coded on punch cards; if the time to complete any task changed, the corresponding card could be re-punched, and all of the other project tasks dependent upon it revised accordingly. The first SHD project to use CPM was the planning and construction of a 700'-long bridge over stadium gulch at the University of Georgia in Athens. The bridge was designed to resolve a traffic flow problem on Lumpkin Street, as well as to provide improved pedestrian access to Sanford Stadium. After the initial trial in Athens, the SHD successfully used CPM to advance complex interstate highway projects, since the computer programming required could not be justified for smaller projects.[41]

The Challenge of New Transportation Responsibilities: Public Relations, Safety, Scenic Highways, and Highway Beautification

Beginning in the late 1950s, state highway departments across the nation were challenged to respond to new transportation responsibilities, most them resulting from requirements of the federal-aid program and interstate highways. These responsibilities were significant because they prefigured the eventual transformation of the highway departments into multi-faceted transportation agencies during the late 1960s and 1970s. In Georgia, they clearly signaled the reorientation of the SHD from its traditional focus on rural roads and bridges to a much more comprehensive approach to transportation planning throughout the state. While few of these new responsibilities had a direct impact on bridge design prior to 1966, they did indicate the department's growing involvement in a wider range of concerns, foreshadowing other changes, especially the department's response to federal mass transit and environmental laws that would be passed in 1966 and later, and the SHD's reorganization into the Georgia Department of Transportation in 1972.[42]

The expanding highway programs, especially the new interstates and their difficult right-of-way negotiations, prompted the SHD to do a better job communicating with the public. A public relations department was established in the fall of 1956 to inform the media about the tremendous increase in construction. SHD officials, in general, felt that the public didn't understand or appreciate the full scope and complexity of their work and

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[41] Biennial Report (1963-64), p. 101; "Computer Speeds Up Road Jobs," "Bridge Eases Tired Feet at University," and "New UGA Bridge Eases Traffic Flow on Lumpkin," Office of Public Relations, Press Releases and News Clippings, (Nov. 1962-July 1963), Record Group 27-6-6, Georgia Archives; Roger H. Brown, "Critical Path Method of Scheduling Work," Georgia Highway Proceedings (1963), p. 12; Hal Rives, "Critical Path Method of Scheduling Project Rab (4) SP 1645 (17) Clarke," Georgia Highway Proceedings (1963), pp. 27-46.

[42] For a fuller treatment of this subject, Lichtenstein Consulting Engineers, *Historic Context of the Interstate Highway System in Georgia*, GDOT (January 2007).

often failed to see the "big" picture of the efforts to upgrade entire highway systems, rather than simply fix the worn-out pavement and bridges serving a particular business or residence. As late as 1967, the SHD was still struggling with this, even reporting that many of its own employees didn't do an effective job of understanding or communicating. Much of this was attributed to the department's rapid growth and the failure of word-of-mouth communications to reach all employees. In response, the public relations staff published *A Pocket Look at Your Highway Department* in 1967 as a guide for employees. Other public relations issues, such as the impact of highways on community land-use patterns, the environment, and historic preservation, were also of increasing concern but, except for the looming battles over the location of Atlanta's suburban interstates, were not generally understood or identified by the SHD until the mid to late 1960s when national legislation such as the National Historic Preservation Act of 1966, the U.S. Department of Transportation Act of 1966, and the National Environmental Policy Act of 1969 forced it to begin assessing effects on cultural and environmental resources and to hire specialists for those assessments.[43]

Safety was an area of roadway and bridge design addressed with greater rigor beginning in the mid 1960s. Safety had always been a concern of engineers, but most safety features, like railings and signs, were based more on professional judgment and logic than scientifically tested assumptions. Interstate highways had been built with balanced design for safety, but fatal accidents still occurred at alarming rates. In response, the state legislature established a Georgia Traffic Safety Committee in 1964. As a result of the committee's recommendations, Georgia started a mandatory auto safety inspection program in 1965. Significant changes in the safety features of highways and bridges did not occur until the federal government took a leadership role. The Federal-Aid Highway Act of 1965 required each state to have a formal highway safety program by the end of 1967. BPR and AASHO test facilities began work almost immediately on devising national standards for roadside features and geometry that could be applied by each state. After new federal guidance was issued in 1967, the SHD bridge division began to seriously rethink its railing designs for safety, including adopting such designs as Jersey-shaped safety barriers.[44]

Activities that fell under the broad heading of promoting scenic development and roadside beautification were another indication of the expanding responsibilities of the SHD. The department had since its inception understood the importance of good roads to tourism in Georgia's scenic areas, but this had not taken the form of a coordinated program. The success of the Blue Ridge Parkway in North Carolina and Virginia, begun in 1935, prompted interest in extending the parkway into Georgia's mountains. Although this scheme was eventually shelved due to lack of support from the National Park Service, it did result in a scaled-down fashion in the Senator Richard B. Russell Scenic

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[43] Biennial Report (1957-58), p. 91; SHD, A Pocket Look (1967).

[44] "OK Given to First Auto Inspection Stations in Georgia," GCGM (Nov. 1964), p. 34; "Address of F. C. Turner, Chief Engineer, U.S. Bureau of Public Roads," SASHO Proceedings (1965), pp. 8-10; "Safer Night Driving: Bridges Get New Reflective Paint," Office of Public Relations, News Clipping, (n.d., circa 1962), Record Group 27-6-6, Georgia Archives.

Highway through the Chattahoochee National Forest. The highway basically followed the old Logan Toll Road, but was regraded with an eye to fitting it to the landscape. Work was done from 1963-66 in cooperation with the U.S. Forest Service, which wanted to open the area for recreation. The scenic highway, which was modeled after many earlier parkways and scenic roads throughout the U.S., was not significant for its design, but it did serve its intended purpose of opening up one of Georgia's last remote regions. There were other scenic-development efforts, most notably the widening and paving of the road to the top of Brasstown Bald Mountain, the highest point in Georgia, in 1957-58. The mountain had been bought by the U.S. Forest Service in 1936 and the work involved widening and improving a winding logging road that had first been opened by the Pfister & Vogel Timber Company sometime prior to 1936. Paving was completed in 1958 along with the construction of a visitors center atop the mountain. Once again, the highway design was not significant, but it did open up a popular tourist destination.[45]

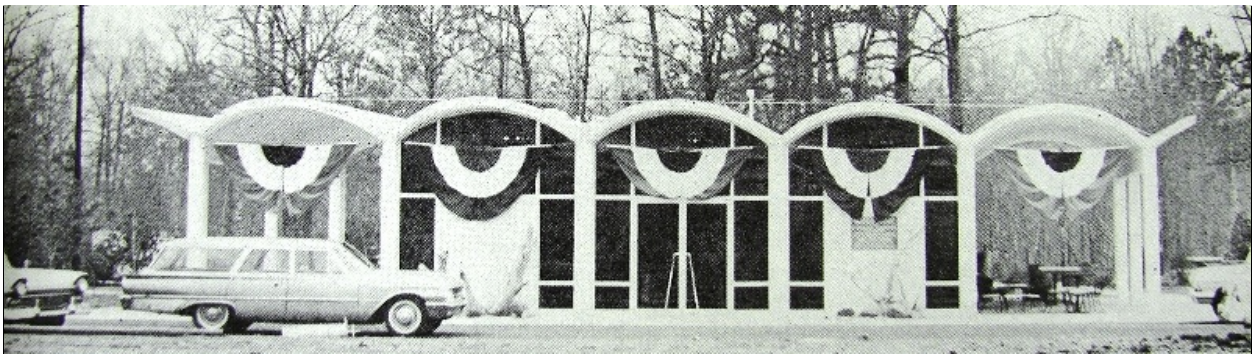

Figure 15*: The SHD opened Georgia's first state-run tourist information center on US 301 near Sylvania in 1962. Source: GCGM.*

The SHD also responded to public concerns about roadside appearance. The department worked with the state legislature to pass a state billboard and junkyard law that became effective in April 1964 making Georgia among the first states to regulate the erection of billboards and plant shrubs to screen junkyards. Similar regulations became federal requirements under the Highway Beautification Act of 1965, but Congressman Russell Tuten of southeast Georgia inserted language that billboard regulations would be "in keeping with customary use" in local areas, thus diluting any attempts at national

[45] "Brasstown Bald ... Georgia's Highest Peak," Georgia Highways (July 1958), pp. 1-3; "State's First Tourist Information Center on U.S. 301," GCGM (Feb. 1962), p. 13. As part of President Lyndon Johnson's War on Poverty, special highway funds were also allocated for economic development of Georgia's Appalachian region. Created by the Appalachian Development Act of 1965, the Appalachian Development Highway (US 19 from the North Carolina line near Harris through Towns, Union, Lumpkin, Dawson, Forsyth and Fulton counties and into Atlanta) received 70-30 federal-state match for engineering and right-of-way and 50-50 construction funds. Georgia received $17 million under the project, but ironically it was plowed into construction of I-85/US 19 in Fulton and Gwinnett counties. It also included special provisions for removal of billboards, beautification projects, and landscaping coordinated with local garden clubs "Appalachian Development Highway," Office of Public Relations, News Clipping, Record Group 27-6-6, Georgia Archives.

billboard standards. His conservative district had a strong billboard industry that objected to the provisions of the state and federal billboard laws. Although the SHD had employed a landscape architect since the 1930s, an official landscape design section was established in 1965 with the main purposes of enforcing the billboard regulations, screening junkyards, and preserving natural beauty. One of the section's first activities was taking a state inventory of junkyards. The landscape section also recommended ways to improve roadside appearance, such as the flattening of cut and fill slopes and adding native plant materials.[46]

[46] Biennial Report (1965-66), pp. 84, 165; Office of Public Relations, News Clippings, (1964-66), Record Group 27-6-6, Georgia Archives.

F. Road and Bridge Building by Counties and Cities

Approximately 1,200 of the bridges in the 1955-65 study population are owned by counties or cities. The majority are short-span bridges located on low-volume roads, and most are undistinguished standardized steel stringer bridges or precast reinforced-concrete slab bridges that are simple and economical to design and build. The reasons for this are several, but can generally be distilled down to the fact that the bridges were more often than not built with the technical advice of SHD engineers who had developed the designs to meet the standards for secondary and county roads throughout Georgia. Very few Georgia counties or cities could afford custom designs or the services of consulting engineers, and thus relied heavily on the SHD.

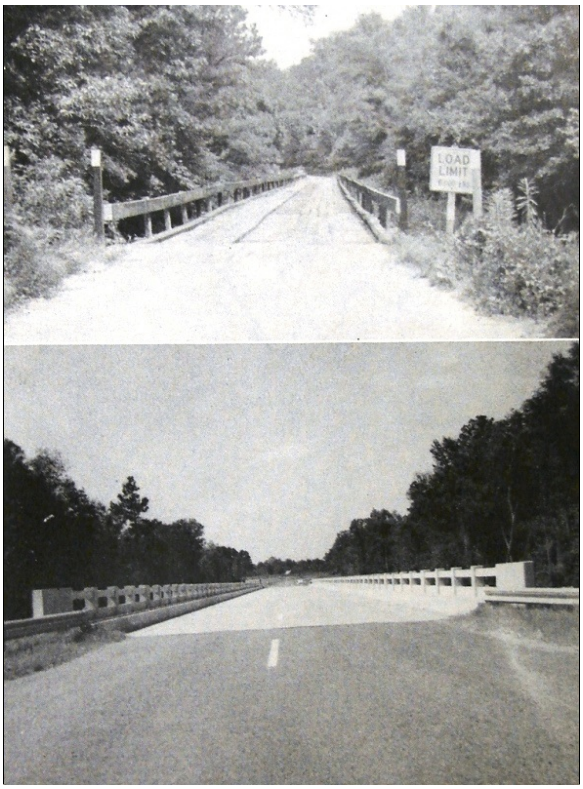

***Figure 16**. Federal-aid secondary program paid for the replacement of many county bridges, such as the before-after photos of this bridge on the Oconee-Milledgeville road in 1958. The new bridges had to meet state standards for roadway width and capacity. Source: Biennial Reports (1959-60).*

Securing federal and state aid for road and bridge projects was an on-going concern of local officials, and the quality of the roads and bridges always a big topic in county politics. The SHD public relations staff kept news clippings from local papers, and these frequently describe county commissioners and mayors coming to Atlanta to meet with state highway officials to ask for their support of specific projects or assistance with worn out roads and bridges. After 1956, due to the impact of the federal interstate funding formula and growing gas-tax revenues, the state government had more funds at its disposal to distribute to local units of government. In 1963, a fairly typical year, about $25 million in state aid was distributed for use on county and city roads and bridges. About $9.3 million of that $25 million went to counties and cities in direct grants for specific road and bridge projects and about $12 million went to county road commissions in the form of county contracts. Another $3.6 million went to pay for work done by state forces on county roads, a practice that tended to benefit poor rural counties that could not afford to employ their own road crews.[47]

In securing labor to build roads and bridges, most Georgia counties fell into one of two models, the “free” labor system or the “prison” labor system. Although the systems had

[47] “Where Road Funds Go,” Atlanta Journal and Constitution (May 31, 1964). Office of Public Relations, News Clipping, Record Group 27-6-6, Georgia Archives.

significant differences, both relied on manual labor and unskilled and semi-skilled workers. This reinforced the need to seek out bridge types that were simple to design and build, like steel stringer and precast concrete bridge types.

Prison labor became very common on Georgia roads and bridges starting in 1908 when state laws required that counties work their prisoners on public projects. At the time, it was considered a positive reform that ended the sometimes brutal and corrupt practice of convict leasing (i.e., the system by which wardens leased the prisoners out to work for private individuals and companies). As the 20th century progressed, prison road gangs themselves became a subject of controversy, with the federal government determining that no prisoner labor could be used as a match on federal-aid projects in 1922. Governor Arnall ordered an end to convict labor on state highway construction projects in 1947. Still, Georgia's counties continued to use prisoners on their road and bridge jobs well into the 1960s, with more than half of the counties reporting some use of convicts in 1962. Furthermore, many counties ignored BPR regulations and used convicts on federal-aid secondary projects. In March 1962, the SHD received an unequivocal warning from the BPR that no prison labor whatsoever could be employed within the limits of a federal-aid secondary project undertaken by the counties. This strongly worded warning promoted a gradual phasing out of the use of convicts on county projects, although some counties continued to use convict labor for basic maintenance and non-federal-aid work.[48]

Mitchell and Troup counties illustrated the two approaches to labor on county projects. Mitchell County was a typical prison labor county that attributed its good roads and bridges to the advantages of working with convicts. In 1962, the county reported that it had from 45-50 prisoners working at all times with an average daily cost of $2 per prisoner. The county commissioners felt it would cost five times as much to employ "free" labor. The convicts were taught to operate construction machinery, and they could work overtime without extra cost to the county. Troup County, a "free" labor county, abolished its prison farm in 1941 and set up a county road department. By the early 1960s, the department had about 50 full-time wage workers maintaining about 900 miles of roadway, and it had crews to perform every type of work, including bridge construction. Earl Edwards, chairman of the Troup County Board of Commissioners, felt that Troup County had "the best kept and maintained" roads and bridges in the state because of its long-term employees and the pride they took in their jobs.[49]

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[48] "Convict Labor Not Allowed on FAS Road Construction Projects," GCGM (March 1962), pp. 10-11.

[49] Earl Edwards, "Troup County Finds "Free" Labor Best," and "Mitchell Makes Improvements with Prison Labor for Citizens," GCGM (Oct. 1962), pp. 11-15; "County Road System Explained in Display," Lagrange Daily News (Apr. 18, 1963). Office of Public Relations, News Clippings, Record Group 27-6-6, Georgia Archives.

G. Conclusion

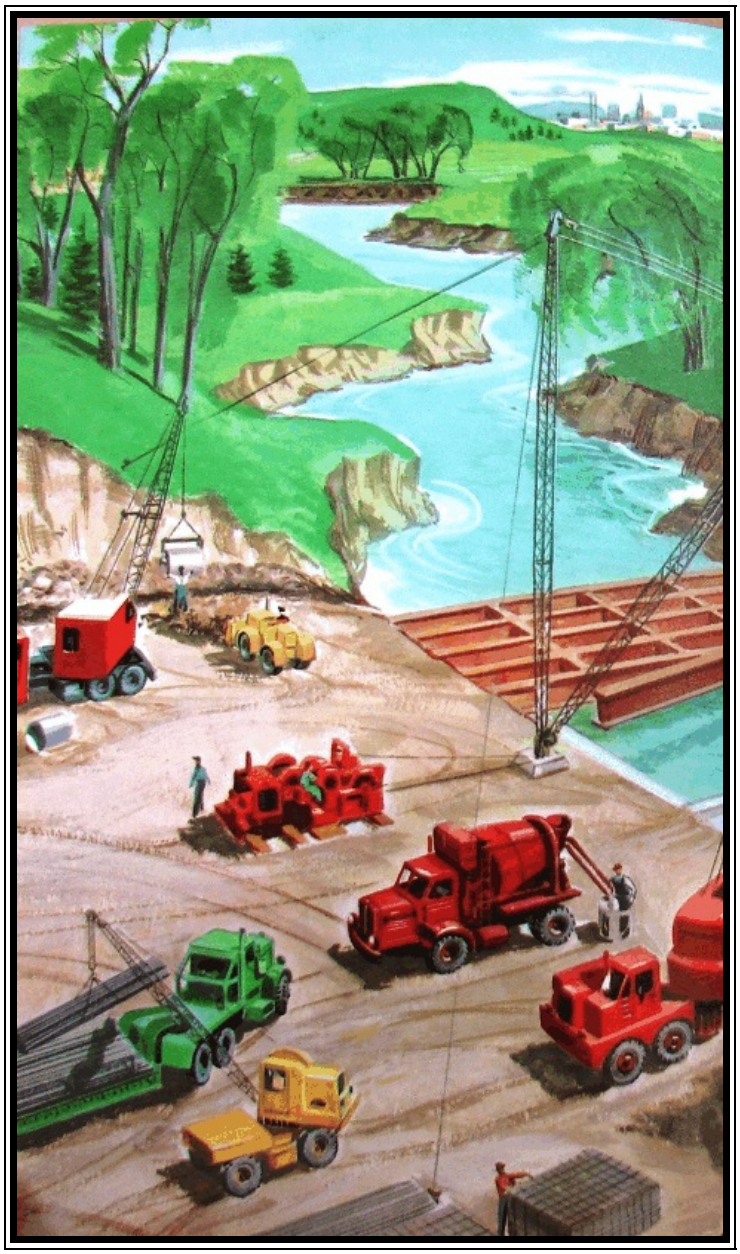
Between 1955 and 1965, Georgia was able to undertake large-scale programs to improve the state's non-interstate highways, while at the same time planning, designing, and building the interstate highway system. Much of this was made possible by the 90%-10% funding formula for interstate construction passed by Congress in 1956, freeing up other sources of revenue for use on non-interstate highways. Also underlying this accomplishment was the maturation of the State Highway Department of Georgia (SHD) as a highly qualified and increasingly efficient and professional organization dedicated to the improvement of the state's roads and bridges.

In order to gear up for these unprecedented efforts, the SHD increased in size from about 5,000 to 9,000 employees, going through growing pains that included political controversy and scandal, a shifting emphasis from rural to urban roads and bridges, tightening of contracting procedures, changes in employment practices, and the adoption of new time-saving technologies, particularly computers. The SHD also expanded its horizons to become more highly involved in activities that went beyond the roadway to include public relations, comprehensive urban transportation planning, and roadside landscaping and scenic development. These were precursors to fundamental changes in highway administration that would become increasingly evident during the environmental movement of the late 1960s and early 1970s.

The decade after 1955 saw increased financial resources directed toward upgrading the state's more than 90,000 miles of existing roadway to statewide geometric standards for all classifications of roadway from the most heavily traveled US-numbered highway to the most lightly traveled county road. Much of this work included replacing, widening, or by-passing old bridges that did not meet the standards. These standards incorporated guidelines developed by the American Association of State Highway Officials (AASHO) at the national level, and thus promoted uniform development. Since standards were higher for roads with higher ADT or on the federal-aid systems, many of the older bridges on these roads were replaced or altered to meet the new standards.

The SHD's bridge engineers met the challenge of surveying, planning, and designing interstate and non-interstate highway bridges by adopting more efficient methods of completing their work. Facing manpower shortages, Georgia's state bridge engineers were among the first in the nation to use computers to perform complex calculations and track multi-stage projects. Computers made it easier to design skewed and super-elevated bridges that conformed with geometric design standards, a critical component of safe, high-speed highways. Due to their emphasis on efficiency and economy, Georgia's bridge engineers and contractors were able to construct on average about one new bridge each work day from 1955 to 1966, a remarkable accomplishment.

HISTORIC CONTEXT FOR BRIDGE-BUILDING TECHNOLOGY IN GEORGIA, 1955-1965



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Detail from Cummins ad, Dixie Contractor (1956).

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HISTORIC CONTEXT FOR BRIDGE-BUILDING TECHNOLOGY IN GEORGIA, 1955-1965

The Era of Uniformity in Bridge Design

Georgia's nearly 2,330 extant highway bridges built from 1955 through 1965 reflect bridge-building trends that are marked mostly by uniformity of established, standardized bridge types, like the steel stringer, the reinforced-concrete T beam, and the reinforced-concrete slab. Refinements of this decade included the use of improved materials and details, including the introduction of prestressed concrete. The emphasis was on finding ways to plan, design, and construct a large number of bridges quickly and efficiently, in response to the needs of the interstate highway system. One of the most important developments was the introduction of computer applications to speed the process of designing bridges. Except for the prestressed-concrete bridges, all of the bridge types in the 1955-65 study population are represented in Georgia's pre-1955 study population.

One of the primary reasons for the uniformity of bridge materials, types, and designs is that technical design standards officially adopted by the State Highway Department of Georgia (SHD) had come to govern practically all bridge projects during the study period.[1] Bridges on the Georgia State Highway System (Interstate, US, SR, and FAS routes) were built under the direct authority and supervision of engineers of the SHD who closely adhered to the comprehensive specifications. Only some county and city bridges, usually the shorter, less complex, and thus less costly bridges, were built without state funding, but even then Georgia's local units of government relied heavily on the technical support of engineers and contractors familiar with state standards. Every bridge builder who worked with the SHD signed a contract that included a clause that all work would conform with the published specifications.[2]

Another factor in the uniformity of bridge type and design was the SHD's Geometric Design Standards, first published in 1949 and revised about every five years thereafter. The stated goal was for all of the state's roadways and bridges to meet minimum geometric standards (roadway width, curvature, live loads, vertical clearance, etc.) for the various roadway classifications. As well, the SHD strived to replace existing substandard bridges or improve them so they met the minimum standards. The Standards incorporated national guidance developed by the federal Bureau of Public

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[1] The SHD was the predecessor of the Georgia Department of Transportation (GDOT). It was renamed GDOT in 1972.

