Volume I

Phase II
State Historic Bridge Context & Inventory of Modern Bridges

Survey Report and Assessments of Significance

Prepared for

State Highway Administration
Maryland Department of Transportation
Baltimore, Maryland

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Prepared by URS Germantown, Maryland

FINAL REPORT

HISTORIC CONTEXT OF MARYLAND HIGHWAY BRIDGES BUILT BETWEEN 1948 AND 1960

Prepared for
Maryland State Highway Administration
707 N. Calvert Street
Baltimore, MD 21202

September 2011

URS Corporation
12420 Milestone Center Drive, Suite 150
Germantown, Maryland 20876
15296716

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ERRATA

URS completed this report in 2004. Since then some projects have been completed (such as the Woodrow Wilson Bridge) or have been undertaken in the intervening seven years.

URS served as project manager and provided agency coordination. URS also conducted background research on the history of road building in Maryland from the 1948-1960 period, conducted research on the history of the individual surveyed bridges, and wrote the historic context. Hardlines Design Company (Hardlines) of Columbus, Ohio, serving as a subconsultant for URS, conducted the field survey of 21 SHA highway bridges in Maryland. Fieldwork was conducted from May to July 2003. Following the survey work, Hardlines completed Maryland Inventory of Historic Properties (MIHP) forms and, along with URS, evaluated the surveyed bridges on MIHP Determination of Eligibility (DOE) forms. The results of the survey evaluation are listed in Table 1.

Table 1 – NRHP Recommendations for 21 Surveyed Highway Bridges in Maryland from 1948 – 1960

MIHP #	Bridge Name/Location	County	Bridge Type	Date Built	NRHP Eligible?	NRHP Criterion
B-4632	I-895 Bridge over CSX Railroad Tracks	Baltimore City	K-truss	1957	Yes	A, C
BA-2681	Wise Avenue Bridge over Bear Creek	Baltimore	Double Leaf Bascule Trunnion	1948	Yes	A, C
BA-2713	MD 157 (Peninsula Expressway) Bridge over Bear Creek	Baltimore	Double Leaf Bascule Trunnion	1960	No	NA
CT-784	MD 2 Bridge over the Narrows	Calvert	Reinforced Concrete Slab	1958	No	N/A
CARR-1673	MD 32 Bridge over Liberty Reservoir	Carroll	Steel Deck (Warren) Truss	1952	Yes	A, C
CE-1083	MD 213 Bridge over Chesapeake & Delaware Canal	Cecil	Metal Deck Arch (Tied Arch)	1949	Yes	A, C
MIHP #	Bridge Name/Location	County	Bridge Type	Date Built	NRHP Eligible?	NRHP Criterion
CH-781	MD 225 Bridge over Mattawoman Creek	Charles	Prestressed Concrete Girder	1957	Yes	A, C
F-3-205	MD 144 Bridge over Monocacy River	Frederick	Steel Deck (Warren) Truss	1955	Yes	A, C
G-III-A-199	Sang Run Road Bridge over Youghiogheny River	Garrett	Stringer/Floor Beam System	1955	Yes	A, C
G-IV-A-290	Swallow Falls Road Bridge over Youghiogheny River	Garrett	Stringer/Floor Beam System	1960	Yes	A, C
HA-2045	Hookers Mill Road Bridge over Bynum Run	Harford	Concrete Box Girder	1957	Yes	A,C

HA-2046	Phillips Mill Road Bridge over East Branch of Winters Run	Harford	Concrete Box Girder	1958	Yes	C
PG:68-100	US 1 Northbound Bridge over NW Branch of Anacostia River	Prince George’s	Concrete Beam	1956-57	Yes	A,C
PG:82A-52	US 301 Southbound Bridge over West Branch of Patuxent River	Prince George’s	Steel Beam	1949	Yes	A
PG:85A-58	US 301 Northbound Bridge over Timothy Branch	Prince George’s	Concrete Arch	1950	No	NA
PG:85A-59	US 301 Southbound Bridge over Timothy Branch	Prince George’s	Concrete Arch	1950	No	NA
QA-542	MD18B Bridge over Kent Narrows	Queen Anne’s	Double Leaf Bascule-Trunnion	1951	Yes	A, C
S-512	US 13 Northbound Bridge over CSX Railroad Tracks	Somerset	Steel Beam	1957	Yes	A, C
S-513	US 13 Northbound Bridge over Manokin River	Somerset	Steel Beam	1958	No	NA
WA-VI-56	I-70 Bridge over Ramp E2 from Maryland 61 Eastbound Lane	Washington	Concrete Rigid Frame	1960	Yes	A, C
WA-VI-57	I-70 Bridge over Ramp E2 from Maryland 61 Westbound Lane	Washington	Concrete Rigid Frame	1960	Yes	A, C

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In 1995, the Maryland State Highway Administration (SHA) joined with the Federal Highway Administration (FHWA) and the Maryland Historical Trust (MIHP) to identify the historic highway bridges owned by either the SHA or by Maryland counties and cities. The resulting Interagency Historic Highway Bridge Committee (IHHBC) was comprised of representatives from the three agencies. As part of the initiative, 1,072 bridges constructed between 1809 and 1947 were inventoried and evaluated for eligibility to be listed in the National Register of Historic Places (NRHP). The IHHBC reviewed each inventory form and recommended 472 of the 1,072 bridges as eligible for inclusion in the NRHP. The results of the 1995 survey and contextual research are presented in *Historic Highway Bridges in Maryland: 1631 – 1960, Historic Context Report* (Paula Spero & Associates and Louis Berger & Associates, 1995). The report provided the basis for the NRHP-eligibility evaluation of any bridge built before 1947.

In 2003, SHA proposed to undertake Phase II of its Historic Bridge Inventory to survey bridges built between 1948 and 1960 (Appendix A). According to SHA's internal records, the State Roads Commission (STC) and the counties and Baltimore City constructed 586 highway bridges during this period (Appendix B). Thus, a large number of bridges are or will be in need of evaluation for NRHP-eligibility to fulfill SHA's responsibilities under Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended. The existing historic context written in 1995 did not adequately address the technological innovations in bridge design and construction characteristics of this period, nor did it provide a comprehensive history of road building activities in Maryland during this period, and it did not establish criteria for the evaluation of bridges from this period to reflect these innovations.

In May 2003, the SHA contracted with URS Corporation (URS) of Gaithersburg, Maryland and Florence, New Jersey to prepare an update of its historic bridge context and to conduct a survey of 21 bridges encompassing 12 bridge types built in the state between 1948 and 1960. The project had multiple goals: to develop more fully the historic context for bridges from the 1948-1960 period to reflect the technological innovations in bridge design and construction from this period; to establish criteria for the evaluation of the significance and integrity of 1948-1960 highway bridges in Maryland for their eligibility for listing in the National Register for Historic Places (NRHP); to document and record 21 highway bridges in Maryland from the 1948-1960 period representing 12 different bridge types; and, to apply this criteria in the evaluation of the 21 surveyed highway bridges for NRHP-eligibility.