[2] C. A. Marmelstein, "Specifications and Their Interpretation," Proceedings of the 12th Annual Georgia Highway Conference (1964), pp. 40-44 (Hereafter cites as Georgia Highway Proceedings; SHD, State Highway Department of Georgia Standard Specifications (1956). The specifications were first published in 1931, and revised in 1936, 1942, 1947, 1956, and 1966. Each revision became progressively "thicker" with Section 500 covering specifications related specifically to bridges and culverts.

Roads (BPR), the American Association of State Highway Officials (AASHO, now AASHTO), and the American Society for Testing Materials (ASTM). Georgia's state bridge engineers played an active role in AASHO committee deliberations, and they assisted in the cooperative development of the standards with bridge engineers from the BPR and other state highway departments. As a result, hundreds of highway bridges from this period across Georgia, and, indeed, across the nation, were technologically indistinguishable from one another.

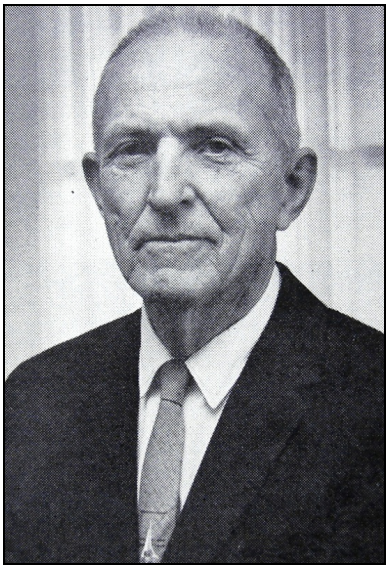

Figure 1. Searcy B. Slack, State Bridge Engineer, 1920-1933. Source: GCGM, 1962.

Inherited tendencies in the SHD's Division of Bridges also played a significant role in the uniformity of bridge design in Georgia. The bridge division had been established in 1920 under the superb leadership of State Bridge Engineer Searcy B. Slack (Figure 1). Over the next 13 years, Slack emerged as a national expert on the use of low-cost, standardized bridges that were functional and unadorned. Under Slack's guidance, personnel in the bridge division became closely attuned to the economics of bridge construction in Georgia, including the cost of materials, the cost and availability of various classes of labor, the cost of transporting materials to bridge sites, and the costs associated with the geology and hydrology typical of Georgia's geographic regions.[3] During the 1920s, Slack favored reinforced-concrete T beam and slab bridges for the preponderance of crossings, and then during the early 1930s he adopted some innovative, standardized, continuous-design and continuous-cantilever-design steel stringer bridges that would prove critical to advancing Georgia's bridge-building program during the Great Depression and beyond.

Slack left the SHD in 1933, yet his successors continued the practices and preferences that he had promoted. Clarence Crocker (Figure 2) who served as state bridge engineer from 1933 to 1955 and Charles Marmelstein (Figure 3) who served from 1956 to 1967 were Slack proteges. They had been recruited by Slack in the 1920s and were among that generation of engineers who made the SHD and the improvement of Georgia's roads and bridges a life-long career. Crocker and Marmelstein were always monitoring, adjusting, and refining the bridge specifications and standard plans so that Georgia "got its money's worth," but they did not try out new bridge types and designs without clear evidence of cost savings. The SHD bridge engineers thus exercised a

[3] L. E. Mallory and R. S. Fountain, "Bridge Substructures and Foundations," Georgia Highway Proceedings (1955), pp. 128-38. By the mid-1950s, experience had shown that the most economical substructure units were two or more column reinforced-concrete piers, steel pile bents, concrete pile bents, and timber pile bents. The bents tended to be used in softer sediments (typical of the Coastal Plain and Piedmont), while the piers could be founded on rock (typical of the Fall Line and Mountains).

Figure 2. Clarence Crocker, State Bridge Engineer, 1933-1955. Source: Georgia Highways (1958).

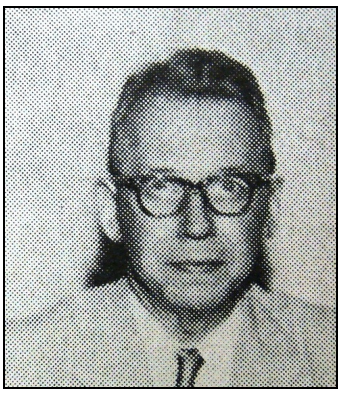

Figure 3. Charles A. Marmelstein, State Bridge Engineer, 1956-67. Source: Georgia Highways (1958).

conservative approach to bridge type selection during the study period, relying heavily on a few bridge types, particularly the standardized steel stringer, T beam, and slab that had proven their ease of design and economy of construction during the first half of the 20th century.

The reason that standardization worked so well was a marriage of technical, economic, and political considerations that had been influencing bridge-building trends in Georgia since the early 20th century. Standardization allowed for quality control across the entire state. Cost comparisons and accurate estimates could be made from project to project, thus serving as a check on contractors. Innovative or untried, individualistic bridge plans tended to introduce unpredictable costs into a bridge project, something no one favored. Standard design details and specifications also helped the SHD obligate federal-aid funds, since once approved the first time they were unlikely to be held up to extra scrutiny by federal engineers. After 1956, state engineers were under tremendous political pressure to advance projects, especially interstate highway projects, to meet the political and public demands for the new freeways, and standardization helped them in the face of manpower shortages while at the same time delivering an unprecedented number of new bridges. It was a remarkable accomplishment, but one that resulted in very few individually outstanding bridges.

The decision of which bridge type to use was most often a reflection of site conditions (e.g., the length of span required, vertical clearance, foundations, classification of roadway, etc.), the current cost of materials, and to some lesser degree the individual preferences of the designing engineer and contractor. Decisions were, however, based almost always on the technical information and specifications developed by the SHD, with input from national trade and research associations, like the American Concrete Institute (ACI), the Portland Cement Association (PCA), and the American Welding Society (AWS). Georgia's bridge engineers met regularly with federal engineers and representatives of academia, private industry, and government at meetings of the Georgia Annual Highway Conference,[4] the Southeastern Association of State Highway Officials (SASHO), the Georgia County Government Association, and the like. Standards and specifications were a frequent topic of review and comment at the conferences. And as State Bridge Engineer Charles A. Marmelstein commented in 1964, one of his primary jobs was writing specifications. He made it a rule "don't

[4] The Annual Highway Conference was held starting in 1951 at Georgia Tech. It brought together SHD engineers, university faculty and students, and private engineers and contractors.

specify the impossible, and don't specify anything not intended to be enforced." This approach enabled state, county, and city engineers to achieve quality and economy in their bridge designs, utilizing best practices and sound engineering principles. It also provided contractors assurance that standards and specifications would not vary greatly from job to job.[5]

Figure 4. Jackie Harmon, a SHD employee, poses at the IBM 650 (left) and the card reader (right). Source: Georgia Highways (1958).

Significantly, the standardized approach to bridge design that had developed in Georgia was a natural fit with the burgeoning era of computerization. In late 1955, state bridge engineer Charles Marmelstein realized that the impending interstate highway program would create a crisis in the bridge division. There simply weren't enough engineers to complete all of the work and no hope of recruiting enough sufficiently experienced engineers. He advocated speeding up the design process by using a main-frame computer to perform calculations then being completed by hand. Since WWII, computers had proven that they could perform this kind of work, especially for the military, and IBM had introduced a new generation of business computers that were increasingly affordable for industry and government. In 1956, the SHD arranged to purchase an IBM 650 computer, and the bridge division immediately assigned two of its engineers – Russell Chapman and Jose M. Nieves – to develop a program that would use input from punch cards to perform the calculations needed to design skewed, super-elevated bridges. This program proved so accurate and successful that other programs were soon developed, including those for calculating the moments in continuous-design bridges and in substructure units, and for more accurately tracking and estimating construction costs. These programs cut down significantly on time spent on complex calculations. The computer could do in a few hours the work that had previously taken state engineers days and days. Marmelstein demonstrated complete confidence in the computer and Georgia emerged as a national leader in the application of computerization to bridge design in the late 1950s. Doug Hudson, an engineer who joined the bridge division in 1947, recalls that the computer's contribution was "miraculous" and that he doesn't think that the division could have competed the bridge designs for the interstate highway system without it.[6]

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[5] American Association of State Highway Officials, Standard Specifications for Bridges (Washington: 1957); Marmelstein (1964), p. 44.

[6] SHD; Biennial Report (1957-58), pp. 107-08; (1959-60), p. 105; Doug Hudson, Personal Communication with P. Harshbarger (July 1, 2007); "The Story Behind the Figures," Georgia Highways (Dec. 1958), pp. 1-3, 15.

Computerization wasn't the only new technology employed by Georgia bridge engineers in the late 1950s. In 1957, SHD bridge engineers introduced the state to a new bridge material – prestressed concrete. They constructed about 100 prestressed-concrete bridges from 1957 to 1965, but unlike the efforts in computerization, Georgia was not known as a national leader in the development of prestressed concrete. While prestressed-concrete beams and pilings were easily standardized, Georgia's state bridge engineers repeatedly found that the prestressed-concrete bridges did not offer significant cost advantages over traditional steel and reinforced-concrete bridges, and, in fact, often cost slightly more. Georgia did not have a strong prestressed-concrete bridge fabricating industry, nor did state officials feel the need to foster it like some states did as a viable alterative to steel or reinforced concrete. After 1958, the SHD built a handful of prestressed-concrete bridges, but all of its bridges used the standardized beam designs that had been approved by AASHO and the BPR in 1954-56 for use throughout the United States. These designs had been tested, refined, and approved by AASHO and BPR engineers for use on federal-aid projects, not developed in-house by Georgia engineers. Thus, there was rarely anything innovative about the early and limited use of prestressed-concrete bridges constructed in Georgia before 1966.[7]

Bridge Types on Georgia's Non-Interstate Highway Systems, 1955-65

The extant 1955-65 bridges on Georgia's non-interstate highway systems are, with few exceptions, steel stringer, reinforced-concrete T beam, or reinforced-concrete slab.[8] Of the 1,825 inventoried non-interstate bridges, 39% are steel stringers, 36% are T beams, and 21% are slabs. The remaining 4% represent a variety of other bridge types, including prestressed concrete, bascule, girder-floorbeam, and truss (Table 1). All of the bridge types, except the prestressed-concrete bridge types, were introduced and refined in earlier periods and are well represented in Georgia's pre-1955 historic bridge population.

The SHD designed all primary federal-aid highway system bridges (IR, US, and most SR routes) during the 1955-65 study period for 36-ton semi-truck design vehicles (H-20, S-16).[9] Based on this load-carrying capacity and typical span lengths and widths

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[7] Ibid.

[8] Interstate highway bridges are excluded from the study because of the national interstate Section 106 eligibility exemption signed in February 2005 by FHWA and the Advisory Council on Historic Preservation. The bridge types on the interstate system were, however, reviewed and reflect, in general, the bridge types found on the other state highway systems.

[9] These codes are a standard system for designing and rating bridges using a theoretical design vehicle. AASHO's Bridge Committee, whose members were state and federal bridge engineers, adopted the system in 1931 and a modified version of it remains in use today. Most states, including Georgia, have used the system or a variation of it since 1931. H-20, S-16 (or HS-20), for example, refers to a bridge that has a live-load design or rating for a semi-truck with a gross-vehicle weight of 36 tons. Other common H-loadings were for H-10 (10-ton, two-axle truck) and H-15 (15-ton, two-axle truck). FHWA,

Bridge Type	Total No. of Examples on Georgia's Non-Interstate Highway Systems, 1955-65
Steel Stringer	707
Reinforced Concrete T Beam	650
Reinforced Concrete Slab	386
Prestressed Concrete Stringer	24
Prestressed Concrete Slab	18
Wood Stringer	11
Steel Girder-Floorbeam	9
Prestressed Concrete Channel Beam	6
Steel Truss	6
Prestressed Concrete Box Beam	4
Reinforced Concrete Channel Beam	2
Bascule	1
Other Types (not specified by NBI)	1

Table 1: Bridge Types on Georgia's Non-Interstate Highway Systems. Source: GDOT, National Bridge Inspection (NBI) database, 2007.

(minimum of 28'), the generally preferred bridge types selected by state engineers based on prevailing conditions and tendencies in Georgia were rolled steel beams or cast-in-place reinforced-concrete T beams. Selection of steel or reinforced concrete tended to be based on fluctuations in price and availability of material due to variations in demand and production at the mills. Georgia's secondary roads and county roads designed for a minimum live-load capacity of 15-ton design vehicle (H-15) during the study period, and this condition, along with generally shorter span lengths of local bridges, lower volume roads, and narrower roadway widths (minimum of 22'), favored a

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America's Highways, 1776-1976 (Washington, D.C., 1976), p. 432.

slightly different mix of bridge types, predominantly steel beam or precast reinforced-concrete slab.[10]

Steel Bridges

Steel Stringer Bridges

Nearly half of all bridges built in Georgia from 1955 to 1965 were steel stringer bridges. Undoubtedly the percentage would have been even higher if demand for steel had not been so high and delays in delivery common. The main drawback to steel bridges during the 1950s and 1960s was that the steel industry did not keep up with high demand, did not invest in more efficient equipment, often had steel diverted to high-priority defense work, and had production problems because of labor strikes. These circumstances resulted in many frustrating delays for bridge engineers and contractors in Georgia, as well as throughout the nation, and encouraged them to use reinforced-concrete or prestressed-concrete bridge types as an alternative to steel.[11]

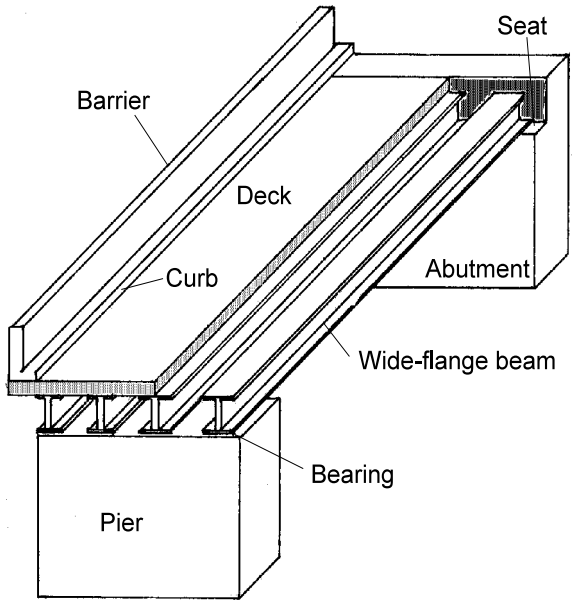

Figure 5. Typical steel stringer bridge.

The SHD built the majority of steel stringer bridges, and its strategy of using standard designs changed little from the 1930s through the 1960s. The versatility of the steel stringer bridge type was that it could be easily proportioned and the beams spaced out to support typical live loads and lengths up to 65' for simple spans using rolled sections and over 150' for continuous or continuous-cantilever designs using built-up sections. The dominance of the steel stringer technology is so complete that even to this day no other highway bridge type comes close to being as common. As a population, the steel stringer bridges are highly undifferentiated. They reflect the successful and unvarying application of standard bridge plans and specifications to highway system development, but individually they are rarely remarkable.

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[10] SHD, Geometric Design Standards for Use on Location and Design (1961).

[11] Forester Booker, "Bridge Superstructures," Georgia Highway Procedings (1956), pp. 93-100; E. L. Erickson, "Bridge Design in View of Present Steel Situation," Proceedings of the Southeastern Association of State Highway Officials (1956), pp. 101-07. Hereafter cites as SASHO Proceedings.

The steel stringer bridge type (also known as multi-beam or multi-girder) consists of a series of parallel longitudinal steel beams supporting a deck, usually of reinforced concrete (Figure 5). A stringer bridge relies on the bending strength of the beam to resist loads. Beam depth is determined by the length of span, beam spacing, and design load – the longer the span, the wider the spacing between the beams, and/or the heavier the load, the deeper the required beam. Some of the most important advances in steel stringer bridge technology have thus occurred in mills and labs where engineers and scientists have sought to improve or refine beam metallurgy. These refinements have included the introduction of particular steel alloys for longer, deeper, stronger, and/or lighter beams, for better withstanding the weather, for welding, and for high-tensile connections. By the 1910s and 1920s, steel beams were proving to be the workhorses of American bridge-building practice. Consequently, steel manufacturers and engineers working through the American Steel Institute (ASI) and the American Society for Testing Materials (ASTM) successfully developed improved metallurgy for specific structural applications, and bridge builders readily took advantage of these improvements resulting in higher strength beams. During the 1950s and 1960s, for example, the primary focus was on developing high-strength steels better suited to longer span bridges using welded beams rather than riveted beams because of savings in material and labor. With higher yield strengths and resistance to corrosion, these new steels allowed bridge engineers to design longer spans using less steel, thus reducing the overall costs of the materials used in bridge construction.[12]

Figure 6. Erecting a steel stringer bridge near Albany. Source: Dixie Contractor (1960).

The popularity of the steel stringer bridge type has its roots in the late 19th century. From the 1890s through 1910s, successive innovations allowed steel mills to roll longer and deeper I-shaped beams. By 1920, most of the major hurdles in manufacturing wide-flange steel beams of up to 36" depth and 60' long had been overcome. Prices for the rolled beams fell through the following years, increasing competitiveness with other materials such as wood, reinforced concrete, or built-up steel beams (see below). The rolled beams were a boon to bridge builders and proved ideally suited for the highway-building campaigns of the

[12] FHWA, America's Highways (1976), pp. 434-39; B. R. Queneau, "Properties and Price Relationship of Structural Steel for Bridges," and F. K. Goodell, "Application of High Strength and Low Alloy Steel in Bridge Design," SASHO Proceedings (1957), pp. 60-64; The Making, Shaping, and Treating of Steel, Sixth Ed. (Pittsburgh: US Steel, 1951).

20th century. Rubber-tired trucks and improved heavy-construction equipment eased the problems of transporting the beams and on-site erection (Figure 6). With primarily accessible flat surfaces, steel stringer bridges were easier to clean and paint than trusses. They also did not require the labor, form work, and curing time of cast-in-place reinforced-concrete bridge types. The rolled steel stringer bridges also had the advantage of being easy to widen, and the beams could be salvaged and reused if a bridge were replaced. For these many reasons, by the 1930s in Georgia and elsewhere the rolled steel stringer bridge type was becoming the preferred bridge type for use on the development of state highway systems.[13]

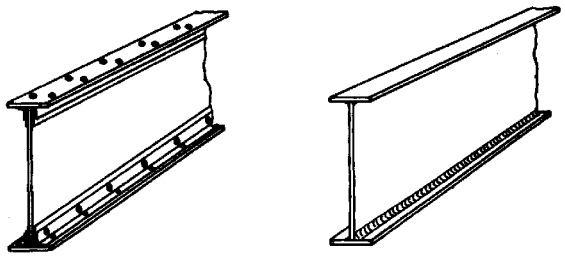

Figure 7. Built-up riveted beam (left) and welded beam (right).

Since the mid-19th century, when bridge builders wanted beams of greater depth than the available rolled beams, they have turned to built-up beams (Figure 7). The technique of building up beams by riveting plates, angles, and channels had been used by the railroads prior to the Civil War, and riveting was the most common method of building up beams through the first half of the 20th century. With improvements in arc-welding, engineers increasingly turned to fabricated welded beams after WWII. These beams, in depths of up to 5' or more, became available in the early to mid 1950s, and were increasingly used during the 1960s, particularly with the availability of structural steel alloys developed specifically for welding. Bridge engineers made expanded use of welded beams citing material and fabrication savings over riveted built-up beams, which according to one 1960 study could weigh 25-30% more than similar welded beams for span lengths from 90' to 140'.[14]

Georgia was slow to use welded beams, in part because trained welders and fabricators were difficult to find in many areas of the state, and inspecting the quality of the welds required considerable experience or expensive testing equipment. The SHD did use welded cover plates to strengthen the flanges of I-beams beginning in the early 1950s and reported building its first “all-welded plate girder bridge” to carry SR 252

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[13] J. A. L. Waddell, Bridge Engineering, Vol. 1 (New York, 1916), pp. 410-411, 463-64. Waddell, one of America’s leading bridge engineers, wrote that the rolled beams were quickly becoming an important bridge-building material because of the above listed advantages.

[14] James G. Clark, ed. Comparative Bridge Designs (Cleveland: James F. Lincoln Arc Welding Foundation, 1954), pp. 24-40; Omer W. Blodgett, “Welded Plate Girders,” SASHO Proceedings (1960), pp. 32-35. Organizations such as the Lincoln Arc Welding Foundation in Cleveland and companies such as Westinghouse actively promoted the use of welding in steel construction. Many of the early advances in welded bridge construction occurred in northern states, including New York, Pennsylvania, Massachusetts, and Ohio.

over the Satilla River at Burnt Fort on the Charlton-Camden county line in 1956 (049-0038-0). Still the 1956 edition of the SHD's Specifications conservatively stated that "welding will not be permitted except where it is specified or to remedy minor defects where its use is approved by the engineers." In 1958, Charles Marmelstein reported that there had been an increase in the use of welding for shop and field work, and the bridge department was working to ensure that it was being done only by "qualified, tested" welders. It was not until the 1966 edition of the Specifications that the SHD dropped the restrictive language and greatly expanded its directions on the proper design, fabrication, and inspection of welded beams and connections. Much of the language was borrowed directly from national guidance issued by the American Welding Society.[15]

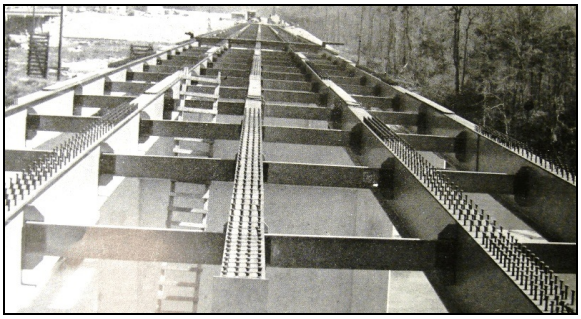

Figure 8. Construction photo showing shear stud connectors for composite beams prior to placing the concrete deck. Source: SHD, Biennial Report (1958).

Another refinement in steel stringer design was the use of composite, reinforced-concrete decks made by use of shear connections, usually metal studs (Figure 8) or spirals, set in the top flange of the steel stringers and embedded in the deck. The deck is thus mechanically attached to the steel beams and made to contribute to the load-resisting capacity of the superstructure with little additional cost and savings in steel by use of shallower beams. After WWII, American engineers began to make increasing use of composite decks based on a growing body of theoretical and empirical research that demonstrated their advantages. Georgia bridge engineers were interested in composite decks because of the cost savings and experimented with them from an early date. Doug Hudson recalls former state bridge engineer Searcy Slack (who continued to work in the state as a consulting engineer) and state bridge engineer Clarence Crocker investigating composite decks and coming up with a horseshoe-shaped, deformed-bar shear connection sometime in the early 1950s. The legs of the U-shaped connection were welded to the top of the beam and the curved end of the U bent up to grab hold of the slab deck. This connector was an "in-house" design because Crocker was concerned with infringing on shear connection patents, and it was a strict SHD policy not to pay patent royalties. The U-shaped connector was used for a few years before being replaced by commercially available spiral and stud connectors.[16]

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[15] SHD, Biennial Report (1955-56), p. 109, (1957-58), p. 107; Specifications (1956), pp, 389, 416; (1966), pp. 489-98.

[16] Hudson (2007); Booker (1956), pp. 98-99. Non-composite construction is the traditional way of placing the reinforced concrete deck on the top flanges of the beams without mechanical connections.

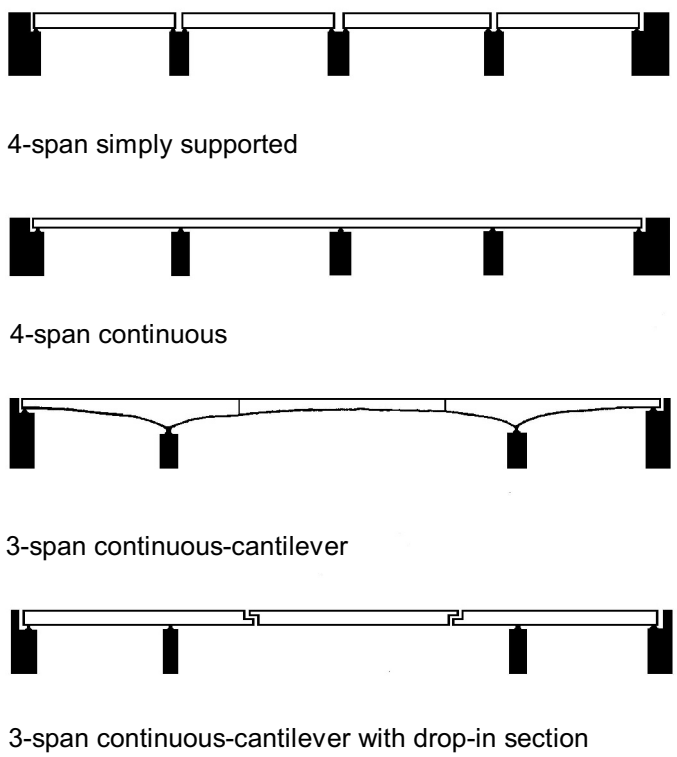

Figure 9. Steel stringer designs.

Many of the multi-span steel stringer bridges in Georgia are continuous designs (Figure 9). Continuous designs are those where the beams continue uninterrupted over one or more piers. These bridges have significant economic advantages because they use less beam material for a given span length than simple supported (non-continuous) spans. Continuous spans distribute loads over two or more spans and thus can use smaller section beams than comparable simply supported spans, which must accommodate the entire load within each individual span. The reinforced concrete deck is also continuous, thus reducing the number of expansion joints, the failure of which is a primary source of bridge deterioration. Simple spans require expansion joints at the ends of each span.

The SHD built its first continuous steel stringer bridges in the late 1920s and early 1930s under the leadership of State Bridge Engineer Searcy B. Slack who was a pioneer in the development of standardized continuous-design bridges. Searcy Slack and Clarence Crocker developed a series of “short cuts” for designing continuous bridges, including using standardized units, such as the two-span 20'-20' and 27'-27' steel stringer bridges used during the 1930s and 1940s, but it wasn’t until the department began using a computer to calculate continuous moments in 1957 that the advantages of multiple-span continuous designs could be realized to their fullest extent over a wide range of lengths, widths, skews, and superelevations.[17]

Contemporary with the application of continuous span technology was the use of the continuous-cantilever and drop-in section for longer span steel stringer bridges (usually those with main spans of about 65' to 90' long). These designs were also pioneered in Georgia by Slack in the late 1920s and early 1930s. The continuous-cantilever design typically has a drop-in (or suspended) section placed between two cantilevered sections or arms. The design allows for a longer clear span with a shallower beam, achieving economy not only in the depth of the beam, but also reducing the number of piers necessary to span a given length of crossing as compared to a simply supported span of the same beam depth. The connection between the cantilever arm and drop-in

[17] Hudson (2007).

section is efficiently achieved by a pin-and-hanger connection, which also simplifies the stress calculations and is better suited to foundation conditions where uneven settlement is a possibility.[18]

The continuous-cantilever steel stringer design was based on engineering principles developed during the late 19th century for long-span cantilever truss bridges. In the late 1920s, bridge engineers first used the principles in combination with the newly available 30", 33" and 36"-deep, rolled wide-flange beams to build continuous-cantilever stringer bridges with spans up to about 100'. Previously, that length was usually spanned with truss bridges. The pin-and-hanger detail continued to be used in Georgia and elsewhere through the 1970s, but with the collapse of the Mianus River bridge in Connecticut in 1984 because of a failure in one of the pin-and-hanger assemblies, engineers all across the country, including those in Georgia, initiated a systematic program of eliminating or modifying this detail or relying on frequent inspections.

Another refinement common to many of Georgia's continuous steel stringer bridges is the use of high-strength bolts to make the connections at beam splice plates. Georgia's bridge engineers kept abreast of developments in high-strength bolts. The SHD revised its specifications in 1956 to allow for the substitution of high-strength bolts for rivets of equal size in any bridge project. High-strength bolts for bridge applications were developed beginning in the late 1930s and had by the 1960s become the dominant fastener used in steel bridge construction in the U.S., largely replacing hot-driven rivets. They represent an advance in the way connections were made in a variety of steel bridge types, including truss, girder-floorbeam, rigid frame, and continuous steel stringer. The use of high-strength bolts originated at university engineering labs in the late 1930s as a result of detailed investigations into the properties and behavior of fatigue and secondary stresses in steel connections. Based on the excellent results of these early scientific investigations, professional engineering and trade industry groups sponsored further trials and standardization of high-strength bolts for practical applications during the late 1940s and 1950s. High-strength bolts proved to have significant advantages over rivets from the standpoint of control of design and the economy of erection, especially eliminating the on-the-job labor costs associated with riveting. During the 1960s, high-strength bolts by and large supplanted rivets as the fastener of choice on most bridge projects.

A significant characteristic of a high-strength bolt is the ability to tighten the bolt to the desired stress and attain a precise amount of clamping force, thus giving the designer greater control over the properties and behavior of the connection detail. High-strength bolts are manufactured from medium carbon or alloy steels, usually having from 100-150% greater tensile strength than the mild-carbon steels typically used for common bolts. They also have short thread lengths that limit the elongation of the bolt under tension. Today, there are many types of high-strength bolts, but two of the most

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[18] Booker (1956), pp. 94-5.

common for bridge applications are the hex-headed bolts designated A325 and A490 by the American Society for Testing and Materials (ASTM). The medium-carbon steel A325 bolt was the first high-strength bolt to come into general use for bridge applications about 1951, and the A490, which is similar to the A325 except made from alloy steel for higher stresses and heavier loads, came into use about 1959.[19]

Steel Girder-Floorbeam Bridges

The steel girder-floorbeam bridge has been in use in Georgia since at least the late 19th century, but it was still in use through 1965 because it held some economic advantages, particularly the use of less steel as compared to steel stringer bridges in span ranges of about 90' to 150'. The history of the steel girder-floorbeam bridge type is similar to the steel stringer bridge type with the primary difference being that steel girder-floorbeam bridges consist of two or more longitudinal beams (i.e., girders) with transverse floorbeams supporting a deck. The longitudinal girders are typically built-up to achieve a greater depth than economically available from attainable rolled beam sections. The girder-floorbeam was developed in the late 1840s and first used by railroads. In fact, the girder-floorbeam was the only serious competitor to the metal truss for railroad applications during the 19th century. The technique of building up the girders has historically been riveting, an expensive and labor-intensive method. Welding became a more common alternative after 1945 with the advancement of welding technology and metallurgy to produce weldable, structural steel alloys. As with the steel stringer, Georgia was a relative late-comer nationally to welded designs and didn't build welded girder-floorbeams until the late 1950s and 1960s. Some post-1930 girder-floorbeams also are continuous or continuous-cantilever designs with span lengths up to about 150'.[20]

Steel Truss Bridges

After 1930, the truss bridge technology, which had been the dominant technology for highway bridge building from the late 19th century to the early 20th century, largely fell from use in Georgia and throughout the nation. There were several factors related to the decline, including the development of reinforced-concrete bridge types and the availability of rolled beams in longer lengths, as well as the Depression of the 1930s when there had been very little new local bridge construction forcing most of the remaining truss fabricators to go out of business. This relegated the truss bridge type to a relatively narrow range of applications, mainly to longer span lengths between about 150' and 500' long where it still held some competitive advantages, especially if designed as a continuous structure. For this reason, the handful of truss bridges built

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[19] Kulak, Geoffrey L. and John W. Fisher and John H. A. Struik. Guide to Design Criteria for Bolted and Riveted Joints. 2nd Ed. (New York: John Wiley & Sons, 1987), pp. 1-4; SHD, Specifications (1956), p. 385.

[20] Carl W. Condit, American Building, 2nd ed. (Chicago: University of Chicago Press, 1982), pp. 225-226.

Figure 10. SR 53 over Lake Lanier, built in 1956. Source: Dixie Contractor (1956).

in Georgia from 1955 to 1965 tend to be long-span bridges and include the three truss bridges built over the U.S. Army Corp of Engineer's 1955-56 Lake Lanier flood-control project on the Chattahoochee River near Gainesville (Figure 10). These bridges required very high piers (over 100' high) because of the depth of the reservoir. The economy of the long-span trusses was based on reducing the number of piers so to save substantially on the cost of substructure work.[21]

Reinforced-Concrete Bridges

Concrete is a mixture of stone aggregate, sand, and cement that when mixed wet can be cast into a variety of shapes. As concrete cures, it undergoes a chemical process, and once set forms a very hard, durable, low-maintenance material. A structural weakness of concrete on its own is that it has low tensile strength. To overcome this, steel bars, which have high tensile strength, are placed in the tension zones. The concrete actually bonds with the steel bars forming its own distinct composite material, known as reinforced concrete.

Reinforced concrete emerged as an important bridge-building material in the 1890s and 1900s, and it had become a standardized and widely available material by the 1910s. The two most common reinforced-concrete bridge types – T beam and slab – were among the first standards developed by the SHD in the late 1910s, and they continued with refinements to be among the most common standardized bridge types constructed through the 1960s. Reinforced-concrete bridges are numerous in Georgia, and account for over 1,700 of the nearly 4,000 extant highway bridges dating to before 1966.

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[21] "C. Y. Thomason Speeds Work on Buford Reservoir Project," Dixie Contractor (Jan. 19, 1955), pp. 18-20, 82; "Steel Rising on Bolling Bridge in Buford Reservoir Area," Dixie Contractor (Mar. 21, 1956), pp. 22-23. The three truss bridges over Lake Lanier are: (1) Browns Bridge Road over Lake Lanier, Forsyth County (117-0022-0), 5 spans, 1,372'-long; (2) SR 53 Westbound over Lake Lanier, Hall County (139-0020-0), 4 spans, 1,216'-long; (3) Bolling Bridge over Lake Lanier, Forsyth County (117-0010-0), 3 spans, 800'-long.

The basics of reinforced-concrete bridge technology changed very little after 1920, although, as with steel, scientific advances and instrumentation resulted in a better understanding and control over the material's physical and chemical properties. Georgia bridge engineers and contractors benefitted from the development of new high-strength, lightweight concretes; from retarding agents that when added to concrete allowed it to be trucked over longer distances; and from centralized mixing plants and electronic instrumentation to better ensure the quality and uniformity of the mix. Reinforced concrete is a very economical, low-cost, high-strength material that is easily standardized and continued to be used through 1965.

T Beam Bridges

T beam bridges are composed of cast-in-place reinforced concrete beams with integral monolithic flanking deck sections used for spans of usually 25' to 65' in length. The primary reinforcing steel is placed longitudinally in the bottom of the beam stem, and the deck or flange reinforcing is placed perpendicularly to the stem (Figure 11). T beams were favored by many state highway departments because of their low long-term maintenance and overall economy of material. The T beam is based on the integral connection of the longitudinal beam and deck section proportioned to achieve a light, strong, and economical section. The SHD adopted standard plans for T beam bridges as early as 1917, and it was a workhorse bridge type in the development of the Georgia State Highway System from the 1920s to 1960s. Georgia currently has approximately 1,080 T beam bridges dating from the early 1900s to 1965. There were

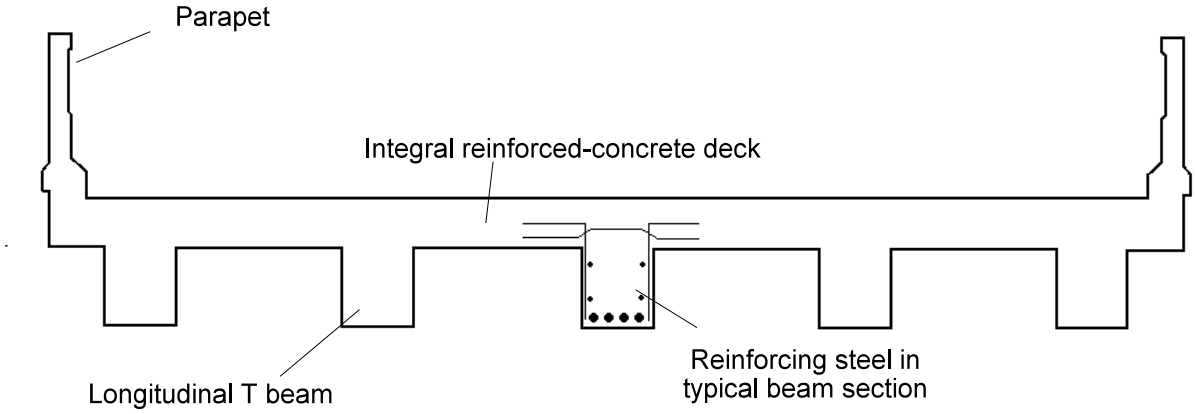

Figure 11. Typical T beam bridge cross section.

few significant changes in the technology after 1920 and later examples are for the most part individually undistinguished and standardized.[22]

Some multi-span T beam bridges from the mid 20th century are continuous designs for reasons of savings in material and elimination of deck joints. The SHD's first long-span continuous-design T beam bridge was built in 1943 to access the Bell Bomber Plant in Marietta, Cobb County (James Jackson Parkway over the Chattahoochee River, 121-0116-0). The impressive, 15-span, T beam bridge with haunched beams was designed by Clarence Crocker and ranks as one of the most significant mid-20th-century bridges in the greater Atlanta area. Continuous T beam bridges use less material than simple-span T beam bridges of comparable lengths, but more importantly offered an alternative to steel bridges, a consideration during the war and into the 1950s due to the military's demand for steel and periodic steel shortages. The haunched continuous designs were, however, difficult to standardize, and even more difficult to design at varying skews and lengths. According to Doug Hudson, almost all of the T beam bridges built in Georgia were simple spans.

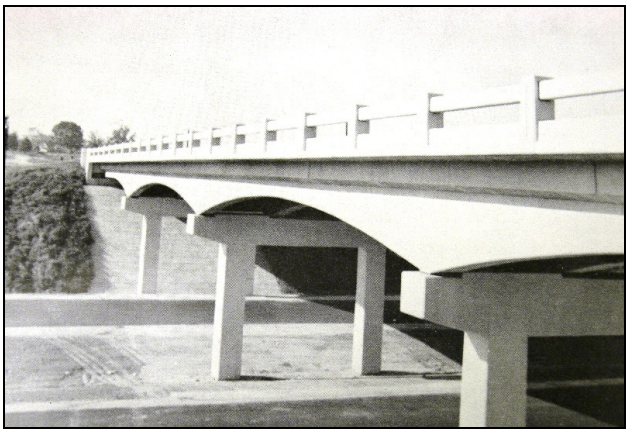

Figure 12. Typical continuous-design T beam bridge. SR 316 over I-85 in Gwinnett County. Source: SHD, Biennial Report (1958).

In 1956, the SHD bridge division did make an attempt to see if continuous T beam designs would be economical for use as a standard overpass type on the interstate system (Figure 12). Lyman Bradley, the BPR regional bridge engineer, reported that Alabama was using the continuous designs at about two-thirds the cost of simple T beam bridges. Alabama's state bridge engineer, John Chambers, gave a presentation on his state's success with the bridges at the annual Southeastern Association of State Highway Officials (SASHO) meeting, which was held in Atlanta in September 1956. In response to the BPR request and Alabama's successful experience, the SHD designed four of the continuous T beam bridges for the I-75 project in Tifton, and, as predicted, the bids came in significantly lower than for a conventional T beam bridge of the same overall length. The contractor, however, "lost his shirt" because he had not factored in the expense of the extra formwork, which had to be set on a firm foundation to prevent settlement, formed to the curve of the beams, and run the entire length of the bridge

[22] T beam bridges are standard fare in most period engineering textbooks. See, for example, Leonard A. Church and Charles Edward O'Rourke, Design of Concrete Structures 2nd ed. (New York: McGraw-Hill: 1926): pp. 105-117; George A. Hool, Reinforced Concrete Construction. Volume III. Bridges and Culverts, 2nd ed. (New York: McGraw-Hill: 1928), pp. 409-413. Numerous statewide bridge surveys and a cursory glance at nationwide NBIS data confirms the ubiquity of the T beam bridge type.

from end to end. Over the next nine months, word got around to other Georgia contractors, and the continuous T beam went from being the cheapest to the most expensive bridge that could be built. The conservative nature of Georgia bridge-building practices shown through.[23]

Reinforced-Concrete Slab Bridges

The reinforced-concrete slab bridge is another very common, early 20th century standardized bridge type that continued to be used through 1965. Georgia has more than 380 precast and cast-in-place examples dating from 1955 to 1965. Slab bridges were used for spans under about 35' long. The bridge type concentrates reinforcing steel in the lower portion and ends where tensile forces and shear are the greatest (Figure 13). The amount of steel and depth of the slab is predicated on length and live-load requirements. Slab bridge technology developed along with other reinforced concrete bridge types, such as the arch and T beam, in the late 19th century and matured during the first decade of the 20th century. Advancement in the understanding of reinforcing placement to accommodate tension and shear forces resulted in reinforced concrete slab bridges becoming one of the favored bridge types for short-span bridges. The slab bridge type proved well suited to the preparation of standard drawings with the result that the nation's state highway departments built literally thousands of nearly identical examples.

Many of Georgia's post-WWII slab bridges are precast rather than cast-in-place as was most common prior to 1941. Precast slab bridges are composed of panels, usually up to about 20' long and between 4' and 5' wide, that were fabricated in casting yards, transported to bridge sites, hoisted into position by crane, and then joined by transverse tie rods and grouting placed between the panels. The standard precast slab

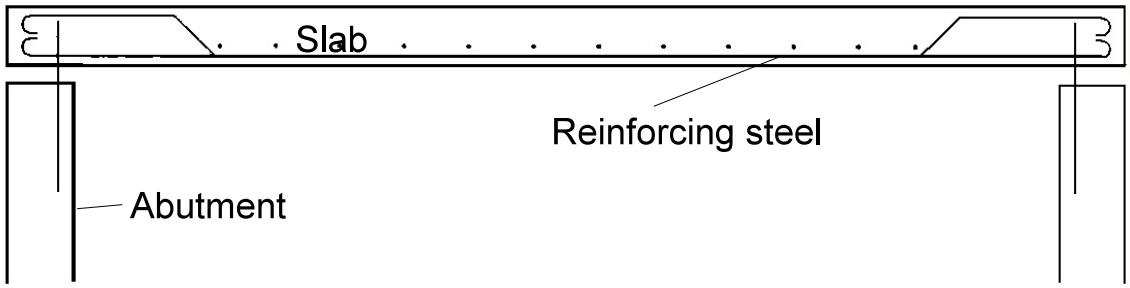

Figure 13. Typical reinforced-concrete slab bridge.

[23] Hudson (2007); John Chambers, "Design and Construction of Long-Span Concrete Bridges," SASHO Proceedings (1956), pp. 112-15.

bridges used in Georgia beginning in the late 1940s were developed by state engineers specifically to address the pressing need for an economical, speedily erected, relatively lightweight, and low-maintenance bridge for H15 live loads on low-volume rural roads. With increased federal and state aid earmarked for rural roads improvement, the slab bridges were seen as an ideal solution to replacing the many wood-decked stringer and truss bridges that had been typical of most county bridge work prior to WWII. Precasting had the advantages of savings in forms and falsework, elimination of on-the-job labor, speed of construction, better maintenance of traffic flow, and closer quality control of concrete. The standard precast designs also reduced the number of engineering man-hours required for relatively routine design work. By the mid-1950s, a number of companies, including the Albany Concrete Products Company and the Link-Belt Company (Atlanta), were supplying a large number of precast units to the SHD and county road commissions based on standard plans developed by state bridge engineers.[24]

Figure 14. "Harry Brown" type, precast slab bridge. Source: Georgia Highway Proceedings (1957).

Early significant examples of precast designs that were developed for Georgia's rural roads programs were identified by the previous study of Georgia's pre-1955 bridges. These included the flat-panel design with the 1'-wide cast-in-place shear keys in the space between the panels and the "Harry Brown type", adopted as a state standard in 1952 with its distinctive, chamfered, 2'-high, concrete curbs designed to withstand impact (Figure 14). The available primary and secondary literature has identified no significant post-1955 variations on the precast slab designs. (This will be confirmed during the GDOT bridge inspection file review.)