The 586 bridges constructed in Maryland between 1948 and 1960 represent 19 different bridge types. Of this number, twelve bridge types were surveyed by URS:

- "K" truss
- Concrete Slab
- Steel Deck (Warren) Truss
- Metal Deck Arch (Tied Arch)
- Double Leaf Bascule Trunnion
- Prestressed Concrete Girder
- Concrete Box Girder
- Stringer/Floor Beam System
- Steel Beam
- Concrete Arch
- Concrete Rigid Frame
- Concrete Beam

Twenty one bridges, dating from the 1948 – 1960 period and representing thse 12 bridge types, were chosen by the SHA, in consultation with MHT and FHWA, to be surveyed as part of the expanded inventory and historic context update. The bridges and their respective types are identified in Table 2:

Table 2 – Bridges Surveyed by URS as Part of the Survey of 1948 – 1960 Bridges in Maryland

MIHP #	Bridge Name/Location	County	Bridge Type	Date Built
B-4632	I-895 Bridge over CSX Railroad Tracks	Baltimore City	K-truss	1957
BA-2681	Wise Avenue Bridge over Bear Creek	Baltimore	Double Leaf Bascule Trunnion	1948
BA-2718	MD 157 Bridge over Bear Creek	Baltimore	Double Leaf Bascule Trunnion	1960
CT-784	MD 2 Bridge over the Narrows	Calvert	Reinforced Concrete Slab	1958
CARR-1673	MD 32 Bridge over Liberty Reservoir	Carroll	Steel Deck (Warren) Truss	1952
CE-1083	MD 213 Bridge over Chesapeake & Delaware Canal	Cecil	Metal Deck Arch (Tied Arch)	1949
CH-781	MD 225 Bridge over Mattawoman Creek	Charles	Prestressed Concrete Girder	1957
F-3-205	MD 144 Bridge over Monocacy River	Frederick	Steel Deck (Warren) Truss	1955
G-III-A-199	Sang Run Road Bridge over Youghiogheny River	Garrett	Stringer/Floor Beam System	1955
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PG:85A-59	US 301 Southbound Bridge over Timothy Branch	Prince George’s	Concrete Arch	1950
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S-513	US 13 Northbound Bridge over Manokin River	Somerset	Steel Beam	1958
WA-VI-56	I-70 Bridge over Ramp E2 from Maryland 615 Eastbound Lane	Washington	Concrete Rigid Frame	1960
WA-VI-57	I-70 Bridge over Ramp E2 from Maryland 615 Westbound Lane	Washington	Concrete Rigid Frame	1960

3.1 BACKGROUND

The *Historic Highway Bridges in Maryland: 1631 – 1960, Historic Context Report* provided background and preliminary evaluation of post-World War II bridges, but did not fully address the important contextual issues that architectural historians, industrial historians, and engineers have examined during the past decade concerning the post-World War II road building era in Maryland. Therefore, SHA sought an update of its historic context that would provide the basis for evaluation of historic bridges and begin a new phase of identification and evaluation with a sample of 21 highway bridges built in Maryland between 1948 and 1960. In addition, the new context report would contain information about previous documentation efforts and build on the work contained in the *Historic Highway Bridges in Maryland.* The end product would include well-developed information about technological innovations in bridge design and manufacturing, bridge manufacturing companies and designers, and important transportation advances or events from 1948 through 1960 in Maryland specifically and the United States generally.

3.2 FIELDWORK

Twenty-one highway bridges, representing the 1948 – 1960 period and 12 different bridge types, were chosen by the SHA, in consultation with MHT and FHWA, to be surveyed as part of the expanded inventory of historic bridges. Hardlines architectural historians visited each bridge and documented the bridge and its appurtenances on Maryland Inventory of Historic Properties (MIHP) forms. In addition to completing each MIHP form, a MHT Determination of Eligibility (DOE) form with a detailed National Register eligibility evaluation was also completed for each of the surveyed bridges. Each bridge was recorded on the appropriate USGS quadrangle map at 1:24,000 scale and photographs were taken using 5 x7-inch, 35-millimeter black-and-white film, and 35-millimeter color slide film. Hardlines also obtained the MIHP inventory numbers for each bridge from the MHT Inventory Registrar.

3.3 RESEARCH AND CONTEXT UPDATE

URS updated the historic context written in 1995 to include information regarding technological innovations in bridge design and manufacturing, bridge manufacturing companies and designers, and important transportation advances or events from 1948 through 1960 in Maryland specifically and the United States generally, as these themes correspond to National Register Criteria A, B, C and D. In order to develop a historic context update for the post-World War II or mid-century-era bridges, historians from URS and Hardlines also conducted general and specific research at a number of local, regional, and university repositories. In addition, these historians researched county and/or SHA bridge maintenance records and construction plans, as well as secondary sources of information, including the Office of Bridge Development’s 2003 *Bridge Inventory* and the most current list of county-owned bridges in Maryland. The historians also had access to the most current SHA Historic Bridge Inventory (1995 – 2001). Inspection of previous cultural resource survey reports, site forms, and other references was conducted either at MHT or at SHA. Other repositories of information used in the research effort include, but are not limited to, the Enoch Pratt Free Library’s Maryland Room, the Maryland State Archives, the Historical Society of Maryland Library, New Jersey State Library, New York Public Library, and the Library of Congress. The inspected documents included historic maps, reports, articles, papers, historic photographs, monographs, and books.

3.4 PROJECT PERSONNEL

URS Architectural History Team Leader Geoffrey Henry served as Principal Investigator and Project Manager for the Historic Context Update and Survey of 21 1948-1960 Highway Bridges in Maryland Project for the SHA. He directed the research, evaluation, and writing of the historic context for this project. URS Architectural Historians Mark Edwards, Amy Barnes, Fred Holycross, Craig Tuminaro, Aaron Levinthal, Ellen Jenkins, and Marvin Brown conducted research, wrote individual bridge histories, and evaluated the 21 bridges for NRHP-eligibility. Fred Holycross, Aaron Levinthal, and URS Historian Ingrid Wuebber conducted historic research and wrote the updated historic context for 1948-1960 highway bridges in Maryland.

Hardlines Architectural Historian Charissa Wang served as Project Manager for the fieldwork phase of this project. Fieldwork was conducted by Hardlines Architectural Historians/Historians Roy Hampton, Stan Popovich, Amy Case, and Mary Crowe. The survey team was divided into two groups to conduct the survey fieldwork: one group working in the eastern half of Maryland; the second group working in the western half.

The historians and architectural historians meet the *Secretary of Interior's Professional Qualifications Standards* for history and architectural history, published in 36 CFR Part 61 (Appendix C).

3.5 PREVIOUS DOCUMENTATION

Four highway bridges built during the 1948-1960 period in Maryland have been previously surveyed and evaluated for NRHP eligibility. These bridges were surveyed and evaluated as part of the Section 106 process, which mandates consideration of the effects to NRHP-listed or -eligible resources (including bridges) from federally funded actions undertaken by SHA. Table 3 lists these previously surveyed and evaluated highway bridges.