Channel Beam Bridges

A channel beam bridge, or waffle slab as it is better known in Georgia, is a precast bridge composed of units that are C-shaped (also known as inverted U-shape) in cross section (Figure 15). The beams are typically 20' to 35' in length and 3' to 4' wide, and can be either reinforced concrete or prestressed concrete (after 1956). The individual beams are locked into a unit by grouted keyways and lag bolts through the beam toes. The channels have diaphragms giving them a waffle-like appearance. There is no visual difference between reinforced concrete and prestressed concrete channel beams, so plan sheets need to be consulted to accurately determine the material.

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[24] SHD, Biennial Report (1955-56), pp. 105-06; C. W. Leftwich, "Road and Bridge Maintenance Problems," Georgia Highway Proceedings (1955), pp. 53-56; J. Roy Fraser, "Precasting Small Concrete Bridges," Georgia Highway Proceedings (1957), pp. 27-43.

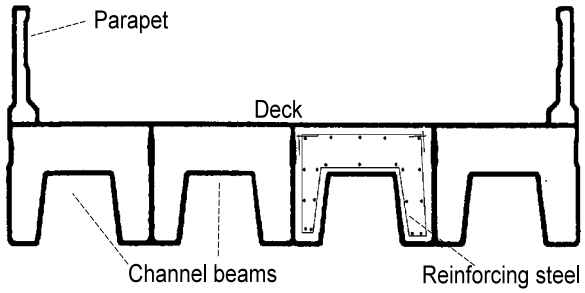

Figure 15. Cross section of typical channel beam bridge.

Channel beam bridges were known in the late 1910s and were one of the SHD's early standardized bridge designs, but no pre-1945 examples are known to survive in Georgia. The channel beam had a resurgence after WWII as one of the precast types promoted as an economical alternative for improving rural bridges. It had the advantage of providing a longer, lighter-weight beam than the precast flat slabs, which were generally limited to spans of less than 20'.

Prestressed-Concrete Bridges

The introduction of prestressed concrete as a bridge-building material was one of the most significant technological advances in America during the 1950s, but Georgia was at the periphery of this development and never a major player. Georgia's bridge engineers, while well aware of prestressed concrete, did not go out of their way to promote its use and based their standard beam designs directly on those proven to be successful and economical in other states. As the price of steel crept upwards during the 1960s, prestressed concrete gradually became more competitive but it did not become the dominant material that it is today in Georgia until the mid 1970s. Prestressed-concrete bridges played an important role in efforts to accelerate the completion and reconstruction of the interstate highways, especially those in metro Atlanta in the 1980s.

Prestressed-concrete beams are internally stressed in compression, usually by high-strength steel wires or cables, to counterbalance the stresses from bending caused by external loads. One of the primary advantages of prestressed concrete is that the designer can make the compressive forces induced into the beam equal to the stresses expected from the dead and live loads and thus counteract the tendency of concrete to develop flexure cracks (vertical cracks that usually start in concrete beams in areas where the bending caused by loads is the greatest). Less deflection also extends the life of the deck. Prestressed concrete is a highly economical use of material that results in strong beams that are lightweight in comparison to conventional reinforced concrete. The beams can be a variety of shapes including "T", channel, slab, voided box, and "I". Nationally, the box and "I" beams were the most common beams used during the mid 1950s through the 1960s, but the SHD only made use of the "I". Prestressed concrete also proved to be a strong, economical material for substructure piling. During the late 1950s, prestressed concrete piles became the preferred alternative to steel and timber piles in Georgia.

Prestressed-concrete beams are made by either pretensioning or post-tensioning. In pretensioning, the steel is positioned, stretched to develop the required stress, and then held in place while the concrete is placed in the forms. After the concrete has cured, the tension in the steel is released and the load is transferred to the concrete. In post-tensioning, the steel is positioned in the unstressed condition in conduits or sleeves and the concrete placed around the sleeves so that the steel is not in contact. After the concrete cures, the steel wire, which is anchored at one end, is stretched by jacking to achieve the required stress, locked in place, and the force transferred to the hardened concrete using anchorages or end blocks. Grout is then injected into the conduits or sleeves.

Prestressed concrete first appeared in bridge applications in Europe during the first decades of the 20th century. Its most noted developer was Eugene Freyssinet of France. Prestressed concrete was slow to spread to the United States, but eventually found its first application in water tanks before World War II. Philadelphia's 1949-51 Walnut Lane Bridge inaugurated the modern prestressed-concrete bridge era. The bridge had 160'-long beams that were cast on site and then post-tensioned. The progress of the Walnut Lane Bridge was followed closely by engineering journals and magazines with the result that many consultant engineers and private concrete-casting companies began to experiment with and develop prestressed-concrete bridge applications. After 1951, many firms entered the field marketing a variety of shaped beams. By the late 1950s, standardized prestressed-concrete beams were used in many states for spans up to about 80', and the nation's leading prestressed-concrete bridge engineers were moving on to new challenges in long-span and continuous-design prestressed-concrete bridges.[25]

Georgia's bridge engineers demonstrated an interest in prestressed concrete but did not rush forward to experiment with it. The primary forums through which SHD engineers learned about and discussed the prospects of prestressed concrete were professional conferences and meetings, like the annual conferences of AASHO and the Southeastern Association of State Highway Officials (SASHO). SASHO's bridge committee almost always had a paper or session on prestressed concrete at annual conferences from 1954 to 1965. In February 1956, William Dean, Florida's state bridge engineer and a national leader in the development of prestressed concrete, spoke at the Annual Georgia Highway Conference at Georgia Tech, concluding in front of the assembled Georgia engineers, contractors, faculty, and students that prestressing had progressed from "an interesting possibility" to a "firmly established construction practice," although Georgia's SHD had yet to build its first prestressed-concrete bridge.[26]

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[25] "Recent Developments in Prestressed Concrete," SASHO Proceedings (1960), pp. 42-43.

[26] W. E. Dean, "Comparative Costs of Prestressed Construction and Conventional Types in Trestle Spans of Florida Bridges," Georgia Highway Proceedings (1956), pp. 10-15.

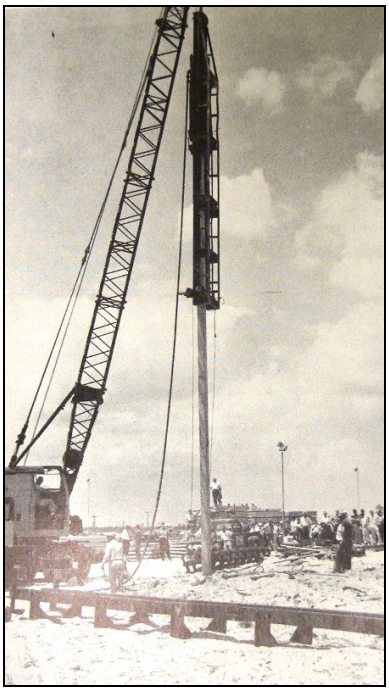

Figure 16. Engineers and contractors gather to watch the driving of a prestressed-concrete pile. The lightweight and strong piles were more easily handled than reinforced-concrete piles. Source: Georgia Highway Proceedings (1957).

In Georgia, the first successful uses of prestressed concrete were not for bridges but for building roof systems. The Albany Concrete Products Company was the state's pioneer developer of prestressed concrete units with most of its early work prior to 1955 involving fabrication of channel and T-section roof panels for low-cost federal housing projects in Atlanta and Columbus. One of the company's largest projects was the roof for the 1956 Singer Sewing Machine Company Warehouse in Atlanta.[27]

While some Georgia architects and builders were eagerly exploring the possibilities of prestressed concrete, Georgia's bridge engineers were more cautious. The first successful use of prestressed concrete in Georgia bridges was for substructure piling (Figure 16). Prestressed-concrete piles offered a lighter weight and stronger alternative to reinforced-concrete piles, which had been used in Georgia since at least the 1920s. The SHD prepared its first standard plans for prestressed concrete piles in 1956. The largest in-state fabricator was the Macon Prestressed Concrete Company, which began operations in early 1956 and was producing in excess of 4,000 linear feet of piles per month by late 1958. Although Macon Prestressed Concrete aspired to do more work for the SHD, its most successful product was prestressed-concrete double-T roof systems.[28]

Contemporaneous with the construction of the 1949-51 Walnut Lane Bridge, several state highway departments, including Pennsylvania's and Florida's, were developing pretensioned, prestressed-concrete beams for use as standard bridge types on their state highway systems with encouragement from the federal BPR and AASHO. Chief federal bridge engineer Eric L. Erickson believed that prestressed concrete could play an important role in standardized bridge construction. BPR, in cooperation with the Prestressed Concrete Institute (PCI), published its first edition of the influential Design Criteria for Prestressed Concrete Bridges in 1954 and a second greatly expanded edition with standard plans in 1956. Among the first places nationally that these types of standardized beams were used was New Jersey's Garden State Parkway in 1953-54.

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[27] "One Answer to New Trends in Concrete Design Usages by Albany, Ga., Firm," Dixie Contractor (May 25, 1955), p. 16; "Prestressed Construction Used on New Singer Building," Dixie Contractor (July 25, 1956), pp. 8-9.

[28] Paul Jones, Jr. "Production and Placing of Prestressed Tee Slabs and Piling," Georgia Highway Proceedings (1959), pp. 57-61.

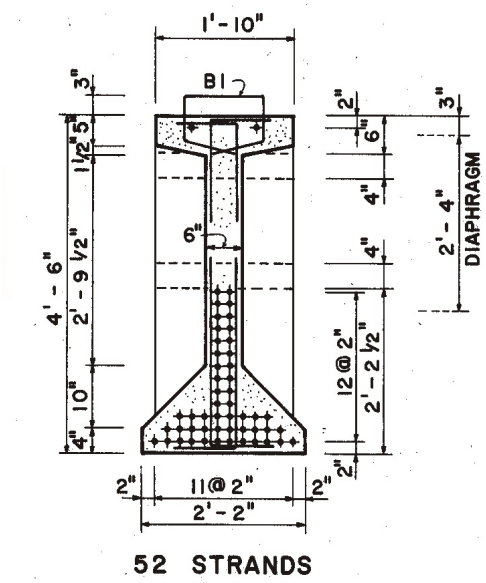

Figure 17. Cross section of BPR-designed prestressed-concrete beam, 1954. Georgia's early beams were based on the BPR's work. Source: Nasser (1979).

Following this, many state highway departments, including Georgia's, began to use the standard AASHO prestressed concrete beams.[29]

Charles Marmelstein reported that the SHD was preparing standard drawings to conform with the BPR design criteria in early 1957, but cautiously concluded that "the economy of this construction in Georgia is yet to be determined." While willing to explore the possibilities, Marmelstein and the SHD were not convinced that prestressed concrete would be cost competitive with other bridge types. In 1957, the bridge division prepared standard plans for prestressed concrete beams of 40', 42', 48', 56', 60', and 64' long. In 1960, standard beams of 70' and 78' long were added. Over the next several years based on experience and analysis of such factors as creep and shrinkage of concrete and relaxation of stress, AASHO's specifications for prestressed concrete bridges became increasingly detailed about such requirements as minimum cover, spacing of prestressing steel, design of end blocks, allowable stresses, and embedment of prestressed strands. The AASHO specifications were incorporated into the SHD's plans.[30]

Charles Marmelstein assigned one of his young engineers, Otis Gillabeau, who had some introduction to prestressed concrete in college, to design the first prestressed concrete beams starting in late 1956. The first six bridges were let to contract in March 1957 on a stretch of I-85 in DeKalb and Gwinnett counties. Vernon W. Smith, Jr. was the senior resident highway engineer assigned to supervise the beam fabrication. The beams, which ranged from 42' to 80' long, were fabricated by Prestressed Concrete of Georgia, located in College Park (Figure 18). Contractor for the bridge erection was the Wainer Construction Company of Valdosta. Fabrication of the beams began in June 1957 and the first three bridges were 90% complete in February 1958. Two of these

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[29] FHWA, America's Highways (1976), p. 433; George D. Nasser, ed., Reflections on the Beginnings of Prestressed Concrete in America (Chicago: Prestressed Concrete Institute), 1981. States out in front on prestressed concrete included Pennsylvania, Florida, Tennessee, and Colorado. See also, Howard Newlon, Jr., "Prestressed Concrete," in Thomas C. Jester, ed., Twentieth-Century Building Materials: History and Conversation (New York: McGraw-Hill), 1995, pp. 115-17; C. A. Marmelstein, "Prestressed Concrete," Georgia Highway Proceedings (1957), pp. 23-26.

[30] Nasser, pp. 319-25; AASHO, Standard Specifications (1957, 1961, 1965); Standard Bridge Plans, undated manuscript in the GDOT Plan Room, Atlanta.

bridges are still in place although widened in 1986 (I-85 over Sweetwater Creek 135-0052-0/135-0053-0).

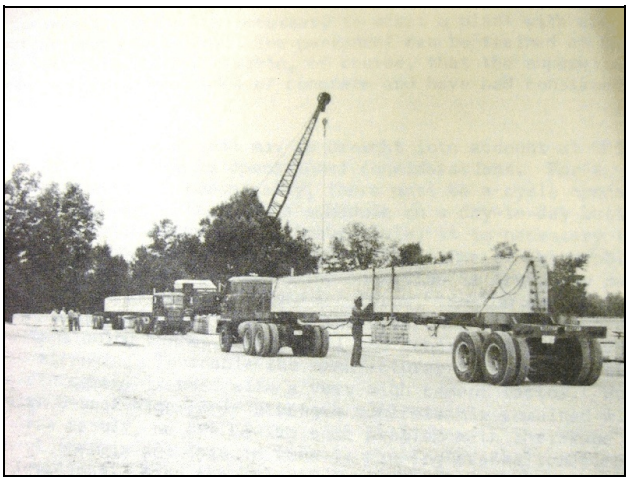

Figure 18. A prestressed-concrete beam is loaded at the College Park fabricating yard for transport to the bridge site on I-85. Source: SHD Biennial Report (1958).

Smith reported on the SHD's field experience with prestressed concrete at the Annual Georgia Highway Conference in 1958. Although he was willing to conclude that "prestressed concrete is a good bridge construction medium," he also noted that unanticipated problems and additional costs had made the SHD's first experience with prestressed concrete disappointing in many ways. The SHD lab had no experience testing high-tensile strength tendons and after much research and several failures eventually was able to devise acceptable methods. The first beams developed horizontal cracks in the end blocks, necessitating a revision in plans for additional reinforcing bars. A major problem was controlling the curing of the beams, requiring cool water trickling on the beams in hot summer weather, and steam curing in cold winter weather with constant monitoring to ensure no quick fluctuations in temperature that would damage the beams. Some beams were post-tensioned, rather than pre-tensioned, and these encountered problems due to friction and binding of the tendons, and even the loss of several of the expensive tendons due to overstress damage. Another significant factor in increasing the cost of the prestressed-concrete bridges was the requirement of special expansion-end bearing plates of bronze, which were high-priced and easily damaged. As a result, the SHD lab began investigations into neoprene (rubber-like) bearing plates.[31]

From June 1957 to June 1959, the SHD reported letting to contract 41 prestressed-concrete stringer bridges because of the slow delivery of steel beams. Most of the prestressed-concrete bridges were built on the interstate highway system with encouragement from the BPR to advance construction as quickly as possible. In addition to 14 prestressed concrete bridges on I-85 between Atlanta and the South Carolina line (Figure 19), another 11 were placed on I-75 near Tifton. A number of these bridges are extant.[32] One of the reasons for these projects was that the SHD

[31] V. W. Smith, Jr., "Plant and Field Experience with Prestressed Concrete," Georgia Highway Proceedings (1958), pp. 112-19.

[32] Extant examples in Tifton County include Adcock Road over I-75 (277-0025-0), Omega-Eldorado Road over I-75 (277-0067-0), and Oak Ridge Road over I-75 (277-0020-0).

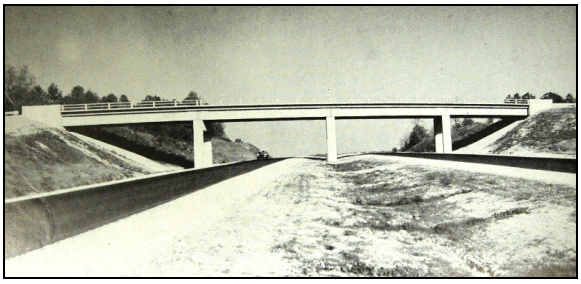

Figure 19. One of the SHD's first prestressed-concrete stringer bridges on I-85 in Gwinnett County. Source: SHD, Biennial Report (1958).

wanted to determine if prestressed concrete beams could be delivered more quickly and at less cost than steel beams, which could take up to two years to be delivered and that was not acceptable for accelerated interstate construction. Building bridges quickly and efficiently was one of the keys to progressing interstate projects since grading and roadway work could not be easily completed without them.[33]

The prestressed-concrete bridges, however, tended to come in about 10% higher in price than the alternative steel or reinforced-concrete designs, which dampened enthusiasm for the new material in Georgia. The time savings did not turn out to be as great as had been hoped because of continued inefficiency and quality-control problems in Geogia casting yards. In about 1960, for example, the bridge division approached Macon Prestressed Concrete's Vice President Paul Jones about supplying beams for a series of long overflow bridges on I-16 coming out of Savannah. The thought was that per unit cost of beams might come down on such a large project. Macon Prestressed Concrete's estimate still came in higher than expected, and the SHD lost interest. Macon and the other prestressed concrete fabricators in Georgia reportedly lacked the capital to invest in the equipment, space, and experienced personnel that might have made large-scale operations more efficient and thus less expensive.[34]

Prestressed-Concrete Bridges on County Roads

There is little evidence that Georgia counties were any more progressive than the SHD in the early use and application of prestressed concrete. A few county commissions appear to have been receptive, but most were not. Of the approximately 90 pre-1966 prestressed concrete bridges in the study population only 26 are county-owned bridges. Spalding County has 18 of the 26 bridges dating from 1956 to 1959. They are classified as prestressed-concrete slab bridges with 20'-long spans. The Troup County road commissioners reported that they began using a standard prestressed-concrete channel beam bridge in 1962, and four examples dating to 1965 are in the study population.[35]

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[33] Erickson (1956), pp. 101-07.

[34] SHD, Biennial Report (1957-58), p. 108; Hudson (2007); Jones (1959), pp. 57-61.

[35] Earl Edwards, "Troup County Finds "Free" Labor Best," Georgia County Government Magazine (Oct. 1962), pp. 11-13.

Timber Bridges

Wood's primary advantages as a bridge material are its natural abundance and its ability to be acquired and worked with but a few simple tools. Its inherent disadvantages are susceptibility to natural deterioration from fungi, insects, and moisture; high maintenance requirements; lack of resistance to fire; and strength properties, which depend on the species of tree but generally limit its effective use to bridges carrying, by modern standards, relatively lightweight loads over short spans. The shortcomings of timber bridges were among the primary impetuses to the development of iron bridges for railroad usage during the 19th century, and timber bridges also became less desirable for use on highways with increased motor vehicle usage during the 20th century. Nonetheless, they have continued to be built primarily for reasons of economy, although usage has been mostly relegated to low-volume roads in sparsely developed settings. As of 2007, GDOT's bridge inventory reported more than 150 timber bridges in use, mostly on county roads. These bridges typically are short-span bridges (less than 20' long) and less than 30 years old, reflecting the fact that timber bridges, due to the nature of the material, have relatively short life cycles. The study population includes 11 timber stringer bridges built from 1955 through 1965 that are part of the continuum of timber bridge building in Georgia. Although the SHD did not have standard timber stringer bridge plans, it did require that the wood be graded and selected according to the Southern Pine Association's rules and specifications.[36]

Movable Bridges

The 1955-65 study population includes one bascule bridge – the 1963 Island Expressway over the Savannah River in Chatham County (051-0132-0). (Further context for this bridge will be developed following a review of plans and files at GDOT.) After WWII, the SHD made a concerted effort to replace movable bridges with high-level, fixed-span bridges that would provide adequate vertical clearance to navigation and eliminate delays to traffic. As well, movable spans were expensive to operate and maintain.

[36] SHD, Specifications (1966), p. 511.

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Office of Environment/Location
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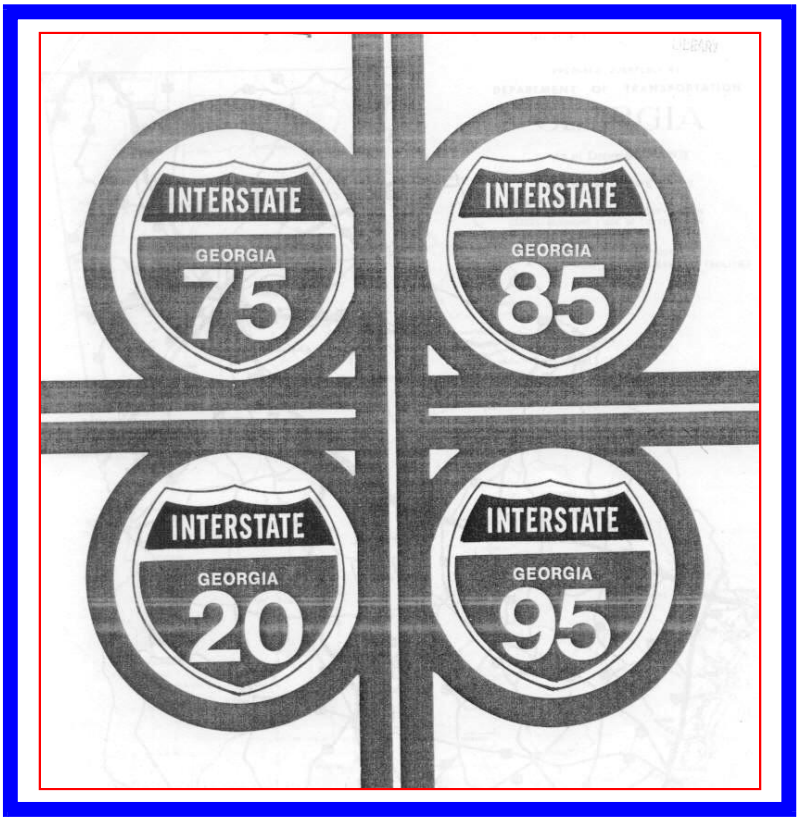
Historic Context of the Interstate Highway System in Georgia



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Georgia's Interstate Timeline

PART 5

1916 to 1943 – The Pre-Interstate Period

National

1916 Federal-aid highway program is established with 50/50 federal-sate match for primary highways. The federal Bureau of Public Roads (BPR) is charged with administering the program, which can only be used to construct roads in rural areas.

1919 Construction begins on New York's Bronx River Parkway, America's earliest limited-access public highway of any length designed for motor cars. Completed in 1925.

1923 New Jersey begins construction of America's first unrestricted-use superhighway, the 13-mile-long approach to the Holland Tunnel in Jersey City. It marks the first application of economic theories of location and operation to highways using balanced design. Completed in 1932.

1938 In response to national interest in a system of cross-country highways, BPR issues *Toll Roads and Free Roads*, which recommends a network of interstate freeways to and through America's cities.

AASHO adopts the first of its *Policies on Geometric Highway Design*, which popularize the concept of balanced-design highways.

1941 The Pennsylvania Turnpike opens. The original 160-mile section is in a rural setting with gradual grades and consistent geometry. The toll road proves that America wants such high-standard, high-speed highways. Funding for construction is provided, in part, by federal, Depression-era work relief programs.

Georgia

1916 State Highway Department of Georgia (SHD) is established to distribute federal road aid to counties on a 50/50 matching basis.

1919 Georgia establishes its first system of state highways connecting county seats.

1935 SHD starts construction of Georgia's first dualized highway, the 17-mile Atlanta-Marietta Highway (US 41). Intended to be "the most advanced design" in the state. Its benefit was quickly lost because roadside development was not restricted. Completed in 1938.

1936 With BPR support, the SHD establishes the Division of Highway Planning to complete traffic studies that will inform future dualized (four lane with median) highway construction.

1942 The Columbus-Fort Benning Road (US 27) is a watershed in highway design in Georgia. Built as part of the war effort and completed in 1944 at the behest of the BPR, it is the earliest example of the balanced-design concept applied to dualized highways in Georgia. It influences subsequent dualized highway design, particularly the Atlanta

Atlanta-Marietta Highway, 1938

Georgia's Interstate Timeline

1944 to 1956 – The Early Interstate Period

National

1944 Federal-Aid Highway Act of 1944 is milestone legislation that finally permits the use of federal aid in cities, marking, at long last, the start of a national system for addressing urban traffic congestion. It also authorizes establishing a 40,000-mile-long National System of Interstate Highways to connect major cities, industrial centers, and the nation's borders.

1947 The states and BPR release the first map identifying the proposed interstate routes. Georgia's interstate highways include the six highways radiating from Atlanta as the nucleus of the system and another highway along the coast.

The American Association of State Highway Officials (AASHO) adopts the first *Policies on Geometric Highway Design*, which will form the basis for the policies issued to govern construction of the interstates starting in 1956.

1956 After years of political squabbling, Congress passes the Federal-Aid Highway Act of 1956 that provides the 90% federal funding to complete the interstate highway system proposed in 1944.

AASHO establishes a uniform design policy for the interstate highways.

Georgia

1945 H. W. Lochner & Co. begins preparation of the metro Atlanta comprehensive highway and transportation plan. Finalized in 1947, it identifies the Atlanta Expressway as the urban portion of the proposed interstate highways with a 1.2-mile connector through the heart of central Atlanta. The expressway is the hub for the state's interstate plan with routes radiating to Chattanooga, Birmingham, Spartanburg, Augusta, and Savannah.

1948 Construction of the Atlanta Expressway begins using pre-interstate highway design standards, but staged construction is very expensive and slow. It will not be completed until 1959 and only after an infusion of federal dollars after 1956. The downtown connector is not completed until the fall of 1964.

1955 Circumferential and distributing highways, like I-285 around Atlanta, are added to the interstate system plan.

The Georgia legislature finally passes limited-access legislation to control roadside development along high-speed highways. Prior to 1955, limiting access was permitted only in Fulton County.

1956 SHD establishes Division of Public Relations, largely in response to public concerns about interstate construction in urban areas.

Contracts for the first section of highway with an official interstate designation, the 3.3-mile-long Forsyth Bypass (I-75), is let in Dec. 1956 and completed by the end of 1958.

SHD begins using a computer to solve earthwork and bridge design problems to increase the efficiency of the interstate design effort.

Atlanta Expressway, 1956

Georgia's Interstate Timeline

PART 5

1957 to 1966 – Constructing the Interstate System & The Freeway Revolt

National

1962 In response to the slow progress and opposition to urban freeways, Congress requires cities to develop comprehensive regional transportation plans as part of the Federal-Aid Highway Act of 1962. Federal-aid funds can be withdrawn if plans not complete by 1965.

1964 In recognition that cities can't build enough freeways to solve urban traffic congestion, Congress passes the Urban Mass Transportation Act to design and build mass transit systems. However, funding is limited.

1966 Congress agrees to use the Highway Trust Fund to pay for the construction and operation of mass transit systems.

The National Historic Preservation Act codifies in the Section 106 process the federal government's commitment to protecting properties effected by federal programs, including interstates.

The U.S. Department of Transportation Act recognizes the multi-modal character of transportation, folding the BPR, along with 30 other federal transportation agencies, into the USDOT. The act makes a strong commitment to preservation of the scenic and built environment through the provisions known today as 4(f).

Georgia

1958 Construction begins on the first 3-mile section of I-285 near the GM plant in Doraville. It takes over 5 years to complete and is indicative of the slow progress on urban sections of interstates.

1959 Atlanta's Metropolitan Planning Commission recommends adding 104 freeway miles to the original 1947 Lochner plan. The proposed Stone Mountain Freeway across Decatur and Druid Hills is met with particularly strong opposition. It is symptomatic of the "Freeway Revolt" beginning to play out across the nation.

1962 Georgia completes about one third of its 1,100-mile interstate system, but most of the progress is in rural areas.

1963 Georgia's three-man state highway board is replaced with a ten-member board to make it less political and more businesslike in conducting the SHD's affairs.

1965 A controversial intermediate loop (I-485) is added to the metro-Atlanta interstate plan. It is immediately opposed by neighborhood groups in Candler Park, Inman Park, and Morningside.

1966 One-third of the right-of-way needed to complete Georgia's interstates has yet to be acquired.

Opening a Section of I-75 near Tifton, 1959

Georgia's Interstate Timeline

PART 5

1967 to 1975 – Struggling to Complete the Interstate System

National

1967 In response to traffic-safety concerns and fatalities, AASHO releases its *Highway Design and Operational Practices Related to Highway Safety* report. Scientifically tested recommendations, from break-away poles to clear zones, re-think highway safety and result in campaigns to replace the safety features on interstates and other highways.

1969 The National Environmental Policy Act (NEPA) is signed into law establishing a broad national policy toward preventing environmental degradation through federal actions, including interstate construction. NEPA requires Environmental Impact Statements (EIS).

1973 The Arab oil embargo leads to a decline in transportation revenues. Inflation increases the cost of road and bridge projects, hampering the completion of the final interstate sections.

Congress authorizes the use of the Highway Trust Fund to pay for safety improvement programs, like pavement markings and removal of roadside hazards on all classes of federal-aid highway.

Georgia

1968 Only about 800 of Georgia's 1,100 mile interstate system is complete. The system was originally scheduled to be complete by 1969. The delay is typical of other states throughout the nation.

1971 A federal court places I-485 on hold due to lack of an adequate EIS. Then the EIS is rejected in 1973 by the USDOT for an insufficient mass transit component. The plans for I-485 are officially withdrawn by GDOT in 1974.

1972 The SHD is reorganized as a the Georgia Department of Transportation (GDOT).

1974 Since I-485 (intermediate loop) has been placed on hold, GDOT also withdraws plans for the Stone Mountain Freeway.

1975 Thomas D. Moreland is appointed commissioner of the state transportation board. He commits to finishing the interstate system and beginning a major effort to reconstruct and upgrade Georgia's interstates. In response, The Georgia legislature allows GDOT to borrow money through bonds, abandoning the decades-old "pay-as-you-go" system of highway financing.

Aerial View of the Atlanta Downtown Connector, 1964

Georgia's Interstate Timeline

PART 5

1976 to 1988 – Completing and Reconstructing the Interstate System

National

1976 Federal-Aid Highway Act of 1976 expands the definition of allowable work using interstate construction funds. The so-called 3 Rs are resurfacing, rehabilitation, and restoration. Thomas Moreland and Georgia's congressional delegation play a significant role in drafting the federal legislation favorable to Georgia's interstate plans for upgrading capacity and safety.

1978 The federal Surface Transportation Assistance Act (STAA) marks a federal policy shift and for the first time earmarks funds for the 3 Rs.

1981 A fourth R – reconstruction – is added by the Federal-Aid Highway Act of 1981 (so called I-4R) funds.

Georgia

1976 Moreland taps federal turn-back (i.e., discretionary) funds to pay for Georgia's interstate construction. Turn-back funds are those federal funds allocated but not used by other states.

GDOT begins using discretionary funds for reconstruction of the metro Atlanta interstate system. The so-called "Freeing the Freeways" campaign focuses on widening and improving safety features.

1978 The final sections of Georgia's original interstate system are completed. GDOT dubs fiscal-year 1978-79 Georgia's "Year of the Interstates."

1981 Georgia's interstate reconstruction effort is far ahead of that of other states due to pre-financing and tapping turn-back funds with the federal government owing the state more than $476M.

1983 GDOT is so adept at planning and executing its interstate reconstruction effort using turn-back funds that the state is receiving $2.50 for every gas-tax dollar it sends to Washington.

1988 The opening of metro Atlanta's Memorial Drive interchange marks the completion of the nation's premier urban interstate reconstruction project of the era.

Cover of SHD Report, proclaiming Georgia's "Year of the Interstates, 1978-79."

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Historic Context of the Interstate Highway System in Georgia

Introduction

Although the story of Georgia's interstate highways reflects the unique aspects of local history and politics, the effort to build its approximately 1,100 miles of interstate highway also mirrors a much wider national context. Elements of the story include the passage of the 1956 federal legislation establishing the funding mechanism that facilitated construction of the interstate network, the rise of the environmental movement and its effect on construction, the use of new technologies and design standards for accelerated construction, and the effort to reconstruct many miles of the earliest-completed urban interstates during the 1980s. All of the issues that characterize the national story played out in their own way in Georgia. And, as in many other states with a dominant metropolitan center, the Georgia story is very much about Atlanta and the great effort expended on solving its traffic problems.

What stands out in the Georgia context, and distinguishes it from the rest of the nation, is the administration of the state's interstate program under the leadership of Thomas D. Moreland, P.E., State Highway Engineer starting in 1973 and State Highway Commissioner from 1975 to 1987. Moreland brought to his dual responsibilities a drive for excellence and a vision for the mission that moved the Georgia Department of Transportation (GADOT) to a proactive position capable of doing the seemingly impossible – completing the original routes by early 1979 and then, by 1989, rebuilding and upgrading the metro Atlanta interstates, one of the largest urban reconstruction campaigns of its day. In many ways, Georgia was the envy of the nation because of its aggressive and innovative programs that allowed the state to first complete its interstate system and then begin reconstruction of the most heavily used sections in the metro Atlanta region.

This is the context of the Georgia Department of Transportation's responses to the challenges associated with construction of more than 1,100 miles of interstate highway in the 32 years from 1956 through 1988.

The National Interstate Context: Federalism and Standards

In 1956, Congress passed the Federal-Aid Highway Act that established the goal of constructing a 41,000-mile National System of Interstate and Defense Highways using an accelerated schedule over the next 13 years. By and large, the national system was completed as planned, although construction took longer and cost much more than originally anticipated. Urban areas proved particularly problematic for a variety of reasons. Prior to 1944, federal funds were largely prohibited from use in municipalities with populations greater than 2,500, and absent federal aid, there simply wasn't the means for most urban centers, like Atlanta or Macon, to keep pace with the demand for adequate highway planning and construction. And even when federal aid for urban

roads finally became available, the scale and the costs of urban highways, like the Atlanta Expressway, were so massive that few cities could begin much less complete such projects until the infusion of federal money. And then, shortly after sufficient funds finally arrived, so did the opposition that blocked construction of many sections of interstate routes through established neighborhoods starting in the mid- to late-1960s.[1]

Congress approved the means for interstate system construction in 1956, but the program has a much longer history. The origins of the effort date to the mid 1930s when thinking about limited-access highways was linked with solving traffic congestion. Several congressmen repeatedly proposed legislation authorizing a scheme of six north-south and three east-west cross-country toll roads, justified mainly as a way of putting people to work during the Great Depression. The German *autobahn* influenced their proposal, but it never came into being largely because federal Bureau of Public Roads (BPR) officials had always opposed toll financing of highway construction. BPR considered tolls a double taxation against motorists, whose gas taxes were used to pay for road improvements. Starting in 1933, states were allowed to use work-relief federal funds for urban extensions of federal-aid highways, but it was not until 1938 that non-work relief federal funds could be used to address urban traffic congestion. That same year, the BPR mandated that state highway departments conduct traffic planning surveys in an effort to have road-improvement decisions based on objective data, which proved that the greatest need was exactly in those urban areas that heretofore had been excluded from federal aid. As more Americans moved to cities, BPR officials were finding that the largest challenge facing road builders was ever-increasing urban traffic congestion, but their response was slow as was states' ability to take advantage of federal funds in urban areas. The two issues of trunk highways and the urban traffic problem came together in the BPR's 1938 report entitled *Toll Roads and Free Roads*, which proposed a system of about 25,000 miles of free roads connecting and, importantly, running into the nation's cities.

The war in Europe quickly distracted attention from highways, but President Franklin Delano Roosevelt appointed a National Interregional Highway Committee in 1940 to study this and other ideas. The committee's 1944 report entitled *Interregional Highways* endorsed BPR's *Toll Roads and Free Roads* vision but with 40,000 miles of high-standard, high-speed express highways to and through the nation's cities, including the five routes radiating from Atlanta toward Spartanburg, Chattanooga, Birmingham, Montgomery, and Macon. The committee's report gained a sympathetic hearing among congressmen worried that the nation might slip back into a depression with the end of war and the stand down starting in 1945. In response, many state highway departments, including Georgia's, began preliminary planning for the tentative interregional routes shown in *Toll Roads and Free Roads* and *Interregional Highways*.

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[1]For a more detailed overview of Georgia's pre-1956 urban highway development, Lichtenstein Consulting Engineers, "Historic Context for Dualized Highways in Georgia, 1935-56," (Dec. 2004), prepared for the Georgia Department of Transportation, Office of Environment/Location.

With the end of the war, more serious planning began, and in 1947 the states and the BPR released the first map identifying the routes of an interstate system of limited-access, high-speed highways (Figure 1). But political bickering about the cost of such a system would result in nearly a decade of uncertainty about its size and shape. The uncertainty was not resolved until passage of the Federal-Aid Highway Act of 1956.

The Federal-Aid Highway Act of 1944 did rectify the exclusion of federal aid from urban areas by providing substantial funding, and it was considered a milestone in federal highway legislation at the time of passage. It provided for the first national program of highway improvements integrating urban roads into the existing primary and secondary rural roads systems. It significantly altered how the states and the federal government approached transportation planning because, at long last, the worst problem – urban traffic congestion – could start to be systematically addressed. During the last years of World War II, BPR engineers worked with state and municipal officials to prepare plans for urban expressways that would be started with the cessation of hostilities.[2] The BPR's chief urban design engineer reviewed the plans for at least 100 major urban centers, including Atlanta, the southeast's transportation hub. But even with the ability to address urban traffic congestion, the problems were still not easily solved. Indeed, some argued that they would never be solved. The historic struggle between urban interests and the rural interests that controlled BPR thinking and policy until the late 1930s, which also played out in state legislatures, profoundly affects urban centers to this day, especially in metropolitan regions, like Atlanta, that experienced explosive post-World War II growth. Due to the relatively slow start on construction of urban highways, followed by the post-1965 effects of the environmental movement, urban highways in such cities have rarely been able to match capacity with demand.

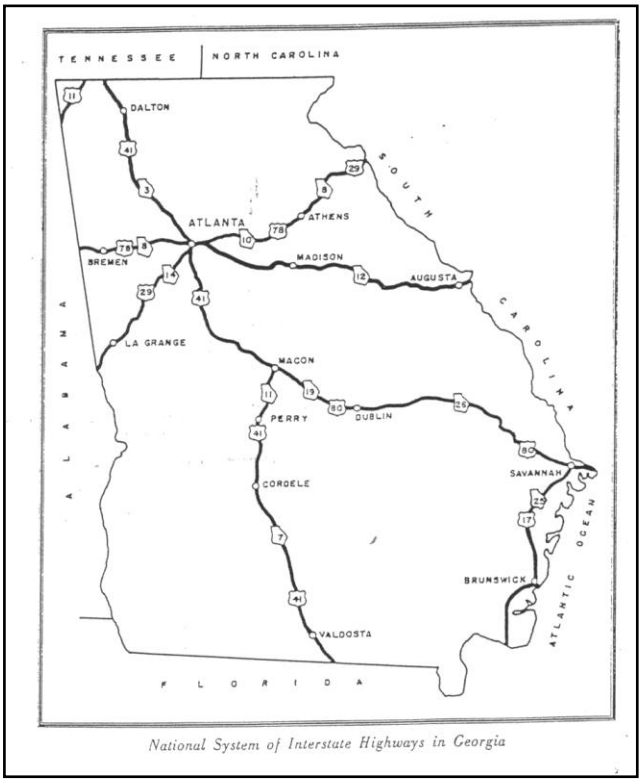

Figure 1: Preliminary map of the National System of Interstate Highways in Georgia, adopted in 1944 and approved by the BPR in 1947. The expressways radiating from Atlanta formed the nucleus of the system and were incorporated in the 1947 Lochner Plan. Source: GSHD, Biennial Report.

[2] Urban expressway planning continued into the postwar period.

Getting Started

The Federal-Aid Highway Act of 1956 marks the beginning of large-scale construction efforts on the National System of Interstate and Defense Highways. Rather than creating the system, it is more accurate to say that this landmark legislation resolved major problems related to funding a national uniform system of superhighways that had been authorized in 1944 and initially mapped in 1947. Thus, the 1956 legislation culminated 20 years of thinking about highway engineering and urban traffic congestion. Most significantly, the 1956 act established the 90% federal and 10% state funding formula for the accelerated construction of the interstate system. That network was expanded in 1955 to include urban distributing and circumferential routes. The act of 1956 thus inaugurated this nation's largest public works project that has so influenced people's lives and the nation's economy. But the federal government did not build the interstate highway system – the states did, each using their own approaches, policies and preferences.

Essential to understanding Georgia's interstate highway system is the organizational and administrative structure that guided its development. Interstate highways were built under *federalism*, in which the national government shared power and decision making with the individual states. Although the federal government paid the lion's share of construction costs under the 90/10 federal-aid formula, state highway departments performed and oversaw the actual work of locating, designing, and building the interstates, albeit to federal standards. Federal engineers approved state-prepared plans and allowed each state flexibility within the national design guidelines. As a result of the ability for variation under federalism, the historical pattern of interstate development differed from state to state, but every state worked within the same general administrative framework.[3]

The Origin of Interstate Highways in Georgia: The Lochner Plan and Atlanta Expressway

The plan prepared in 1946 to address metro Atlanta's traffic congestion represents the start of the interstate highway era in Georgia. Late in 1944, the Georgia State Highway Department, in cooperation with the City of Atlanta, Fulton County, and the BPR, turned to H. W. Lochner & Company, a newly founded transportation planning firm in Chicago, to prepare a comprehensive highway and transportation plan for the region based on traffic survey data gathered by BPR and the department from 1936 to 1945. In keeping with *Toll Roads and Free Roads* with its combination of interregional and through urban

[3] For a definitive overview of the origins of the federalist system of highway administration, Bruce Seely, Building the American Highway System: Engineers as Policy Makers (Philadelphia: Temple University Press, 1987).

routes, the plan identified what would be the "urban portions of the interstate highways identified on the 1944 map . . . [as] major arteries radiating from Atlanta toward Spartanburg, Chattanooga, Birmingham, Montgomery, and Macon" and a sixth arterial route toward Augusta identified by the Georgia State Highway Department as the nucleus of the state's interstate highway network (Figure 2). The plan also developed that network's most problematic feature – the section through downtown Atlanta that connects four of the six radiating routes. Interestingly, the radiating expressways were based on the existing regional railroad network plan and is just a later iteration of the historic transportation patterns laid down in the railroad era.[4]

The Lochner plan was hailed in the late 1940s as the solution to the worst of Atlanta's traffic congestion and safety problems, and its main component, the Atlanta Expressway, was to be the most "modern" highway ever in Georgia. The primary link of this radiating system of expressways was to be a below-grade, limited-access connector through the heart of the city and extending around the north, east, and south sides of the central business district. The goal of the plan was to locate the radiating expressways along existing traffic flows in order to be able to serve the greatest feasible number of vehicles within the urban core, as well as around it. The initial estimate was that 60% of the traffic using the connector would be local in nature, bound for downtown. To the greatest extent possible, the routes were intended to go through "marginal neighborhoods," and the radiating expressways were to conform to the "most modern highway design standards as developed by the Federal

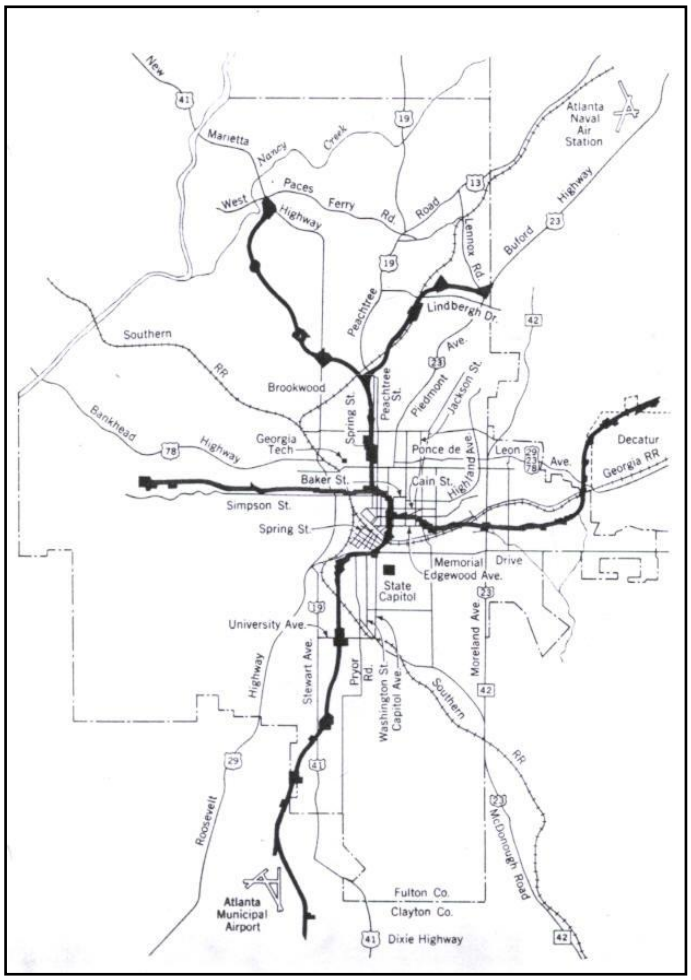

Figure 2: The 1947 Lochner plan for the metro-Atlanta expressway system showing radial freeways and downtown connector. Source: Lochner 1947.