Table 3 – Previously Surveyed 1948–1960 Highway Bridges in Maryland

Bridge #	Bridge Name/ Location	MIHP/ DOE #	County	Date Built	NRHP Eligible?	NRHP Criterion
0400800	MD 231 over the Patuxent River	CT-1214	Calvert and Charles	1950/1951	Yes	Criterion C
2200302	Business US 13 over the Baltimore & Ohio Railroad Tracks	WI-222	Wicomico	1930; Second Span-1951	Yes	Criterion C
0106600	Blue Bridge/ MD 942 over the North Branch of the Potomac River	AL-IV-A-153	Allegany	1954; renovated 1996	Yes	Criterion C
F-10700	Doubs Road over the Tuscarora Creek	F-1-215	Frederick	1935; rebuilt 1950	No	Not Applicable

Nineteen highway bridges in Maryland dating from the 1948-1960 period have been evaluated for NRHP-eligibility without the completion of individual MIHP forms. MHT DOE forms were completed and/or MIHP ID numbers were assigned to these bridges as part of their evaluation. In accordance with the provisions of Section 106 of the NHPA, the NRHP-eligibility determinations were made by SHA with the concurrence of MHT.

Table 4 – NRHP Eligibility Determinations of 1948–1960 Bridges in Maryland

Bridge #	Bridge Name/ Location	MIHP/ DOE #	County	Date Built	NRHP Eligible?	NRHP Criterion
0309900	MD151 over MD 151B and the Patapsco & Black River Railroad	BA-2714	Baltimore	1954	Yes	Criterion C
1600800	US Alternate 1 over the Anacostia River	PG:69-35	Prince George's	1955	Yes	Criterion C
0201801	MD 195 over the Amtrak Railroad Tracks and Stony Run		Anne Arundel	1950	No	Not Applicable
0201802	MD 195 over the Amtrak Railroad Tracks and Stony Run		Anne Arundel	1950	No	Not Applicable
0204200	MD 70 over Weems Creek and College Creek	DOE-AN-0002	Anne Arundel	1953	No	Not Applicable
0204300	MD 70 over Weems Creek and College Creek	DOE-AN-0003	Anne Arundel	1954	No	Not Applicable
BC-40200	Waterview Avenue over MD 295	DOE-B-1345	Baltimore City	1950	No	Not Applicable
0305200	Cold Bottom Road over I-83	DOE-BA-0002	Baltimore	1955	No	Not Applicable
0315700	I-695 and I-83 Expressway projects	DOE-BA-0006	Baltimore	1954	No	Not Applicable
0603201	MD 140 over the Maryland Midland Railroad and MD 27		Carroll	1952	No	Not Applicable
0603202	MD 140 over the Maryland Midland Railroad and MD 27		Carroll	1952	No	Not Applicable
0604101	MD 140 over MD 97		Carroll	1952	No	Not Applicable
0604102	MD 140 over MD 97		Carroll	1952	No	Not Applicable
HO-00900	Old Montgomery Road over Deep Run	DOE-HO-0002	Howard	1955	No	Not Applicable
P-48600	Molly Berry Road over Rock Creek	DOE-PR-0007	Prince George's	1956	No	Not Applicable

4.1 INTRODUCTION

The years between 1948 and 1960 are one of the most active periods of road and bridge construction in Maryland's history. Relentlessly increasing traffic volumes, coupled with a minimal amount of maintenance during the World War II years, created the almost insurmountable challenge for highway engineers of rebuilding the state's road system. Prewar predictions from highway experts could not envision the volume of traffic and the increases in vehicle speed and size that would occurred after 1945. Maryland was in need of an improved highway system to meet these demands and to enable the state's businesses to prosper (Public Administration Service 1952:6).

In 1947, Governor William Preston Lane (1947-1951) unveiled a plan to launch the greatest road building program in Maryland's history intended to make the state's highway system "second to none in the nation" and to lay the groundwork for major construction projects in the 1950s (State Roads Commission 1949:61; 1960:3). By the early 1950s, the motoring public was beginning to see some improvement as new road construction (such as the limited-access Washington National Pike) and reconstruction (such as the divided highway extension of US 140 in Carroll County) were underway or completed (State Roads Commission 1950:1; 1952:2, 4). Between 1947 and 1951, the state saw 757 miles of roads built or rebuilt, work on the Chesapeake Bay Bridge (the governor's highest priority project) began, and planning for a statewide expressway system was underway (LeViness 1958:157; State Roads Commission 1964:17).

Maryland's next Governor, Theodore Roosevelt McKeldin (1951-1959), continued the efforts to improve roadways and bridges in the state. In 1951-1952, McKeldin commissioned a study that found that 67 percent of the state's roads were in need of improvement or reconstruction to reach standards adopted by the State Roads Commission (SRC) in 1948. The study recommended a 12-year program to rebuild Maryland's highway system by 1965 (LeViness 1958:165–167, 175–176; State Roads Commission 1952:5; 1954:2). Many Maryland residents saw that effort as too little and too slow; by 1960, the public was impatient with what they perceived as inadequate and obsolete roadways. A five-year program, the so-called "Go Roads" program, was instituted in 1960 to plan for 100 miles of primary and interstate highway construction in each of the next five years and to extend modern primary highways or expressways into every region of the state, with beltways to serve urban areas (State Roads Commission 1960:3).

Bridge building and design was an integral part of Maryland's overall road-building program after World War II. Failing bridges were in need of replacement or repair and new bridges were planned as part of an overall upgrade of the state's road system. During 1947 and 1948, the Division of Bridge Design completed preliminary studies, estimates, and schemes for constructing more than 50 new bridges and bridge improvement projects to repair and strengthen existing structures (State Roads Commission 1949:65–66, 70). This was particularly important in a state like Maryland split down the middle by the Chesapeake Bay with numerous tributaries throughout the state feeding the bay.

In addition, many large bridge and road projects built during this period had important social implications: the Chesapeake Bay Bridge ended the isolation of the Eastern Shore; the Patuxent River Bridge united two Southern Maryland counties; and the beltways around Washington and Baltimore under construction at the end of the period encouraged the relentless sub-urbanization of their surrounding counties. The SRC bridge database lists 586 bridges built between 1948 and

1960 on state and county roads and 203 on interstates. Bridges were constructed in all of Maryland's 23 counties and in the city of Baltimore (SHA 2003). This period of bridge construction left a profound mark on the state's transportation system and on its landscape that continues to link and shape Maryland's diverse communities.

4.2 MARYLAND HIGHWAYS BEFORE AND DURING WORLD WAR II

During the 1920's, Marylanders took to the road in increasing numbers. To keep up with increased demand, the State Roads Commission (SRC) improved the hard-surfaced road system and paved the secondary system of farm-to-market feeder roads. The agency was justifiably proud of its accomplishments, as Maryland was considered to have the country's best road system in the period between 1915 and 1925. Nevertheless, instead of remaining at the forefront of road construction, Maryland soon lost ground to the onslaught of tractor-trailers and passenger vehicles that became faster, heavier, and more numerous than the state's roads were designed to carry. Highway departments throughout the country found themselves dealing with these same issues, yet Maryland's predicament was more pressing due to the state's streams and waterways that pass through every region of Maryland emptying into the Chesapeake Bay. Its bays, rivers, and estuaries had facilitated communication and provided transportation corridors within Maryland for centuries, but in the automobile age, traffic could not flow smoothly without the construction and maintenance of numerous bridges to connect an enhanced highway system.

Roads and bridges previously built to meet local and regional needs had to meet the demands of heavier and faster traffic moving over longer distances. The solution lay in design improvements such as flattening steep grades, reducing dangerous curves, providing longer sight lines, widening pavement, adding more traffic lanes, and building medians to separate oncoming lanes in high volume traffic areas (LeViness 1958:101-102; State Roads Commission 1940:1). Despite the country's economic woes in the 1930's, revenues from road use remained stable and some places registered an increase in the sale and use of automobiles. Buses, offering lower fares than rail travel, also became a preferred method of transportation for those who could not afford a car (Kuennen 2001a:21).

The federal government reacted to the nation's economic decline during the Great Depression by expanding road funding. In 1930, federal aid increased from $75 million to $125 million and Congress appropriated emergency funding for highways even during the leanest years of the 1930s. The National Industrial Recovery Act of 1933 earmarked $400 million for highway projects without requiring matching state funds. Prior to the Great Depression, federal spending had targeted state highway systems in rural areas. Now, grants became available for improvements to city streets and municipal construction programs that linked to the state highway system. For the first time, the Public Works Administration administered federal funds and bypassed state road departments by delivering the money directly to local government. Road projects operated as employment programs as well as being an economic stimulus (Kuennen 2001a:22).

In 1934, the Hayden-Cartwright Act appropriated $200 million to reestablish the lapsed federal aid highway program. This legislation is noteworthy for being the first time that funds were set aside for state highway departments to plan for the future, make surveys, and investigate the economic and engineering benefits of particular road improvements (Kuennen 2001a:20-21).

Highway departments began examining such factors as road conditions, the volume and nature of highway traffic, highway life spans, and future highway needs.

In 1937, the Maryland General Assembly authorized the SRC to formulate a comprehensive plan for the construction of bridges and tunnels across major bodies of water in Maryland. The intent of the plan was to provide north-south arterial roadways that would bypass congested urban areas. Funding for this program came from state revenue bonds that were to be repaid from tolls. The SRC hired the J. E. Greiner Company (Greiner), a Baltimore-based engineering design firm with an international reputation in construction, to develop a proposal for bridge construction across the state. The resulting report, *Maryland's Primary Bridge Program*, recommended a bridge across the Susquehanna River at Havre de Grace; a bridge across or tunnel under the Patapsco River between the Fairfield and Canton sections of Baltimore City; a bridge across the Potomac River at Ludlow's Ferry; and a bridge across the Chesapeake Bay (Bruder 2000:11-12). These vital crossings would require the construction of long multi-span bridges (or possibly a tunnel in the case of the Patapsco River site). Congress ratified the plan in 1938 under its regulatory powers over navigable waterways and the Public Works Administration promptly awarded financial aid to the SRC to build the Susquehanna and Potomac River Bridges, but deferred action on the remaining two projects until after the war (Greiner 1944:2).

The SRC chose Greiner to plan the Susquehanna River crossing. The firm designed an elevated bridge to accommodate the shipping traffic still active on the river. The bridge project complemented improvements underway to heavily traveled US 40 between Baltimore and the Delaware State line in Cecil County, where a relocation of the alignment was necessary to eliminate sharp curves, reduce grades, extend sight lines, and widen the roadway for dualization. Greiner's design called for a steel three-span bridge, consisting of one through-truss and two partial through-trusses, while the remainder of the bridge would utilize deck trusses or deck girders (Bruder 2000:13-14). The total length of the four-lane bridge was 1.5 miles and crossed the Susquehanna River from a point near Perryville in Cecil County to a point near Havre de Grace in Harford County. The bridge opened in 1940 as the Susquehanna River Toll Bridge. In 1986, it was renamed for Thomas J. Hatem (1925-1985) who represented Harford County in the House of Delegates from 1955 to 1958.

Greiner also designed the Potomac River Bridge (US 301) between Charles County, Maryland and King George County, Virginia. The bridge opened in December 1940 and enabled travelers from eastern and southern Maryland heading to Virginia and points further south to bypass Washington, D.C. where they had previously crawled through along US 1. Traffic engineers predicted the bridge would carry an average of 136,000 vehicles-per-year during the first five years. During 1942, the traffic volume surpassed 171,600 vehicles; four years later, the count climbed to 453,900 annually. Traffic peaked at 3.2 million in 1964 but dropped by a third the following year after the opening of the Capital Beltway (I 495), which allowed southbound motorists to quickly travel around Washington, cross the Potomac River along the Woodrow Wilson Bridge, and continue south into Virginia (St. Mary's Today 2004). In 1968, the US 301 Bridge was renamed the Harry W. Nice Memorial Bridge to honor the governor of Maryland (1935-1939) during whose administration the bridge was planned and built.

John Greiner's partner, Herschel Allen, developed and patented the "Potomac Pier" for the Nice Bridge project. His pier design eliminated the need for a coffer dam by placing a steel form on the floor of the river and then driving piles through the form. Additional piles were attached and covered by concrete until the pier was fully formed. Greiner engineers used a cantilever design for the main span of the 11,446-foot bridge. (Bruder 2000:14-15).

The 1930s also saw construction activities focused on the elimination of railroad grade crossings with federal funds helping state highway departments cover the costs. Additional federal dollars came from the Emergency Relief Appropriation Act of 1935 that provided $200 million to eliminate the most dangerous crossings (Kuennen 2001a:21). With these funds, the SRC made an inventory of all the railroad crossings in the state and formulated hazard ratings for each crossing.

By 1938, Maryland completed work on 70 grade elimination projects, but still had 150 grade crossings in the state highway system outside of incorporated towns and cities. The only form of protection on nearly all these crossings was a warning sign. The SRC looked at accident reports involving grade crossings around the state. They found 27 people killed and another 70 people injured over a five-year period. The Commission concluded that the construction of an expensive overpass or underpass was not necessary at every grade crossing. Instead, changes to the road or the installation of flashing lights or a warning signal, known as a “wig-wag,” could provide a quicker and better way to utilize scarce funds (State Roads Commission 1938:30-31).

In 1938, the SRC reported on the results of a statewide highway planning study showing that Maryland contained a total of 18,137.6 miles of roadway, of which 4,057 miles or, about 21 percent, was under the direct control of the SRC. Traffic volume on state highways ranged from a high of more than 20,000 vehicles a day along US 1 between Baltimore and Washington, to less than ten vehicles a day on a road in Charles County. An increasing proportion of these vehicles were trucks (State Roads Commission 1938:17).

At the national level, Congress requested the Bureau of Public Roads (BPR) in 1938 to study the feasibility of a system of high-speed national highways. The BPR worked with state highway departments to develop planning surveys following passage of the Hayden-Cartwright Act in 1934 that allowed 1.5% of federal highway funds to be used for “surveys, plans, and engineering investigation of projects for future construction.” The effort also led states to undertake massive needs studies to project future population trends, traffic volumes, and vehicle ownership trends (McDonald 2003).

The resulting data provided the foundation for the BPR’s 1939 report *Toll Roads and Free Roads*, a master plan for a 26,700-mile interstate highway system. President Roosevelt appointed the National Interregional Highway Committee to study the plan in 1941. Congress backed the Committee’s expanded version of the plan and the BPR issued a revised master plan, *Interregional Highways* in 1944 that urged state highway departments to begin planning for a 40,000-mile network of express roads so work could begin as soon as the war ended (Seely 2000).