[4] H. W. Lochner & Company and De Leuw, Cather & Company, Highway and Transportation Plan for Atlanta, Georgia, prepared for the State Highway Department of Georgia and the Public Roads Administration, Federal Works Agency (January 1946).

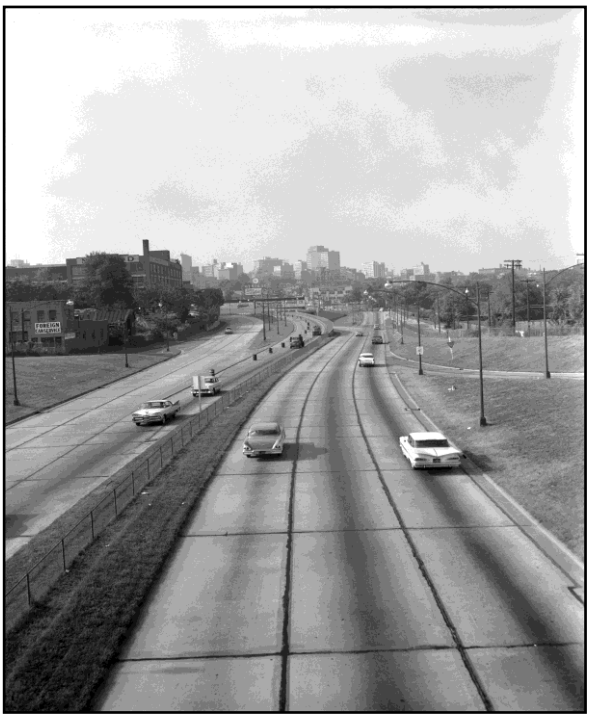

Figure 3: Sections of the Downtown Connector were opened as they were completed, as shown in this October, 1959 view. Note the geometric design with either no improved shoulder or a narrow shoulder/drainage gutter. Source: Atlanta History Center.

Interregional Highway Committee."[5] Such layouts reflected the thinking of most urban road builders, and many planners as well, since marrying road construction and "slum clearance" (later named urban renewal) offered the best chance of minimizing property acquisition costs for the new highways.[6]

Construction on the Atlanta Expressway began in 1948 using pre-interstate highway design standards, but higher than anticipated right-of-way acquisition and construction costs, public relations problems, and changes in the highway design stymied notable progress for most of the years prior to 1956. There was a spurt of construction activity between 1948 and 1952, but the city and county had to approve an additional $12.7 million in bonds to keep the project going after 1952. As many as 3,000 parcels had to be assembled for a mile-long section of the route. Additionally there were difficult and politically controversial decisions to make about the alignment of the downtown connector, and the region's explosive growth caused the engineers to rethink the roadway geometry. Additional lanes were recommended, and that decision caused further delays and, of course, higher costs. By the summer of 1958, ten years after construction was started, only 18 miles of the state's premier urban project were actually open to traffic. It was only with passage of the 1956 Federal-Aid Highway Act and its infusion of funds for interstate highways that the 1.2-mile long downtown connector was opened in September 1964 at a cost of $33 million (Figure 3, Figure 4). It was dedicated with a great fanfare, including a special expressway section in the Atlanta Times with articles on topics like how to negotiate the connector.[7]

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[5] Ibid., pp. xiii, 14.

[6] Mark H. Rose and Bruce E. Seely, "Getting the Interstate System Built: Road Engineers and the Implementation of Public Policy, 1955-1985," Journal of Policy History, Vol. 2, No. 1 (1990), pp. 36-7.

[7] Sam Allison, "Atlanta Expressway to Move Rapidly During 1958," Georgia Highways (Jan. 1958), n.p.; Atlanta Times (Oct. 15, 1964). The design standards used starting in 1948 did include 12'-wide travel lanes but not full shoulders or sufficient acceleration and deceleration lanes. The wide median was quickly eliminated for additional lanes separated by a chain-link fence, and the Brookwood interchange between the Northeast (I-85) and Northwest (I-75) Expressways with the Connector and local streets had sharp curves and steep grades. Between 1948 and 1952, the section from Baker Street north

Initial Impact of the Atlanta Expressway

Figure 4: Downtown Connector looking south from North Avenue showing short acceleration lane and fixed objects lining the travel lanes. Source: Atlanta History Center.

The impact of the Atlanta Expressway on the history of the metro Atlanta region and the state of Georgia was and continues to be tremendous. Longtime Atlanta police chief Herbert Jenkins in his 1977 memoir recounts that the era of the expressway changed Atlanta as much as the coming of the automobile, and that the Lochner plan moved the city from small town to great international city because traffic could now move about it. He recounts that "people were incredulous that a road in the center of the city did not have stop lights." The expressway and upgrading of local streets to feed it also represented a major reorientation in thinking about the region's transportation systems by making the highway, and not the railroad, the dominant system. Implementation of the Lochner plan transformed the Atlanta region into a vast trucking terminal with expressways radiating from the city center hub (just as the railroads had done) and connecting to major cross-state and interregional routes.[8]

Well before the downtown connector was finished in 1964, planners and engineers knew that the Atlanta Expressway, particularly the connector, had reached capacity despite having been upgraded during construction from a four-lane to a six-lane facility. Traffic volumes on the expressway's north leg topped 65,000 vehicles per day and 8,000 vehicles per hour during the morning rush. Amazingly, the daily traffic counts in 1958 were greater than the Lochner plan projection for traffic volumes in 1970 with enough traffic between Fourteenth Street and the Brookwood interchange at the evening peak to justify a 16-lane-wide roadway. The numbers were a sure sign of continued traffic congestion problems ahead and the need for improvements, but circumstances and attitudes would change making it impossible to remedy those late-1940s decisions based on the Lochner plan.[9]

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to Lindbergh Drive on the northeast leg and to near Paces Ferry Road on the northwest leg were completed as was the southern leg from University Avenue to the Clayton County line.

[8] Herbert T. Jenkins, Atlanta and the Automobile (Atlanta: Center for Research and Social Change, Emory University, 1977), pp. 133-41; Lichtenstein Consulting Engineers, "Georgia Dualized Highways" (Dec. 2004), pp. 24-25.

[9] Metropolitan Planning Commission, Crosstown and By-Pass Expressways, Expressway Policy Study, Report No. 2 (June 1959), pp. 12-16.

Establishing the National System of Interstate and Defense Highways in 1956

Many if not most states, including Georgia, struggled to complete their urban expressways. The reasons for slow progress on these desperately needed urban highways were many, including materials shortages, first because of inflation and then the Korean Conflict. State road organizations, like the Georgia State Highway Department, were also challenged by a shortage of civil and structural engineers. Engineering "manpower" had been affected by the war, but even as the GI Bill led to dramatic increases in student populations, many new fields of engineering (computers, materials, aviation and aerospace, nuclear power) were attracting students away from civil training. Thus as state construction programs geared up to meet traffic demands and to spend the larger appropriations coming from Washington, highway departments like Geogia's scrambled for enough trained engineers and bridge designers.

As demonstrated by the Atlanta Expressway, the more difficult problem was paying for the expensive, limited-access highways. State highway department budgets simply did not grow as fast as federal-aid allocations, which initially required a 50% state match. In addition to the urban expressways, there was much work to do to redress road and bridge maintenance that had been deferred during World War II. Many state highway departments failed to claim all of their federal-aid highway funds for 1947 and 1948 because they could not meet the 50/50 match, leaving an unobligated backlog of more than $500 million. That prompted President Harry S. Truman to eliminate all federal-aid highway funds from the 1949 budget and to propose sharp reductions in the appropriations for 1950 and 1951.

One solution to paying for superhighways was toll financing. The success of the Pennsylvania Turnpike, which opened in 1940, illustrated that motorists and truckers were willing to pay for the convenience of faster, limited-access highways, and that tolls could generate sufficient revenue to pay off the construction bonds. In 1945, New York proposed a toll thruway across the state, while Maine actually opened the first postwar turnpike in 1947. In 1947 New York officially created the Thruway Commission, and other states like New Hampshire, West Virginia, New Jersey and Maryland followed suit. By 1953, 762 miles of toll road had opened, with another 1,077 miles under construction, mostly in the Northeast and Midwest. The peak year of turnpike construction came in 1954. Georgia lawmakers, like those in most southern states, discussed toll financing but did not authorize turnpikes.

That so many states resorted to toll financing was a clear indication of serious disarray in the nation's highway policy in the late 1940s and early 1950s. Highway and motor vehicle lobbying groups ever more loudly demanded improvements for every type of road, from main routes between cities to secondary roads and the new interstate system. But Congress, distracted first by the challenges of returning to peacetime, and

then by the cost of meeting the demands of the Cold War, could not agree on how to resolve the impass. While the 1950 and 1952 highway appropriation bills totaled $550 million and $575 million respectively, there was no solution to the problems states faced providing the required 50% match for those larger amounts.

After years of congressional squabbling and public insistence on the need for building a better national highway system, the federal legislation establishing the National System of Interstate and Defense Highways finally passed in 1956. The Federal-Aid Highway Act of 1956 set up programs to build the interstate highway system and at the same time increase allocations for construction of other categories of federal-aid highways to more than $800 million per year after 1956. All were to be funded by user taxes locked in the Highway Trust Fund. The most significant aspect of the 1956 act was that the federal government agreed to provide 90% of the cost of interstate highways, the step that finally provided the money states needed to make real progress on a network of those very expensive, high-standard, express highways between and into the nation's cities. In 1958 it was estimated that urban mileage constituted 11% of the total interstate highway system, but that its construction would require 42% of the funding.[10]

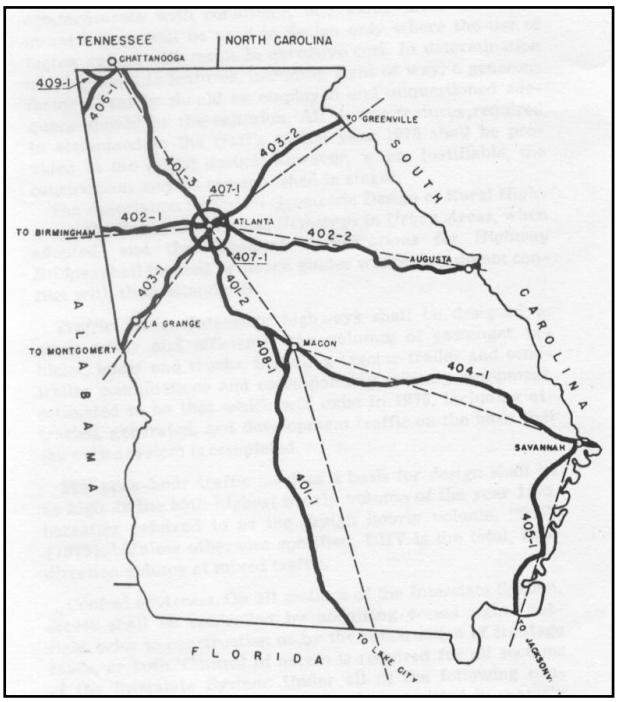

Figure 5: Georgia's Interstate highway map (1956) showing the addition of Atlanta's circumferential highway (I-285). Source: Roy A. Flynt, "The Meaning of "Interstate Highways" and "Limited Access," Proceedings of the 5th Annual Georgia Highway Conference (1956).

With the passage of the 1956 act, the states launched the largest highway construction program in history. In 1955, in recognition of the traffic congestion that was gripping American cities, circumferential and distributing highways, like metro Atlanta's I-285 perimeter road, had been added to the interstate system (Figure 5). That was also the year that the Georgia legislature belatedly passed an act allowing for limited-access highways (previously permitted only in Fulton County to facilitate construction of the Altanta Expressway), which was a federal requirement in order for the states to receive interstate highway funds. Many other states had passed such legislation in the early 1940s. But the benefit was clear, for under the 1956 act, Georgia was to receive $840 million over the next 13 years for approximately 1,100 miles of interstate

[10] "What's Right with the Interstates," Engineering News-Record, Vol. 165 (Aug 25, 1960), pp. 24-25).

highways. The amount was determined by an allocation formula involving each state's land area and population. The Atlanta Expressway was the only existing limited-access highway taken into the interstate system in 1956, while other urban bypasses, like the one under construction in Tifton, were redesigned to near interstate standards and thus designated interstate routes.

Interstate Highway Design Standards

A key component of building the interstate highway system after 1956 was agreement at the national level on the basic design standards. These standards were worked out cooperatively through the American Association of State Highway Officials (AASHO, now AASHTO) and were set down in a uniform design policy in July 1956. The uniform design policy was an example of "balanced design," meaning that every element – curve radius, sight distance, super-elevation, and gradient – were to be determined by speed so that drivers could easily anticipate road conditions and not encounter surprises. All at-grade crossings were eliminated, and access to and from the highway was restricted to interchanges. Many of the nation's postwar urban expressways, like the Atlanta Expressway, had been built to lesser standards, particularly roadway geometry and interchange designs, but they were taken into the interstate system anyway because they were "near" interstate standards (Figure 6).[11]

Figure 6: Atlanta Expressway, ca. 1952. The early design standards did not include such features as wide medians, improved shoulders, and lengthy acceleration and deceleration ramps that would be required of post-1956 interstate highways. Nonetheless, the pre-1956 roads were incorporated into the interstate highway system with plans to upgrade them at a later date. Source: Biennial Report (1952).

Balanced design was a crucial step in the evolution of safe, high-speed highways. The leading developer and advocate of balanced design was Joseph Barnett, an engineer with the BPR, who had as much to do with the standardized geometry of the interstate system as any individual. Barnett cut his teeth on the Westchester

[11] The major items of the national policy include complete control of access throughout the entire system with access and egress only at designated locations; design speeds of 50, 60, and 70 mph respectively for mountainous, rolling, or flat terrains; curvatures, super-elevation, and gradients to match design speeds; 12'-wide minimum travel lanes; 10' minimum graded shoulder width; elimination of all at-grade intersections; separated traffic lanes with medians or barriers appropriate for the setting; and 300'-wide right of way whenever possible.

County (New York) parkway system during the 1920s and early 1930s. He joined the BPR as a senior engineer in 1933, and he quickly became its high-speed highway specialist. Barnett's influence was enormous; in 1937, to facilitate acceptance and popularization of the balanced-design concept, he developed a table for transition curves, which provide for a gradual and safe change in the roadway's curvature and super-elevation from a straight to a circular path. Between 1938 and 1944, in his capacity as secretary of AASHO's Committee on Planning and Design Policies, Barnett was the primary author of seven policies on geometric design, ranging from highway classification to sight distances. The AASHO policies were developed cooperatively by the state highway officials, but the influence of Barnett and the BPR was as unmistakable as it was profound and ubiquitous. The committee officially approved the policies in 1945 and published them in 1950 as its *Policies on Geometric Highway Design*. The policies were the basis for the one issued by the committee for the interstate highway system in July 1956 and used by the BPR to approve interstate projects. Georgia officially adopted the national uniform design policy as its standard for interstate highways in 1956.

The design standards initially used for interstate highways were intended to meet demand through 1975 and featured elimination of all at-grade intersections/crossings, medians not less than 4'-wide in urban areas, right-of-way between 150' and 300'-wide depending on urban or rural setting, design speeds between 50 and 70 miles per hour, and bridge decks with no overhead obstructions. Vertical clearance above the roadway would be 14'. To save money, bridges on interstate highways did not originally have shoulders and there were left-hand exits. But as construction progressed, it became apparent that minor modifications to the design standards were in order. In 1960, for instance, vertical clearance was increased to 16' and interchanges had to be two miles apart in urban sections and four miles apart in rural areas (Figure 7).

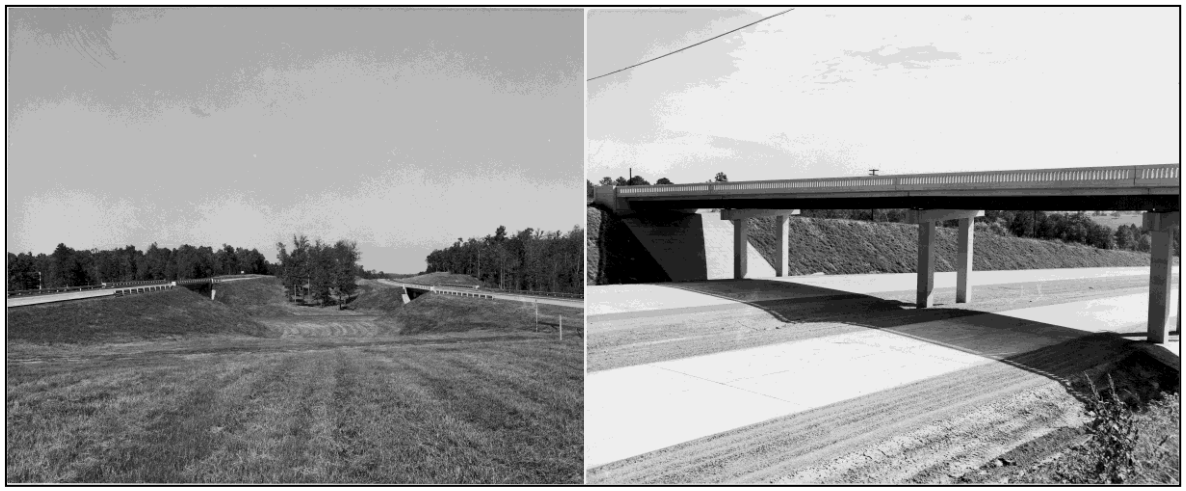

Figure 7: Interstate highway geometric design standards include wide medians for rural sections, bridges that blend seamlessly with the roadway, and use of overhead bridges to eliminate all at-grade intersections with other roads to support the efficiency and through nature of the limited access system. Source: GDOT Bridge Division Collection. Georgia Archives.

Georgia Interstate Construction 1956-1973

When Congress finally passed legislation in 1956 that provided the mechanism for accelerated construction of the interstate highway system, many of the administrative and technical pieces needed to tackle the herculean task of planning, designing and constructing Georgia's 1,100 miles of interstate highway were already in place or were about to be implemented. The Georgia State Highway Department had been established in 1916 to administer federal aid, and in 1920, it had established the bridge division with the brilliant Searcy B. Slack from LaGrange as the state's first state bridge engineer.[12] Like state highway departments all across the country, the Georgia State Highway Department had also positioned itself to address challenges of building urban expressways since the late 1930s, when federal aid was extended to include urban roads as well as upgrading existing roads. The Division of Highway Planning headed by Roy A. Flint was established in 1936 to conduct traffic counts, economic investigations and fiscal studies that supported the proposed location of those urban roads. It also obtained data on truck weights and prepared highway maps. The Division of Right of Way was created in 1944 to handle acquisition of right of way in advance of the construction program. Division engineer R. E. Adams noted that his greatest concern in complying with the federal-aid program was securing the necessary 200'- to 300'-wide right of ways preferred by federal engineers for dualized highways and urban expressways, and personnel in the division increased from 15 men in 1954 to 70 just four years later in 1958 (Figure 8). The Division of Urban Projects headed by S. P. Allison was created in the summer of 1947 for projects using federal-aid urban funds. The Division of Public Relations was established in the fall of 1956, ostensibly to deal with right of way acquisition problems. One of its initial efforts was the monthly publication of *Georgia Highways*, a 20-page magazine that stressed the political neutrality of the engineer but only continued for one year in 1958. The bridge division continued its well-established tradition of identifying which materials, designs, and details would provide the state with the most efficient and economical bridges. In the mid 1950s, it

Figure 8: The Bridge Division in 1960 under the leadership of state bridge engineer Charles Marmelstein and assistant state bridge engineer Russell Chapman (men in suits in center of the photograph). Source: GDOT Bridge Division Collection. Georgia Archives.

[12] For a history of the Georgia Department of Transportation through 1956, please refer to the modern roadways chapter in the Development of Transportation Networks in Georgia section of the Department's *Historic Bridge Inventory Update Historic Contexts* (June 2001) by Lichtenstein Consulting Engineers, Inc.

developed its own designs for shear details to make rolled beams and concrete decks composite.[13]

Figure 9: Georgia State Highway Department employees load a camera on the department's airplane. Aerial photography eliminated the need for labor intensive ground surveys and was one of the new technologies employed to improve the efficiency of locating and designing interstate highways. Source: Georgia Highways (Jan. 1958).

The Department used technology to increase the ability of its cadre of designers to provide the plans needed for the expanding highway programs of the 1950s, particularly the large volume of work needed for the interstate highways. One of the most important tools in efficiently locating and designing new highways was photogrammetry, an aerial mapping technique that relied upon two cameras in an airplane to produce images that, when viewed together, created stereo images that could be turned into accurate plans and drawings (Figure 9). This photo equipment affected large economies in construction costs and engineering manpower required for the interstate highways for both location and specific design problems. The department purchased its own plane in 1953 and led all southeastern states in use of photogrammetry.[14]

Georgia was one of the first states to utilize the timesaving advantages of computers in bridge and highway design. By 1957, the department was using a computer, the IBM 650, to solve earthwork and bridge design problems. Bridge engineer Russell Chapman, who started with the department in 1947 and served as state bridge engineer from 1968 until 1974 when he became a preconstruction engineer, went to programmer school and developed programs that solved geometry problems and the design of continuous beams with variable moments of inertia. The advantage of the computer was that it could accomplish big calculation problems quickly.[15] The bridge division was constantly studying new bridge types and designs to determine if they were more economical. Types and designs that were studied included the continuous reinforced concrete T beam design favored in Alabama and the cast-in-place post-tensioned box beam bridge that worked so well for Florida DOT. Neither, however, proved to be more

[13] Georgia State Highway Department (GSHD), Biennial Reports, 1920-1956; Proceedings of the 7th Annual Georgia Highway Conference (1958), p. 166; Douglas Hudson, Personal communication with Mary McCahon (LCE), April 2006.