In 1940, the SRC published its twenty-year plan for meeting Maryland’s future highway needs. Entitled *Maryland’s Highway Needs 1941-1960: A Report of the State-wide Highway Planning Survey,* the plan envisioned a long-range construction program based on the premise that the SRC would control all aspects of planning, financing, constructing, improving, and maintaining the state’s highway system with local city streets and county roads remaining under municipal or county control. One of the benefits of planning two decades in advance was that it made the acquisition of right-of-ways less costly. Backed up with effective zoning laws, the SRC hoped to control commercial encroachment and limit access to the roadway (State Roads Commission 1940:xvii-xix).

The twenty-year plan was the culmination of several years of research and analysis into Maryland's roads. Begun in August 1936, planners thoroughly investigated the scope and physical condition of the road system and highway structures, including bridges. The planners were looking to understand how Maryland's highways did not meet the present needs of motorists and to project how they might not meet future needs. The planners studied the character and volume of traffic flow and predicted traffic growth in the future in order to develop the construction program based on objective criteria. The plan recommended improvements and their locations, and the manner in which highway funds could best be utilized (State Roads Commission 1940:1-2).

The planning survey counted 703 bridges that were twenty feet or more in length on the rural state highway system. Of those bridges, 24 were judged as being in poor condition and 120 as fair. Approximately 60 percent of the bridges averaged 110 feet in length and 20 to 26 feet in width. Another 11 percent of bridges were even narrower and longer. Engineering studies had thus far shown that 20 feet of paved surface was the minimum for safe passing on lightly traveled two-lane roads and that an additional 10 feet was best to minimize the possibility of collision with bridge railings. Only 29 percent of bridges in existence in the late 1930s had widths of 27 feet or more. Since a width of 27 feet was inadequate for bridges on three and four-lane roads, the number of bridges deemed inadequate was even higher. Consequently, about 20 percent of the state's bridges were posted with load and speed restrictions. The study concluded, "[t]hese narrow and defective structures are extremely hazardous to traffic, and their replacement forms a logical part of the modernization program" (State Roads Commission 1940:14-15).

A SRC publication from the same period, *Modernizing Maryland Highways*, emphasized the commission's desire to address the "deficiencies" and "inadequacies" of the state highway system. This pamphlet exhaustively listed highway problems including 600 sharp curves, 1,500 steep grades, 16,000 places where obstructions limited sight distance, and more than 400 inadequate bridges, among numerous other problems. The SRC called for funding on over $216 million through 1960 with $55 million "urgently needed within the next five years' to pay the costs of modernization. The SRC suggested that a boost in registration fees for commercial trucks be increased, changes made to refund claims on motor fuel taxes, and consolidation of highway administration to pay for the program (*Modernizing Maryland Highways* c.1940).

With the threat of involvement in wars in Europe and Asia imminent, pundits, politicians and some road builders discussed the idea that an interstate system could strengthen internal national security. The American Road Builders Association (ARBA) suggested in 1940 that "[a] network of limited access highways is highly desirable in any plan of national defense at a time when a new world conflict is threatened" (Kuennen 2001a:23).

The limited-access design of the Pennsylvania Turnpike, which opened in 1940, became a model for future interstates. Built as a four-lane "superhighway" through the Allegheny Mountains, the Pennsylvania Turnpike was the first road in the United States that had no cross streets, no railroad crossings, and no traffic lights over its entire length. When the war ended, traffic mushroomed and plans were made to extend the turnpike east to Philadelphia and west to Ohio. Traffic volume by 1950 reached 4.4 million vehicles, nearly 3 1/2 times what the planners had originally envisioned. In 1952 with both extensions open, traffic volume ballooned to 11 million vehicles (Orr 1999).

World War II curtailed the growing call for a modern interstate system. The Defense Highway Act of 1941 authorized surveys and plans, including advance engineering, for the development of a strategic network of highways and of bypasses around, and extensions into and through, cities. The Defense Highway Act also restricted the activities of state highway departments and federal funds to what was a “Strategic Network of Highways,” a system of roads that accessed military bases, defense-manufacturing plants, and other strategic sites. With the economy focused on the war effort, state highway departments and their scarce stockpile of materiel, were further limited to projects with a direct benefit to industrial plants or military facilities (Kuennen 2001b:15; State Roads Commission 1943:73-74).

By early 1941, these national defense concerns superceded the SRC’s highway construction program. The SRC’s plans for crossing the Chesapeake Bay and Patapsco River would have to wait until peacetime. Maryland, however, enjoyed a strategic position in the nation’s defense system and was part of the Strategic Network of Highways. As the gateway to the nation’s capital, and having several important Army and Naval installations, Maryland became a focus of efforts to build a national system of inter-regional highways that would support defense needs. During World War II, Maryland built the Suitland Parkway (US 675), Indian Head Highway (MD 210), and the extension of MD 235 to the Patuxent River Naval Air Station in St. Mary’s County, all roads that connected military bases to Washington (Bruder 2001). The state also rebuilt roads linking military bases near Solomons Island with Prince Frederick in Calvert County, constructed the Camp Ritchie-Pen Mar Road in Washington County, dualized the road to the Sparrows Point area east of Baltimore, and improved access to Aberdeen Proving Grounds. These and other projects totaled approximately $28 million (LeViness 1958: 15).

While funds for other projects dried up during the war, planning continued to some degree. By the Second World War, Baltimore-Washington Boulevard (US 1), which connected the two cities was viewed as one of the most dangerous roads in the country. The road was a heavily traveled highway infamous for its many accidents. Known as “Death Highway”, US 1 had dangerous curves, narrow ten foot-wide lanes, and no traffic medians. Its accident rate was three times the national average and thirty to forty people died each year along the roadway (Kaszynski 2000:162-163).

Increasing congestion and traffic hazards made modernization of US 1 a priority for the SRC. Greiner was hired to address the highway’s needs and in March 1944, the engineering firm submitted a preliminary report on the highway and its approaches to the Patapsco River Bridge. Greiner’s planning approach included the “freeway principle of highway design” that would produce a safe roadway for motor vehicles driven at high speeds. The freeway principal design approach included grade separations for cross traffic; the use of median strips or center guard rails between opposing traffic lanes; guard rails along the outer shoulders; merge lanes; deceleration lanes; right-hand exits; long curves providing long sight distance; and surface and underground drainage systems (Greiner 1944:2-3).

The traffic dangers and congestion on Baltimore-Washington Boulevard became an example to many of the need to upgrade the state’s road system to enable a growing, modernizing society to travel for commerce and pleasure. A *Life* magazine article from 1955 entitled “Dead End for the U. S. Highway,” used US 1 as an example of what was wrong with America’s roads. The article explained that American cars were "big, fast, and comfortable," while the country's roads were "awful." U.S. 1 had become an "oxcart route for giant trucks" (Brean 1955:112). The following section discusses how Maryland sought to change both the reality and the perception of "1955 cars and 1935 roads" in the period from 1948 to 1960.