[14] GSHD, Biennial Report (1958), p. 103.

[15] Russell Chapman, Personal communication with Mary McCahon (LCE), April 2006.

economical than rolled steel stringer bridges, which was used almost exclusively on the interstates until the mid 1970s.[16]

Use of technologies like photogrammetry and computer-generated calculations, coupled with greater reliance on standard bridge and roadway designs, greatly assisted the state highway department's goal to produce the plans for the interstate highways and their associated bridges as fast as possible. Uniformity and standardization were the names of the game in Georgia as in most of the country. Indeed, the adoption of standard drawings and specifications simplified the process of getting the approval of the federal highway bureaucracy, since there were few variations to be concerned about and inspected.

Construction Begins on I-Designated Highways

Passage of the Federal-Aid Highway Act of 1956 meant that in addition to applying the 90/10 funding formula to dualized highways like the Atlanta Expressway already under construction, work could now begin locating and designing all the interstate routes identified on the 1944 map and the 63.3-mile-long circumferential loop around Atlanta (I-285) added to the system in 1955. The precise alignments of the interstate highways in Georgia were generally not influenced by politics and reflected the original agreements between the BPR and the state in 1944 with the exception of I-85 east of Suwanee. Its route to Greenville, SC was changed from through Gainesville to its present route via Lavonia, the hometown of Ernest Vandiver, governor from 1959 to 1963.

Figure 10: Governor Vandiver (third from left) and State Highway Board Chairman Jim L. Gillis, Sr., preside over the dedication of 37 miles of I-75 in Tift and Turner counties, Oct. 9, 1959. In the early years of the interstate program, such celebrations were common, but became accustomed to the piecemeal development of the interstate highway system. Source: GSHD, Biennial Report (1960), p. 86.

Initially progress was slow and was focused on survey, property acquisition, and design. While specific interstate routes had been approved, they had not been specifically located, so surveying dominated initial efforts. By the middle of 1958, 776 miles of Georgia's 1,100 interstate miles had been surveyed, while plans were completed for 32 miles with another 200 miles in various stages of completion.[17] Dualized (but not limited access) highway plans in hand when the act was

[16] Hudson, April 2006.

[17] GSHD, Biennial Report (1958), pp. 101, 105.

signed in June of 1956, like those for the Tifton Bypass, required extensive revisions to bring them up to or near interstate design standards. The 5-mile-long Tifton Bypass, which is commonly but erroneously held as the first section of interstate constructed using an "I" designation in Georgia, was actually started in 1953 using 40/60 funding. When it was taken into the interstate system as part of I-75, it was brought up to interstate standards by adding a frontage road in order to make the dualized highway section limited access. The first section of highway to be let with an "I" designation, and thus could be considered the "first" section of interstate built as such in Georgia, was the nearby 3.3-mile-long Forsyth Bypass that was let in December of 1956 and completed by the end of 1958 (Figure 10). [18]

Figure 11: Construction of I-20 and Downtown Connector, 1962.

The design and construction of the original interstate routes (I-16, I-20, I-75, I-85, I-95, and I-285) were broken into short-mileage sections and then designed and let incrementally. Work proceeded on both urban and rural segments in this piecemeal fashion through the early 1970s with segments opened to traffic as they were completed. When one segment was let, work would begin on preparing the plans for the next segment as funds became available. Work continued on the Atlanta Expressway, which was designated I-20, I-75 and I-85 after 1956. I-75 was open to West Paces Ferry Road in 1957, and the first section of I-285, a 2.5-mile-long segment near the General Motors plant in Doraville, was let in June 1958, but it was not completed until 1963. By 1964, only 19.7 miles of the perimeter road had been completed. Design work commenced in 1958 on the 125-acre I-20 interchange at Memorial Drive and Capitol Avenue, which included 18 bridges (Figure 11). By the middle of 1966, some 33% of the right-of-way needed to complete the system still had to be acquired.[19] An indication of slow progress was reflected by the fact that in 1968, one year before the entire system was to have been completed, only about 800 of Georgia's 1,100 interstate miles were complete with, not surprisingly, the urban sections proving to be much more challenging than the rural sections. This pace was typical of other states that were experiencing similar problems completing their border-to-border systems.

A significant change within the department itself during the first 13 years of interstate construction was Governor Carl Sander's 1963 replacement of the three-man state transportation board with a ten-member board appointed by the governor and a

[18] Emory Parrish, Personal communication with Mary McCahon (LCE), April 2006.
[19] GSHD, Biennial Report (1966), p. 101.

director/commissioner elected by the board. This made the board less political and more businesslike in conducting its affairs.[20] Jim L. Gillis, Sr. of Soperton was the first commissioner, and he served from 1963 through much of the state's interstate construction campaign until 1971 when he was succeeded by Bert Lance.

The Freeway Revolt Changes Everything

Actual construction of the interstate highways, particularly through urban residential areas, and urban renewal programs triggered a groundswell of concern about the effect of federal programs on the built and natural environment. This groundswell, which was being played out all across the country, gained momentum in the early 1960s and culminated in passage of precedent-setting environmental legislation starting in 1966. The new laws established procedures for transportation agencies to consider the impact of their projects on everything from minority employment requirements to the effect on historic buildings, and the laws permitted the public and affected parties to participate in that process. Local groups that had been battling the department during the 1960s over expressways planned for the eastern side of Atlanta used the newly enacted federal environmental laws in the early 1970s to stop construction of I-485 and the Stone Mountain Freeway. Both were important sections of the proposed intermediate loop-east that had been envisioned since the early 1950s as a way to relieve congestion on the downtown connector.

Long-Recognized Limitations of the Lochner Plan

That the connector (I-75/I-85) was inadequate was apparent by the early 1950s as Atlanta experienced unprecedented growth. In 1952, the Metropolitan Plan Commission (MPC), predecessor to the Atlanta Regional Commission (ARC), called for expanding the Lochner Plan of radiating expressways from the city core by adding inner and outer loop highways.[21] Ambitious as that plan may have seemed in 1952, passage of the Federal-Aid Highway Act of 1956 made augmentation of the city's expressway network possible, and the outer loop, intended to tie together the then-sparse but fast-growing suburban centers and to bypass the urban core, was programmed as I-285 in 1955. The proposed inner loop was not programmed as part of the original interstate system, but it would be added in time.

The MPC's 1959 plan, *Crosstown and By-pass Expressways*, reexamined the need for the envisioned but as yet unprogramed urban expressways. It also considered alternative modes of transportation. Even with the 63-mile-long outer loop (I-285), the study recommended about 104 more miles of freeways in the metro region, including the inner loop (now dubbed the intermediate loop) and a new, much-needed north

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[20] Parrish, Apr. 2006.

[21] Metropolitan Planning Commission, Crosstown and By-pass Expressways, Expressway Policy Study, Report Number Two (June 1959), p. ii.

expressway (the Roswell Expressway/GA 400). The most controversial of the 1959 recommendations proved to be the intermediate loop (east) that would link with the proposed Roswell Expressway at its northern terminus and the Lakewood Expressway near the federal penitentiary at its south end. There were to be major interchanges with I-20 and Ponce de Leon Avenue. This route, which was distilled from similar loop freeways proposed in the 1952 and 1954 plans, was seen as best for achieving two goals; taking through traffic off the connector and linking right-of-way acquisition and redevelopment with urban renewal in what were considered "blighted neighborhoods" in East Altanta (Figure 12). Regardless of alignment, the intermediate loop (east) was going to affect some of Atlanta's oldest residential neighborhoods, making the proposed eight-lane-wide facility one of the most expensive highway projects in the state.[22]

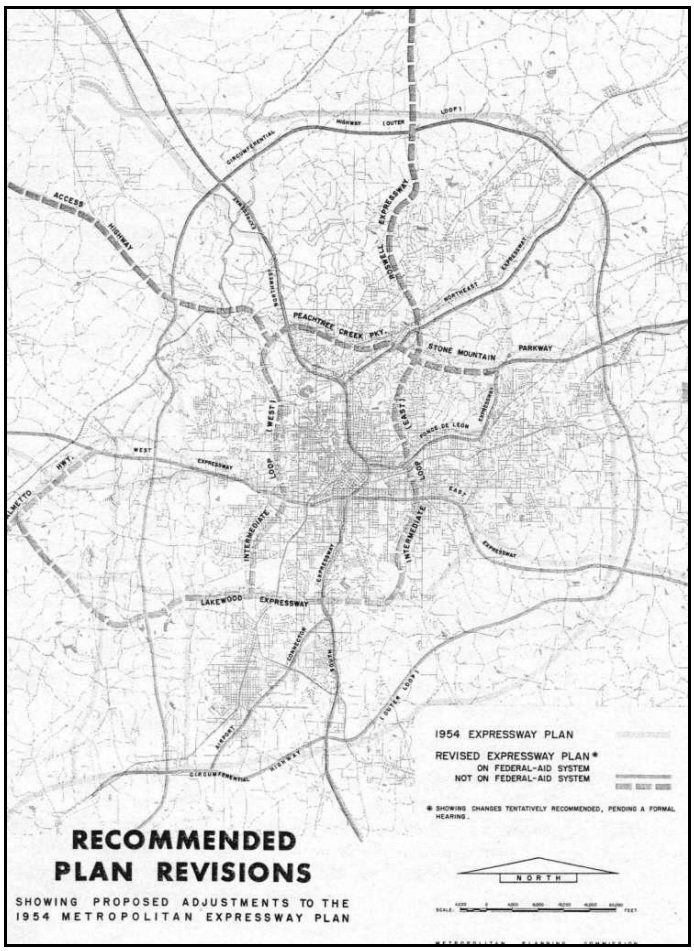

Figure 12: The 1959 Metropolitan Plan Commission (MPC) called for expanding the 1947 Lochner Plan of radiating expressways from Atlanta's city core by adding inner and outer loop highways. The plan's recommendations for expressways, especially on the east side of Atlanta, would become the flashpoint for Georgia's "Freeway Revolt" in the 1960s and 1970s. Source: MPC, Crosstown and By-pass Expressways (1959), p. 30.

[22] Ibid., p. 31.

A critical 5.2-mile-long segment of the intermediate loop (east) was formally added to the interstate system in 1965 as I-485. It broke out from the downtown connector at Boulevard and passed through inner city neighborhoods like Candler Park, Inman Park and Morningside to Lindbergh Drive/Cheshire Bridge Road and I-85, where it would also connect with the proposed Roswell Expressway. Another 5.3-mile-long expressway was proposed across Decatur and Druid Hills to link with the Stone Mountain Freeway on the east side of I-285. That road was to meet I-485 at a 120-acre interchange near the present intersection of North Avenue and Barnett Street in the Virginia Highlands neighborhood. Local opposition to both expressways was immediate and strong.

By the early 1960s, the demolition and displacement occurring in American cities as a result of interstate highway construction spawned a dramatic change in the public's attitude toward engineers as policy makers. The once-trusted transportation engineers and the agencies for whom they worked were increasingly questioned by a public that was turning to city halls, state houses, the courts, and Congress to press their opinions. Through the 1960s engineers watched as their long-held position as the expert, apolitical decision makers was eroded. Steadily, decisions once controlled almost exclusively by engineers began to be made with input from others. The actual control of decisions began to shift from the engineering arena. While public hearings for the urban bypass and then intra-urban highways were required under the federal-aid highway acts of 1950 and 1956, and then extended to interstate highway projects in 1958, these rules did not suggest meaningful input was solicited or that it had an effect on engineering decision making. In 1962, however, in response to ever-increasing public and political pressure, BPR tied federal-aid funds to a requirement that cities with a population greater than 750,000 prepare long-term, multi-modal, comprehensive regional transportation plans. Funds would be withdrawn after 1965 if a city did not comply.[23]

Then, in recognition of the fact that the nation's cities could not build enough highway lanes to solve their traffic congestion problems, Congress passed the Urban Mass Transportation Act in 1964 for construction of mass transit systems. Allocated funds were initially limited, but two years later, in 1966, funding for both construction and operation of mass transit systems was to be provided by the Highway Trust Fund – another blow to the influence of highway engineers who now saw their once-exclusive funding source shared with fixed rail systems.

In 1966, just ten years after the federal legislation initiating construction of the great national system of high-speed, limited-access highways, Congress passed two pieces of legislation that illustrated just how different the climate had become for transportation engineers and agencies trying to complete the interstate system as originally envisioned. One was the National Historic Preservation Act (NHPA) that gave standing

[23] U.S. Department of Transportation, Federal Highway Administration, America's Highways 1776-1976: A History of the Federal Aid Program (Washington, DC: 1976), p. 371.

to those concerned about changes to historic properties and provided a process for them to comment, which is codified in Section 106 of the act. The other was the US DOT Act of 1966 that, to better administer the multi-modal character of transportation, created the Department of Transportation from 30 different federal transportation-related agencies. The BPR became the Federal Highway Administration (FHWA) in 1967, and mass transit moved to the Urban Mass Transit Administration (UMTA).[24]

The US DOT Act of 1966 also made a strong commitment to preservation of the scenic and built environment by restricting all US DOT agencies from using certain types of properties, including publicly owned park or recreation land, wildlife refuges and historic properties, as part of building their projects unless no other prudent and feasible alternative existed. Because so many highways involved demolishing historic buildings and taking land from parks, this provision, known today as section 4(f), significantly altered interstate highway construction programs all across the country. It also forced state and federal transportation officials to now consider and reflect the perspectives and values of many stakeholders, particular affected citizens and elected officials.

In 1968, federal highway legislation strengthened the long-standing policy on public hearings, now requiring them for both the location and design phases of all federal-aid projects not yet actually under construction, including those for which right-of-way had been acquired. In Georgia that included I-485 and the Stone Mountain Freeway through Decatur and Druid Hills, two projects that had been highly controversial since the early 1960s. The department went on record opposing the policy because of the perception that it would delay projects (Figure 13).[25]

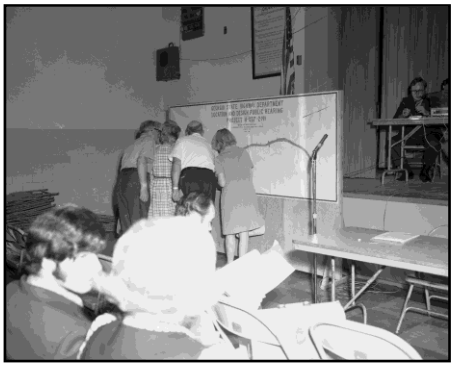

Figure 13: A public hearing conducted by DOT in Druid Hills neighborhood of Atlanta in 1970. Such meetings where residents were encouraged to comment on proposed highway design were mandated by FHWA as part of the new environmental review process. Source: GDOT Bridge Division Collection. Georgia Archives.

The 1960s groundswell of concern about what was happening to the environment culminated in passage in December 1969 of the National Environmental Policy Act (NEPA). It was signed into law by President Richard M. Nixon on January 1, 1970.

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[24] There were several federal agencies that managed the nation's highway programs before 1967. The original agency was the Office of Road Inquiry established in the Department of Agriculture in 1893. While in the Department of Agriculture the agency changed its name four times. In 1899 it became the Office of Public Road Inquiries, in 1905 it became the Office of Public Roads, in 1915 it changed to the Office of Public Roads and Rural Engineering, and in1918 it was the Bureau of Public Roads (BPR), which it remained through 1966. BPR was moved to the Federal Works Agency in 1939 and renamed the Public Roads Administration. In 1949, the BPR name was restored and the agency was put under the Department of Commerce where it remained until the Federal Highway Administration was established within the Department of Transportation in 1967.

[25] "H'wy Board Opposes New Federal Regulations," Survey, Vol. 3, No. 12 (Dec. 1968), p. 2.

NEPA enunciated for the first time a broad and overarching national policy toward preventing environmental degradation by federal actions. Federal agencies were now required to consider the consequences of their actions on the environment, both natural and manmade. Detailed, multidisciplinary, written assessments called environmental impact statements (EIS) were to be prepared for all substantial federal activities, like constructing new highways. The EIS included addressing the provisions of the NHPA and the US DOT Act of 1966.

Understanding how the freeway revolt played out in Georgia is instructive to appreciating the climate of the times and its lasting consequences. Most highway engineering bureaucracies in the United States resisted these changes, considering them sources of inefficiency and delay. Many did not grasp the political dynamics underlying all of the legislative acts, and this, in turn, added fuel to what came to be called the "freeway revolt." In Atlanta, the new laws threatened nearly 20 years of planning that had sought to redress deficiencies of the Lochner Plan. Then about 1970, a Morningside neighborhood group brought suit against the department to force implementation of the newly passed NEPA and to address FHWA's policies of addressing neighborhood integrity and multimodal solutions to urban traffic congestion. In 1971 the group prevailed in federal court, and I-485 was put on hold until the department could complete an EIS, including assessment of the proposed MARTA rapid transit lines through the northeast corridor.

When the EIS was submitted early in 1973, it was rejected by US DOT because the mass transit component was insufficient. Citizens continued to work the political side of the equation, and the Atlanta Board of Aldermen voted against the proposed expressway on June 18, the same day the EIS was rejected by US DOT. The fate of I-485 was not known for certain until the Atlanta Regional Commission (ARC) revised its Altanta Area Transportation Study (AATS).[26] The 1974 revision called for deleting I-485 (which ARC had endorsed as part of the 104 miles of new urban expressways included in its 1969 AATS). With that decision the State Transportation Board voted to withdraw the mileage from the interstate system, and FHWA accepted the withdrawal in 1975.[27] In 1977, I-485 had come full circle as GADOT moved to dispose of all of the property that it had acquired for construction and cleared north of St. Charles. The area has been largely redeveloped for residential use.[28]

The Stone Mountain Freeway shared a similar fate. In 1972, Governor Jimmy Carter appointed a commission to study the issues associated with the highly divisive project

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[26] John York, "I-485 All Tied Up in Controversy," Atlanta Journal (Aug. 19, 1973), p. 19-A.

[27] FHWA gave states several options for dealing with sections of interstate highway that could never be constructed. The one Georgia selected was to substitute different projects that could be constructed. Those included I-175 (Albany Connector), I-420 (Lakewood Extension), and I-675 (South Atlanta Freeway). Some states returned funds, and those returned funds would come back to factor significantly in Atlanta.

[28] "Houses Rise from the Ashes of I-485," Atlanta Journal (May 10, 1981), p. C-8.

that would cut across viable historic neighborhoods and impact schools and the local science center. The commission argued that building the expressway was an irreversible action while the reversible step it recommended was to wait for the assessment of the impact of the proposed MARTA lines in accordance with FHWA guidance.[29] Governor Carter accepted the commission's recommendation late in 1972, and his action meant that the Stone Mountain Freeway, like I-485 with which it was to connect, was no longer a viable option for GADOT because of environmental considerations. Again, transportation decisions were being driven by preservation and other issues. Other segments of interstate routes were also affected by environmental and political considerations, including former mayor Maynard Jackson's position that I-675 linking I-20 with I-75 through southeast Atlanta would never be built.[30] Largely as a result of federal environmental legislation, only 32 miles of the 104 miles of urban freeways proposed during the 1950s and 1960s were ever built. Another environmentally and politically derived decision was that I-75 northwest of Atlanta would not cross Lake Allatoona. Its alignment was finally settled on the west side of the lake close to Cartersville to mollify politicians and environmentalists.

Constructing interstate highways to and through other cities in Georgia, like Macon, Columbus, Augusta, and Savannah, were not nearly as problematic as in Altanta for a variety of reasons, including that those cities' circumferential and distributing routes were not part of the original interstate system or, as in the case of Macon, the interstate routes through the city proper had been constructed prior to the freeway revolt and federal environmental laws.

The Moreland Era, 1973-87

Into this very different climate that had evolved by the mid 1970s – one where engineers now had to accommodate the perspectives of other disciplines and meet rigorous legislative mandates to justify actions that not long before had been their nearly exclusive domain – came Thomas D. Moreland (Figure 14), who was appointed commissioner by the state highway board in 1975. He had been promoted to state highway engineer in 1973. His charge, as both state highway engineer and commissioner, was to lead the department in completing the gaps in the interstate highway system in addition to addressing other pressing transportation demands, like improving other classifications of federal-aid highways and implementing metro Atlanta's mass transit system. His already challenging job was compounded by the 1973 Arab oil embargo and the resultant dramatic drop in gasoline tax revenue, which is what Georgia depended upon to fund its pay-as-you-go road and bridge construction activities. The tax was also the primary source of its contribution to the federal Highway Trust Fund. Matters were further complicated by the 25% increase in the costs of

[29] US DOT, FHWA and GADOT, "Final Environmental Impact Statement, Georgia Project M-9152(2), Fulton/Dekalb Counties (May 22, 1984).

[30] Parrish, Apr. 2006.

Figure 14: Thomas D. Moreland. Source: GDOT Translator, Vol. 6 (Aug. 1977).

building materials between 1973 and 1975 caused by rampant inflation. And since the interstate highways were nearing completion, the department had initiated staff reductions through attrition from an all-time high of 9,000 to 7,500 by the end of 1975.[31]

After graduating from Georgia Tech, Moreland started with the department in their new training program in 1957. Charles Marmelstein, the state bridge engineer, encouraged him to return to Tech to study soil mechanics with noted geologist and engineer George W. Sowers. He then came back to the department and the material laboratory where he made the soils lab pre-eminent. He was appointed state materials engineer, and in this position he moved the department to emphasize materials performance data. The information was used to support and justify materials specifications and testing procedures to ensure that they met the state's standards. Like he had done with the soils lab, Moreland moved Georgia's materials laboratory to national prominence. His position as head of the lab and the fact that materials permeated most everything that the department did, as well as his promotion to direct operations, put him in a position to be involved in nearly all the department's activities, so it was not surprising that in 1973 he was promoted to the position of state highway engineer, the most senior career position in the agency.

Against this backdrop of scarcity and pluralistic decision making that hamstrung many other state departments of transportation, Thomas Moreland managed to not only complete Georgia's interstate highways by the fall of 1978, but he also led the 1975-1988 reconstruction and upgrading of the interstate system in the metro Atlanta region – an accomplishment that was the envy of the nation, particularly in states with urban centers that had experienced tremendous growth after World War II. Under his leadership the department adapted to the new realities of the changing attitudes and policies of the times and found innovative and effective ways to get business done. In fact, Georgia's transportation department began to move at an accelerated rate that drew national attention. Moreland pushed Georgia's highway system to the forefront nationally by being a capable decision maker, politically and technically savvy, and absolutely dedicated to getting as much out of every federal dollar as he could.[32]

[31] GADOT, Annual Report (1975), pp. 6-7.
[32] Paul Liles, Personal communication with Mary McCahon (LCE), Sept. 2006.

Enjoying the confidence and trust of progressive Governor George Busbee,[33] he worked closely and effectively with the state legislature, the congressional delegation, and the department's federal partners at FHWA to leverage federal money, without which Georgia would not have accomplished what it did.

Moreland's transformation of the department started when he became state highway engineer in 1973. He moved research to the materials lab and then used the data to support and defend decisions from material specifications to department policies. For instance, rather than relying on outside contractors, he had department personnel learn to perform their own welding inspections, making the lab a national leader in that area.[34] Perhaps his greatest change was a plan to complete the gaps in the state's interstate highway system (some 23% of the total mileage) by the end of fiscal year 1979. Moreland stated that it could be done because of the capabilities of the department but only if financing could keep pace with the department's preconstruction activities.[35]

Even more changes occurred when Thomas Moreland became commissioner in the spring of 1975. The biennial report, previously a traditionally dry report, took on the look of public relations material appropriate to a general audience with each issue based on a theme and containing quantitative summary information and catchy graphics. The department was reorganized into five operating divisions (planning and programming, administration, operations, preconstruction, and construction) that reflected the linear progression of how projects were advanced.

The story of Moreland's successful tenure as commissioner represents more than the accomplishments of one man. He benefitted from a talented and dedicated staff, including Hal Rives his assistant commissioner who was named as his successor in 1988, and Emory Parrish, executive assistant director.[36] Alton Dowd served as chief urban engineer then the head the preconstruction division that included addressing environmental requirements. Alva Byron was chief highway engineer. Moreland generally engendered great loyalty among the rank-and-file, from whom he expected long hours and work of the highest quality. Not one to be told no, he was constantly striving for efficiencies in order to achieve desired results, like convincing the state legislature to change from the pay-as-you-go approach to funding highway construction

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[33] George Busbee (1927-2004) was the first Georgia governor to serve two consecutive terms; 1975-1983. When he was first elected governor in 1974, the state constitution did not permit a governor to succeed himself; governors were not permitted consecutive terms. Largely because of Governor Busbee's effective administration, the Georgia constitution was amended in 1976 to permit a governor to succeed himself for an additional four-year term. When the intention of completing the gaps in the interstate highway system during his administration was set, that he would serve two terms was not known.

[34] Liles, Sept. 2006.

[35] Moreland's definition of "finished" in 1973 was having all of sections under contract, not necessarily done. Moreland to State Highway Board, Nov. 30, 1973 in GADOT, Commissioner Records, State Archives of Georgia, Atlanta.

[36] Emory Parrish retired in 1982.

and approve advance funding in order to secure federal aid to finish the interstates, or moving the bridge division to prestressed concrete for long bridges so that interstate construction would not be held up by steel delivery disruptions caused by labor strikes and the like. That decision did much to start Georgia's now nearly total transition away from steel bridges.

Finishing the Interstates

The pace of interstate construction had slowed when Moreland became state highway engineer in 1973. Activity in each state was predicated on several factors including the amount of a state's allocation from the Highway Trust Fund. The fund was not adequate to cover the actual cost of interstate construction in a timely manner, which is one of the main reasons why it took so long to complete the national system. He recognized this dilemma, as did transportation officials in other states. In 1973, he calculated for the state transportation board that finishing the system border-to-border by the end of fiscal year 1979 would require $350 million more that the projected federal-aid allocations and that by relying solely on federal apportionments, the interstate work would not be finished until 1987.

To meet his goals, Moreland proposed pre-financing interstate construction using bonds that would be retired with future federal apportionments. Debt service on the bonds would be funded by the state's general funds.[37] Impetus for this approach came in the form of the opportunity to leverage additional federal funds. By 1974, it was apparent that interstate funds allocated to some states were never going to be spent, for a variety of reasons including new environmental regulations that were blocking construction of some routes. FHWA made those turned-back funds, now called "discretionary funds," available to states that (1) had construction plans ready and (2) could be let for construction starting in the summer of 1975.

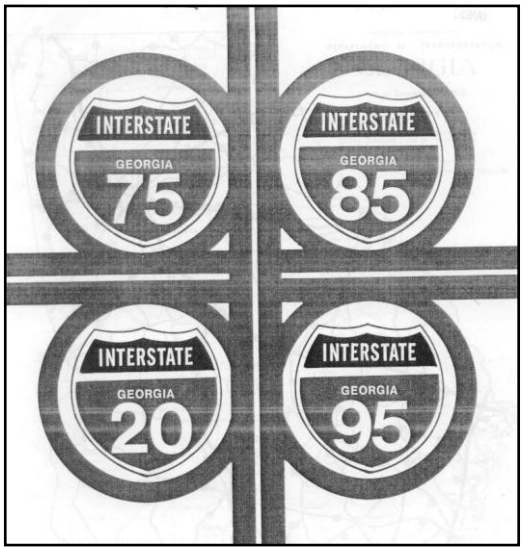

Figure 15: Source: Cover, GADOT, Biennial Report 1978-79

In 1975, now-Commissioner Moreland was in a position to follow through on his 1973 claim that, with advanced funding, the department could complete the interstate highway system by the end of fiscal year 1979. The effort was made a centerpiece of Governor George Busbee's first administration, which ended in January 1979. Moreland and his staff, working through the governor's office and the state legislature and aided by the congressional

[37] Moreland to Broome, Nov. 11, 1973. Letter in GADOT, Commissioner Files, State Archives.

delegation in Washington, set up the advance funding program that leveraged discretionary federal dollars and facilitated completion and opening of all sections of the original interstate routes by the fall of 1978. Starting in 1975, the state legislature authorized the sale of state bonds for pre-financing construction, and the program continued with great success through the mid 1980s. Georgia's first discretionary funds award in 1975 was $8 million. Because of the pre-financing and the accelerated preconstruction program, successive awards to the state were larger and larger until 1983 when the state received $2.50 for every gas-tax dollar it sent to Washington.[38]

By the end of 1977, all four of the major border-to-border interstate highways (I-20, I-75, I-85, and I-95) were complete, and additional urban bypass sections like I-520 in Augusta, I-575 in Cherokee County, and I-185 to Columbus were also under construction. The original system was officially finished with the September 1978 opening of the last section 1-16. The biennial report covering fiscal year 1978-79 declared it the "Year of the Interstate" (Figure 15), and between November 22 and December 23, 1977 alone, the department celebrated the completion of interstates 20, 75, 85, and 95 (Figure 16). The frenetic pace of completion was highlighted when Moreland and Governor Busbee attended four ribbon cuttings in one week.[39]

Without Moreland's vision and leadership, it is not likely that the accelerated completion of the interstates would have been accomplished. In addition to his acknowledged ability to motivate his staff,[40] he never lost focus of the big picture. In order to finish the interstates during Governor Busbee's first administration, Moreland set up a letting schedule that was held to be inviolate. He directed a logical progression of staged designs and contract awards. For instance, bridges needed to haul materials to a site were designed and let ahead of overpasses, which could wait until the earthwork associated with grading and preparing the roadway bed was well

Figure 16: Dignitaries open a section of I-95 in southeast Georgia. Source: GDOT Bridge Division Collection, Georgia Archives.

[38] Thomas Moreland Folder (1987) in Government Office Clippings, Record Group 27-6-6, State Archives.

[39] GADOT, Biennial Report (1979), p. 8.

[40] Paul V. Liles, Jr., who started with the Department in their training program in 1970 and became state bridge engineer in 1988, remembers Moreland's ability to instill his staff with great personal responsibility for production. "You felt like everything depended on you and that you did not want to be the one that let the project down." Although he is remembered by many as being a strong leader, Liles stated that he would also be the first person to commend a job well done. (Personal communication to Mary E. McCahon, April, 2006).

underway. In this manner, like a general leading his troops, Moreland orchestrated an efficient and effective construction campaign that put the state's interstate highway program in the national spotlight.

To be considered for discretionary funds meant that the department had to use all of its annual interstate federal allocation nine months into each federal fiscal year.[41] This meant that the department's engineers and specialists had to complete a year's worth of work in nine months and then complete the plans for discretionary-funded work. It was a hectic pace. Moreland reasoned that he could leverage even more production by using his staff to supervise work being done by consulting engineers with each engineer supervising several projects rather than doing the actual design himself.[42]

Freeing the Freeways

While the accelerated completion of the interstate system certainly was an outstanding accomplishment for the department, Moreland's and the state's national reputation for modernizing its transportation systems was further burnished by the massive 1976-1988 campaign to reconstruct the metro Atlanta interstate system. The work was desperately needed as actual traffic volumes far exceeded design projections, and some sections were approaching 30 years of age and the end of their design life. Despite incremental rehabilitation projects, most of the sections still had deficient geometry and safety features, and the inadequacy of the downtown connector continued to stymie traffic flow through the region. The success of the $1.4 billion "freeing the freeways [of congestion]" campaign, the largest urban interstate reconstruction program of its day, was, again, based on Moreland's shrewd ability to make use of shifts in federal priorities and policies and leverage millions of federal dollars to complete the project.

Pursuing the freeing the freeways campaign was a pragmatic acknowledgment that reconstruction of existing expressways, not new construction, was the way to address Atlanta's severe traffic congestion problems. Environmental laws from the 1960s, like the NHPA and NEPA and subsequent court decisions, meant that no more superhighways were going to be constructed inside the perimeter road. The department correctly reasoned that instead of fighting for new roads, they would expand the ones they had – a decision that has served the state well as lane capacity in and around Atlanta was significantly expanded at a time when it was possible to do so.[43] And starting about 1976, mass transit was included as part of that rebuilding effort.

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[41] Award of interstate discretionary funds was predicated on the following criteria; spent all allocation, have plans in hand ready to let, and have 10% state matching funds in hand.

[42] Liles, Sept. 2006.

[43] The Clean Air Act of 1990 and the Intermodal Surface Transportation Enhancement Act (ISTEA) of 1991 mandate that all transportation projects consider their impact on ambient air quality. The result has been that in areas of nonattainment, like Atlanta, additional highway lanes cannot be constructed unless it can be demonstrated that emissions will not exceed the 1990 level. The result has been that additional lanes cannot be added to interstate or any other classification of highways in areas of

The mid-1970s decision to pursue reconstruction was based, in part, on national shifts in thinking about both design of interstate highways and what types of work should be allowed using interstate construction funds. Beginning about 1960, research was proving that traffic fatalities could be significantly reduced by changing unyielding roadsides to forgiving ones free of obstructions such as light poles, signs, blunt ends of bridge railings, and confusing geometry. Mounting evidence that all manner of highway geometry and roadside appliances from culverts in medians to maintaining the roadway section across bridges made a dramatic difference in safety led to the 1966 Highway Safety Act. The act placed the federal government and the newly established FHWA in the leadership role to guide and finance highway safety activities for all types of highways, particularly the interstates. The American Association of State Highway and Transportation Officials (AASHTO) quickly followed with its influential 1967 *Highway Design and Operational Practices Related to Highway Safety* report that established the 30'-wide clear zone. The clear zone was intended to provide vehicles leaving the road a safe recovery area free of obstructions that could cause injury or death.[44] The recommendations in the report, from break-away poles to carrying shoulders through access ramps and placement of signs, affected such dramatic reductions in fatalities that a FHWA engineer working in Ohio in 1969 stated that old (pre-1967) design features like guide rails and light poles were replaced with the new, safer ones on any project that was less than 95% complete, even if the roadside features were brand new.[45] The findings and recommendations in the initial 1967 report were refined and expanded through the 1970s and resulted in a revised version in 1974 and FHWA issuing the *Handbook of Highway Safety Design and Operating Practices* in 1973 (revised 1978). Interestingly, the 1978 publication included a photograph of the I-75/85 and I-20 split to illustrate deficient nose recovery area (Figure 17).

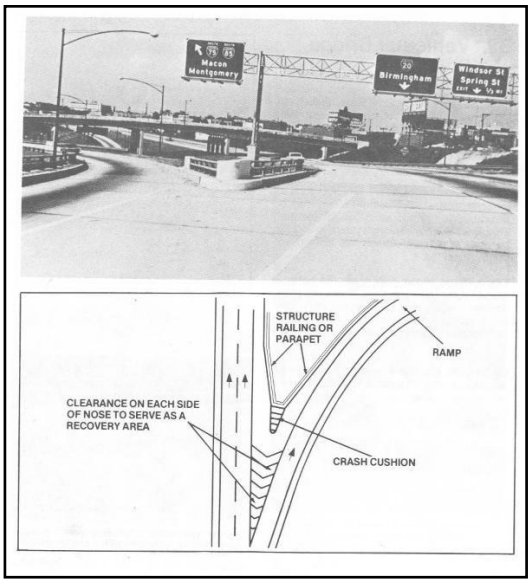

Figure 17: The I-75/85 and I-20 split in downtown Atlanta was used in FHWA's Handbook of Highway Safety Design and Operating Practices (1978) to illustrate deficient recovery areas and how they could be retrofitted for improved safety.

In Georgia, as in the rest of the country, much of the interstate highway system predated 1967. Common deficient features, which are so

nonattainment, and this has severely affected urban areas that did not upgrade their urban interstate highways before the provisions of the two acts were implemented in the mid 1990s.

[44] Hayes E. Ross, Jr., "Evolution of Roadside Safety," in Roadside Safety Issues, Transportation Research Circular, Transportation Research Board/National Research Council, 1994.

[45] Wright Aldridge, "A Lesson in Safety," Internet On-line, <http://fhwa.dot.gov/interstates/memories.htm. [Oct. 13, 2006].

apparent in historic views of the Atlanta Expressway (Figure 5), included left-hand exiting, lack of shoulders on bridges, acceleration and deceleration lanes that were too short, grades that were too steep, insufficient median barriers, and skid-prone riding surfaces. They also had unyielding roadsides. Additionally, traffic volumes had increased far beyond 1940s and 1950s projections, further compounding the inefficiencies of the older designs and contributing to fatalities.

The push for applying the new safety and operational features to existing interstate highways came in 1973 when Congress authorized for the first time using money from the Highway Trust Fund for safety improvement programs, like pavement markings and removal of roadside hazards, on all classes of highways including the interstates.[46] In 1975, FHWA released its study that compared fatality statistics on old and new sections of interstate highway. The findings demonstrated the merit of redressing old design standards. Using the watershed year of 1967 as the break, the study proved that interstates designed after 1966 were much safer in both urban and rural sections. The report concluded that upgrading pre-1967 sections of interstate to post-1967 standards would contribute to "overall safety of the system." At that time, "older sections" comprised 77% of the total system miles nationwide.[47] In response to the cumulative safety data and the fact that some of the oldest sections of interstate highway were approaching the end of their design life, the Federal-Aid Highway Act of 1976 expanded the definition of what work could be done using interstate construction funds to include resurfacing, rehabilitation and restoration (known as the 3 Rs in highway parlance) for sections that were greater than five years old (Figure 18).

Figure 18: Comparing geometric design of pre- and post-1966 segments of Interstate highway. With a greater understanding of the safety, shoulders were widened and improved, fixed objects were eliminated from the roadside, and center medians were added to urban segments. Acceleration and deceleration lanes were also lengthened and widened. Source: GDOT Bridge Division Collection. Georgia Archives.

[46] Ross (1994), p. 6.

[47] U.S. General Accounting Office, "Report to the Congress by the Comptroller General of the United States, Costs and Problems of Completing the Interstate Highway System," (Sept. 4, 1975), p. 14.

The 1976 expansion of allowable work marked a sea change in the evolution of the interstate highway system as it now permitted adding lanes, improving geometry, building new interchanges, or significantly improving existing ones – all of the enhanced maintenance items needed to bring the entire system, regardless of date of original construction, into compliance with modern design and safety feature standards. The Surface Transportation Assistance Act (STAA) of 1978 further strengthened the policy shift by earmarking interstate construction funding for 3R work, and this at a time when many states had not even completed all of their original mileage.

The timing of the policy change could not have been better for Georgia. It meant that rather than marking the end of its interstate construction early in 1978 with the border-to-border completion of the original routes, Georgia could now apply the same immensely successful approach of pre-financing and accelerated preconstruction activities to rebuilding the metro Atlanta interstates using the 90/10 funding formula. The allowable 3R activities would make it possible to provide a higher level of service by increasing the number of lanes and improving interchanges, as well as upgrading a host of roadside and operational features.

To appease varied interests, the Federal-Aid Highway Act of 1981 clarified the distinction between the two types of allowable interstate construction by defining work to complete the gaps in the original system as interstate construction (IC) and adding reconstruction (the fourth R) to allowable work to bring old, existing sections up to current design and safety standards. A funding formula for 4R work was established using the 90/10 ratio, and the Surface Transportation Assistance Act (STAA) of 1982 established a mechanism for dispersing any lapsed I-4R funds to states that could obligate them. The dispersal criteria were the same as for earlier lapsed interstate discretionary funds – having plans in hand and being able to quickly let contracts for that work.[48]

Thomas Moreland and the Georgia delegation played a significant part in the drafting and passage of the federal highway legislation that was favorable to Georgia's reconstruction program. With the same deftness used to secure funds for completing the original routes, the department set out again to get discretionary funds. Due to inflation and dramatic drops in gas-tax revenue in the late 1970s and early 1980s, some states were not able to obligate their I-4R allocations, which meant that fairly large sums of turned back money was available for states, like Georgia, that could. While Georgia was not the only state making use of discretionary I-4R fund, by the end of 1981 it was far and away the leader in pre-financing, with the federal government owing it

[48] Richard F. Weingroff, "Origins of the Interstate Maintenance Program," Internet On-line, FHWA, Highway History <http://www.fhwa.dot.gov/infrastructure/intmaint.cfm>, [Oct. 18, 2006].

Figure 19: Piedmont Viaduct under construction as part of the post-1976 reconstruction of the metro Atlanta Interstate highways. Traffic is maintained on the original alignment of I-85. Source: GDOT Bridge Division Collection. Georgia Archives.

$476,525,000 – more than three times that owed Florida, the next closest state.[49] So successful was Georgia's approach to financing the hugely expensive freeway reconstruction program that by 1983 Georgia had moved from a donor state to a recipient state receiving $2.50 returned for every Georgia dollar sent to Washington.[50]

Moreland directed his staff to complete the metro Atlanta reconstruction with minimum disruption to the traveling public. Work to increase lanes from six to eight on I-20, I-75, I-85, and I-285 and ten lanes on the downtown connector involved 126 total miles and was phased over 13 years between 1976 and 1988 (Figure 19). The improvement campaign also included elimination of sharp curves and grades, left-hand exists, excessive interchanges, and short acceleration/deceleration lanes. About 30 miles of HOV lanes were also provided on the northeast leg of I-85 as part of the reconstruction as were park-and-ride facilities. So as to offer a bypass around construction through the center of the city, the perimeter road (I-285) was completed first (Figure 20). The radiating expressways were then upgraded, and the last phase was reconstruction of the depressed sections through downtown Atlanta. By June 1983, some $252 million in discretionary funds had been used to complete most of the highways save for some major interchanges and the downtown section.

Figure 20: Adding lanes to I-285. Traffic was maintained during reconstruction of the perimeter highway. Source: GDOT Bridge Division Collection. Georgia Archives.

[49] U.S. Secretary of Transportation, "A Revised Estimate of the Cost of Completing the National System of Interstate and Defense Highways (March 1983), pp. 11-13.

[50] Thomas Moreland Folder (1987) in Government Office Clippings, Record Group 27-6-6, State Archives.

Figure 21: I-75/I-85 Downtown Connector Williams Street interchange, 1987. Source: GDOT Bridge Division Collection. Georgia Archives.

The eight miles of the downtown section, which includes the 4.4-mile long downtown connector, was the most complicated section of the entire reconstruction. Work was started on it in 1984, and it included redesigning the massive interchange between I-20 and I-75/85 at Memorial Drive where much of the mileage was on structure. The downtown connector was to be widened to ten lanes, and this required quite a bit of right of way acquisition. Many bridges, including the 55 over the connector portion alone, had to be designed and built (Figure 21).

With completion of the Memorial Drive interchange in November 1988, one of the nation's premier interstate urban expressway reconstruction projects of the late 20th century was completed. It marked the end of an era – an era dominated by the vision and drive of Thomas D. Moreland who, more than any other person, was responsible for Georgia's nationally recognized, modern interstate highway system, especially the metro Atlanta expressway system that stands out for its lane capacity and high design standards. The $1.4 billion estimated cost price tag to rebuild the metro Atlanta interstates nearly equals what was expended on the construction of the rest of the statewide system.

Reconstruction of the metro Atlanta expressways marked the zenith of Moreland's effectiveness. Immensely popular on the local level, he was considered by many the most powerful non-elected official in the state. For years he exercised his considerable influence over the state legislature for the betterment of the department, thanks to the support of his many friends in the state house, including Zell Miller and Michael Bowers. During the mid 1980s that support eroded and relations between the department and legislature changed, and the political contentiousness that had marked road work in so many states caught up with Georgia. Longtime department lobbyist Emory Parrish recalled that "our best friends in the legislature started voting against the department" and that "they stopped coming over to the department to talk" because of the pressure for support that Moreland applied to them.[51]

In the early and mid 1980s, Moreland and his allies on the federal level had lobbied hard for a two-and-half-cent increase in the state gas tax to be used for highways to stimulate economic development throughout the state. Its failure to pass coupled with other changes, including federal legislation that limited Georgia's ability to secure

[51] Parrish, Apr. 2006.

discretionary funds, replacement of FHWA Georgia Division personnel that had been instrumental in completing the Atlanta reconstruction work, and increasingly contentious political battles, prompted Moreland to announce his retirement in May 1987, ending his 40-year career with the department. His legacy is the remarkable interstate highway system that was completed by the department under his leadership to the highest standards of the day and to the envy of most of the other states. Indeed, as fitting recognition of all that he accomplished, the technically complicated interchange between I-285 and I-85 with its graceful sweeps of prestressed concrete box beam bridges was named the Thomas D. Moreland Interchange in his honor (Figure 22). The interchange, which encompasses some 311 acres, was built between 1982 and 1987 and cost $86 million. It and similarly designed interchanges in the metro region are the most dramatic elements of the building campaign that sets Georgia apart during the last half of the era of interstate highway construction.

Figure 22: Thomas D. Moreland Interchange (I-85/I-285). Source: GADOT Web site, 2007.

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