4.3 HIGHWAY DEVELOPMENT IN MARYLAND AFTER WORLD WAR II

Two major factors drove the increase in highway construction in Maryland from 1948 to 1960: bad roads and more cars. American roads were already unable to handle increasing traffic loads before the war and had deteriorated further due to lack of maintenance. The solution seemed simple—existing roads must be fixed and new highways built in order for the economy to grow and prosper. However, other trends were also driving the need to expand the highway system. Maryland, like American society as a whole, was mobilizing and moving like never before. The continued rise of the automobile as a symbol of the American way of life became inexorably linked to a shift in population to the suburbs.

The monetary investment in Maryland's roads in this period is an example of how state government responded to these cultural trends by building new roads and bridges to keep ever-increasing numbers of vehicles moving on the state's highways. Maryland also took advantage of increased funding for highways and other roads from the federal government. Improved roads and bridges were more than ever a crucial part of both the country's infrastructure as it began a transition from being primarily an urbanized place (in terms of where most of the population lived) in the late nineteenth and early twentieth centuries, to becoming a suburbanized society by the end of the twentieth century (Brugger 1988:575). The SRC played a major role in making Maryland a modern, suburbanized society with roads to match and the state's collection of bridges shows the material investment in roads in the period as the American lifestyle became based on individual mobility enabled by the automobile.

4.4 MARYLAND AND FEDERAL HIGHWAY POLICY

The rise of the American suburb and the rapid shift of population in Maryland to its suburban areas in this period played a major role in developing political support for government funding for new and improved highways to service the changing suburban landscape. In addition, Americans simply wanted cars. The post war period saw a huge increase in car purchases by Marylanders and traffic counts soared on all of the state's main highways. The need for modern multi-lane highways became more acute as the number of vehicles increased. Crumbling two-lane highways were obsolete, clogged with commercial traffic, commuters, and vacationers competing for road space. Travel time increased as more cars drove longer distances and main arteries became congested by unlimited access from side traffic. Cars were larger, heavier, and faster at a time when bridges were not strong enough and roads not wide enough. Americans drove on a hazardous 1920s highway system built to handle low speeds, with dangerous curves, narrow bridges, and numerous intersections (Kaszynski 2000:162).

During the war years, highway construction essentially halted except for defense-related projects. Consequently, the highways experienced rapid deterioration at a time when they carried heavier loads for which they were not designed (Childs 1949:17-19). Previously, the nation's railroads had been able to meet the transportation needs of most Americans with railroads also carrying the bulk of America's commercial traffic. After World War II, most railroads experienced a steep decline in service and dependability, putting additional strains on the nation's roadways. A new, first-class highway system was coming to be seen as essential to the postwar American lifestyle as Maryland's economy, like that of other states, became increasingly dependent upon a highway network linking material, manpower, and markets.

In the quarter century following the first Federal Aid Road Act in 1916, states used federal money to surface rural roads and to integrate local roads into a national system. Yet the improvement of rural roads actually increased the volume of traffic on the main highways.

By World War II, traffic jams were making travel through American cities, including Washington and Baltimore, unbearable. Planning for an interstate system to relieve congestion began in the late 1930's with the Federal-Aid Highway Act of 1938 that asked the predecessor of the Federal Highway Administration (FHWA), the Bureau of Public Roads (BPR), to study the feasibility of a toll-financed system of three east-west and three north-south superhighways. The BPR's report, *Toll Roads and Free Roads*, showed that a toll system would not be self-supporting and instead advocated a 26,700-mile interregional highway network. In 1941, President Franklin D. Roosevelt appointed a National Interregional Highway Committee to evaluate the need for a national expressway system. The committee's January 1944 report, *Interregional Highways*, advocated a system of 33,900 miles, plus an additional 5,000 miles of auxiliary urban routes (FHWA 2004).

In 1944, Congress initiated a large-scale program of joint action by federal, state, and local governments, called the Federal-Aid Highway Act of 1944, that included urban highway improvements and expanded the scope of federal aid to include secondary rural roads. Along with supplemental legislation passed in 1948, Congress authorized large sums of money specifically for the relief of urban traffic problems and traffic congestion in general (LeViness 1958:182).

These programs set up a system of federal aid whereby the states could obtain special allocations for primary, secondary, and urban road projects. Special allocations for projects were made up to two years in advance to enable states to develop their road plans and to raise matching funds. These allocations, known as ABC funds, were an integral part of postwar road building programs. The 1944 Federal Aid-Highway Act also laid the foundation of the future interstate highway system by selecting the most heavily traveled roads of the federal-aid primary system to form the interstate network. This system of roads would connect state capitals, principal metropolitan areas, cities, and industrial centers by direct routes (LeViness 1958:182; MacDonald 1949:32).

The Federal-Aid Highway Act of 1954 set aside $175 million for the construction of the interstate highway system. However, even more money was needed for the system that President Dwight Eisenhower envisioned, and he continued to press for additional funds. Two years later, the expanded Federal-Aid Highway Act of 1956 authorized a budget of $25 billion, of which the federal share was to be 90%. The Act proposed a 41,000-mile interstate highway system to be completed by 1969. It was the most comprehensive and expensive public works program in the country's history. The program included uniform design standards and gave the federal government the authority to condemn and purchase land for rights-of-way (Childs 1949:20; Kaszynski 2000:137).

Many states were unwilling to devote scarce federal-aid funds for interstates but instead looked for ways to improve their own transportation infrastructure with privately funded highways.

Highway "authorities" as governing agencies were created to fund construction and maintenance of highways through the sale of bonds underwritten by the state and through toll collection (Kaszynski 2000:138, 146). Maryland was not shy about taking federal funding to finance public programs, and by 1958 was receiving almost $10 million for improvement of its primary highway system, secondary roads and its urban highways. Maryland's interstates consisted of 350 miles of roads in 1958, including portions of both the Baltimore and Washington beltways, and the state intended to apply for 194 more miles in the future. In the same year, the state was approved to receive (apportionment was on a two-year cycle) over $56 million in 1960 for its share of cost to build the federal interstate system in Maryland (LeViness 1958: 182-183).

Maryland demonstrated its commitment to the concept of the federal interstate system and to roads in general by its early construction of many sections of several of the future interstate routes selected by the federal government in 1947. Maryland officials saw highway construction as among the state's most important responsibilities and Governors and the legislature in this period launched the biggest road building program in the state's history (LeViness 1958: 157). The SRC built portions of the Baltimore-Harrisburg Expressway (today I 83), the Baltimore Beltway (1 695), the Washington Circumferential Highway (now the Capital Beltway; I 495), and a bypass around Frederick without funding from the Federal-Aid Highway Act of 1956 that provided 90% grants for projects with a 10% match from each state (LeViness 1958: 183-184). State funding for highways increased 409% from 1945 to 1951 in Maryland at a time when the percentage of increase for the entire state budget rose at a rate of 25% a year, or 264% for the same period (Callcott 1985: 105).

4.5 THE SRC AND HIGHWAY POLITICS IN MARYLAND

The major public expenditure in the state during this period was for highway improvements. Seven major road improvements took place in Maryland during the period from 1948 to 1960, each costing more than $100 million to construct. Not all of the seven were in the suburbs but they had their greatest impact there by primarily servicing the outer reaches of Baltimore and Washington, thereby promoting sub-urbanization by enabling commuting farther distances than ever before (Callcott 1988:76). Those projects included:

- The Chesapeake Bay Bridge (1952);
- Baltimore-Washington Parkway; MD 295 (1954);
- John Hanson Highway, Washington-Annapolis; US 50 (1955);
- Baltimore-Frederick; I 70 (1956);
- Baltimore Harbor Tunnel and the Harbor Tunnel Thruway; I 895 (1957);
- Washington-Frederick; I 270 (1957);
- Baltimore-Harrisburg; I 83 (1959).

During the 1950s, the State's population increased nearly one-third to 3.1 million people. Pent-up demand for automobiles outstripped supply and people were happy to drive anything with four wheels. By the early 1950s, Maryland had 800,000 motor vehicles registered, roughly one car for every three people. Road construction could not keep up with the 18 million new cars on the road between 1945 and 1950 (Kaszynski 2000:137; Public Administration Service 1952:11; State Roads Commission 1964:8-10).

The SRC focused its resources on addressing the deterioration as best it could. The first two years following the war, 1946 and 1947, were spent keeping highways minimally drivable and making surveys and plans for future construction. Construction and maintenance costs doubled in the post-war years above the cost-of-living index. Postwar design standards also pushed up costs with twenty-foot pre-war pavements being widened to a safer twenty-four feet, the reduction of grades requiring more excavation, heavier traffic requiring thicker pavement, and controlled-access expressways necessitating grade separations and interchanges (LeViness 1958:162). Yet the legislature and Governors in the period moved forward with new plans and ways to pay for them.

Major construction activities resumed in 1948 with the implementation of Governor William Preston Lane Jr.'s (1947-1951) highway construction plan that was enthusiastically approved by the state legislature in 1947 and which provided $200 million over five years. Governor Lane's road program called for new construction of expressways, dual highways, and two-lane highways. Existing roads were to be improved by widening and resurfacing until they could be completely rebuilt in the future. A network of secondary roads was also planned. In 1948 the SRC's Chief Engineer prepared a report entitled *Desirable Standards for Roads of the State Highway System of Maryland*. The standards delineated dimensions for highways and associated structures that were to be designed according to the expected levels of traffic for each project (State Roads Commission 1949:61; 1960:3). In the four years of Lane's administration, the SRC built or repaired 757 miles of roads at a cost of over $106 million, began the interstate and expressway system and started work on the Chesapeake Bay Bridge. Road building in Maryland increased from a yearly average of $7 million to over $33 million in the same period (LaViness 1958: 157).

Lane's administration also contributed to modernizing Maryland's highways by planning and partially constructing some of the state's first controlled- or limited-access highways. The year 1947 was a significant turning point in the design and construction of highways in Maryland in this regard. Up until that time, it had been the policy of the SRC to permit unrestricted access to all highways, both new and existing. That changed when the General Assembly approved the Expressway Act of 1947 that legally established the concept of controlled access expressways in Maryland and approved a $200-million bond issue for major highway improvements that included a number of new expressways. The Act defined an expressway as a major thoroughfare containing two or more lanes in each direction with medians separating the lanes, grade separation structures at all intersections, and entrances or exits from the road limited to specific locations (LaViness 1958:161).

The dangers exhibited by the example of US 1 showed that limiting access not only made roads safer but also made them more efficient. Prior to this time roads were operated with "unlimited access" that allowed anyone who could afford land along a road to construct entrances and operate a business or build a residence. The busier the road, the quicker it became congested by commercial buildings, signs and other devices to attract the passerby and convince them to slow or stop (Brean 1955:116). The concept was hard to sell in much of the state, but the Lane administration vigorously supported the principle and began construction of the Baltimore-Washington Expressway (later Parkway), one of Maryland's most important highway projects of the period. When completed, the highway was a 30 mile-long divided highway requiring bridges and connecting roads in 3 counties. Lane's tenure also saw construction starts on the Baltimore-Harrisburg Expressway (I 83) and the Washington National Pike (later I 270) south of Frederick, with the principle as a guide. Partial limited access (where access was denied except at selected road crossings) was used for new highways such as the eastern approach to the Bay Bridge (US 50) and the section of US 40 from Pine Orchard to West Friendship (La Viness 1958:161).

Governor Lane's enthusiasm for spending money on roads and other programs led to his replacement by Theodore R. McKeldin (1951-1959) as state spending rose from $60 to $219 million during his term and the higher taxes need to pay his programs became too burdensome for most voters (Brugger 1988:569). Yet, McKeldin also believed that the modernization of roads and state services in general was among his chief aims in office. He therefore supported the completion of the Bay Bridge and funded a study of future road needs and how to pay for them (Brugger 1988:574; LaViness 1958:165). Known as the Twelve-Year Program, McKeldin's plan was designed to rebuild Maryland's road system by 1965 and included a priority system that enabled each county to receive advance notice of the improvements they could expect and when they would be built (LaViness 1958:165).

The Legislature adopted McKeldin's plan in 1953 with estimated completion costs of $568 million. The plan scheduled improvements to both the primary and secondary systems in the state with SRC District Engineers reviewing the plans to utilize their knowledge of local roads. The plan called for 241 miles of roads of the State Primary System to be constructed and/or reconstructed at a cost of $367 million and 2,208 miles of the State Secondary System at a cost of $200 million (Twelve-Year Program 1952:11-12.). The most significant highway projects completed during his term were the first Chesapeake Bay Bridge (1952), the Baltimore-Washington Parkway (1954), the John Hanson Highway between Washington and Annapolis (1955), Interstate 70 from Baltimore to Frederick (1956), the Baltimore Harbor Tunnel and Harbor Tunnel Thruway (1957), and Interstate 270 from Washington to Frederick (1957) (Callcott 1985:67).

Governor J. Millard Tawes (1959-1967) continued the support of road modernization at the end of this period with extraordinary new levels of spending being supported by the 90% matching funds for interstate highways provided by the federal government. Tawes oversaw the completion of the Baltimore-Harrisburg Expressway (I 83) in 1959 and later in his term the Washington and Baltimore beltways, and the portions of interstate from Baltimore to Wilmington, Delaware (I 95), Baltimore to Hancock (I 70), and Washington to Frederick (I 270) (Callcott 1985:67).

4.6 THE SRC & THE DIVISION OF BRIDGE DESIGN

With the rapid increase of highway construction after 1948, the SRC's Division of Bridge Design (DBD) became overwhelmed preparing plans and specifications for structures on new roadways, and for the repair and widening of existing bridges. The DBD also prepared studies, estimates, and plans for county road structures when requested, making their job even harder. The SRC divided the state into six engineering districts, each under the control of a District Engineer, who was responsible for constructing and maintaining highways, bridges, and other facilities of the SRC, including both state and county roads. By 1952, the volume of construction and reconstruction had overtaxed the resources of all of the engineering districts. In response, the SRC reorganized and created a seventh district, spreading the heavy load a bit in the ensuing years (State Roads Commission 1949:111; 1952:2).

The DBD was initially divided into three sections, Design and Drafting; Specifications and Contracts; and Hydraulics and Construction. Later a section dealing with Special Studies, Reports, and Permits was added (LeViness 1958:131; State Roads Commission 1952:46). The DBD designed all types of highway bridges from the simplest of timber trestles to multi-million dollar projects such as the Patuxent River Bridge. The design services of consulting engineering firms were typically utilized when projects had a short timeframe, such as the Baltimore-Washington Expressway, or were of a specialized nature, such as for the design and construction of draw spans (State Roads Commission 1949:64, 69).

During 1947 and 1948, the DBD completed preliminary studies, estimates, and schemes for constructing more than fifty new and improved bridges as well as repairing and strengthening existing structures. The SRC's bridge engineers prepared all drawings, plans, specifications, and contract documents for the projects and the DBD assumed the construction management responsibility for the more complex bridge projects, with as many as fifteen such projects under their supervision at any one time. Between July 1950 and June 1952, the DBD prepared 250 sets of construction plans for the repair, rehabilitation, and widening of existing bridges including a broad range of structure types from small drainage culverts to major, long span bridges crossing rivers and streams, highways and railroads. The DBD was also responsible for collecting technical data concerning load limits of trucks and for non-bridge projects such as bulkheads, jetties, weighing stations, maintenance facilities, and potential ferry systems. The Bureau was also responsible for the immediate replacement of structures destroyed by flash floods (State Roads Commission 1952:46, 49). This level of activity continued through the 1950s.

Between 1948 and 1950, the State Roads Commission increased the staff of the Engineering Department, but was still unable to keep pace with the workload. Workweeks expanded from 40 to 60 hours for many engineers. Finding qualified men to fill the ranks of the expanding engineering division was difficult, due to competition for trained bridge engineers in the climate of postwar improvements. Most of those available were recent college graduates. During the summer months, engineering professors became temporary employees. Problems continued as engineers jumped to private industry in search of better financial compensation. It became even more difficult to hire adequately experienced staff during the Korean War (1950-1953) as a substantial proportion of SRC employees were either in active military service or were of military age (LeViness 1958:162; State Roads Commission 1950:2).

The SRC was chronically short-staffed and saw the logical solution to be the use of paid consultants. The use of consulting engineers was nothing new. The SRC had used the engineering services of an outside consulting firm as far back as 1916 during the construction of Baltimore's Hanover Street Bridge. Nevertheless, during the first half of the century this was the exception. The urgency of the postwar building programs however substantially increased their involvement on large SRC projects (LeViness 1958:171; State Roads Commission 1949:1-2, 61; 1950:67, 69).

In 1954, the DBD became the Bureau of Bridges (the Bureau) as the Twelve-Year Program necessitated a reorganization of the department. The Bureau became responsible not just for the design of bridges, but also for supervising the construction and maintenance of bridges. Due to the work load in the period the Bureau increased its use of consulting engineering firms to design and prepare specifications. By 1956 more than half of the contracts put out for bid by the Bureau of Bridges were designed by consulting engineering firms (State Roads Commission 1956:59).

The Bureau reviewed the work of outside consulting firms to ensure they conformed to the SRC's standard geometrics, types, details and specifications (State Roads Commission 1954:60). However, McKeldin's Twelve-Year Program created the need to establish a Reviewing Office in order to oversee the work of the increasing numbers of consulting engineers. The expanded program of rehabilitating and constructing new highways greatly increased the volume of engineering services required by the Bureau of Bridges. Between January 1954 and June 1956, the Bureau entered into 89 contracts with 30 local and out-of-state consulting engineering firms. Some contracts covered all services from preliminary studies through the supervision and inspection of construction. Others were more limited in scope and covered only those phases of engineering work that could not be expeditiously carried out by the SRC's engineering staff (State Roads Commission 1956:11-12).

In 1955, Maryland legislators launched an attack on the SRC for depending too greatly on the J. E. Greiner engineering firm. The criticism stemmed from the manner in which new right-of-way was acquired for the 13.5 miles of approaches to the planned Baltimore Harbor Tunnel. The SRC had followed Greiner's recommendation and hired two real estate firms to acquire the right-of-way because its own right-of-way department was overloaded with work and lacked the expertise in the acquisition of industrial properties. The legislative committee attacked the SRC for its "extreme" dependence on consulting engineers that seemed to them a clear indication that the SRC had abdicated its responsibilities by allowing Greiner a greater share in policy decisions than was prudent (Engineering News-Record, December 15, 1955: 24).

Criticism concerning the activities of the SRC had begun during the 1954 gubernatorial campaign when the Democratic candidate accused Republican Governor McKeldin and the SRC of political favoritism in the granting of non-construction contracts. The Democratic-controlled General Assembly had continued the attacks on the SRC following McKeldin's reelection (Engineering News-Record, December 1, 1955:25). The outcome was to replace the three-man State Roads Commission with a single director with control over administration and operations. Matters of policy were delegated to a three-man advisory board, of which the director was a member. The director would have two deputies, one in charge of administration and the other overseeing operations. An aide to the deputy for operations would be in charge of the Bureau of Engineering and the Bureau of Maintenance. Separate divisions were created for Right-Of-Way, Traffic, and Research and Standards (Engineering News-Record, December 1, 1955:25).

At the end of the 1950s, the SRC went through another reorganization. A Division of Planning and Programming was established to coordinate highway construction and location with statewide and regional planning. A Division of Administration was created to handle administrative functions of all divisions. The Commission itself expanded from three members-at-large to seven members, six of whom represent regions of the State (State Roads Commission 1960:20).

4.7 IMPORTANT MARYLAND HIGHWAY AND BRIDGE PROJECTS DURING THE 1948-1960 PERIOD

The number of highway projects initiated and completed in the period, or soon thereafter, is extraordinary. Governor William Preston Lane Jr., as discussed above, vigorously supported highway construction and his ambitious program to improve and enlarge the state's road system after 1947 included beginning construction on the following major Maryland highway projects (State Roads Commission 1949:65-66, 70; 1950:3):

- The Washington-Baltimore Expressway (now MD 295), completed as the Baltimore-Washington Parkway in 1954;
- A new Defense Highway connecting Annapolis and Washington, called the Annapolis-Washington Expressway and later renamed the John Hanson Highway and the Blue Star Memorial Highway (now US 50/301), completed in 1955;
- The Baltimore-Harrisburg Expressway (I 83), completed in 1959;
- The Frederick-Washington Expressway, also known as the Washington National Pike, later renamed the Dwight D. Eisenhower Highway (now I 270), completed in 1957;
- A highway from the Chesapeake Bay Bridge to the Maryland-Delaware Line (now US 301);
- The dualization of the Baltimore Frederick National Pike westward from Ellicott City, (now US 40).

Governor Theodore R. McKeldin continued the strong advocacy of highway construction after 1951 and counted the Baltimore Harbor Tunnel, the largest public enterprise in the State's history, as his favorite project. During 1951 and 1952, he directed SRC engineers to undertake a physical inventory of the entire 4,736-mile state road system. The study found roads built during the previous administration to be satisfactory but that 67 percent of the rest were in need of improvement or reconstruction to meet SRC standards adopted in 1948. The study also revealed a need for an additional 291 miles of new roads, including an expressway to link the Chesapeake Bay Bridge to the Delaware State line (now US 301) and beltway routes around Washington and Baltimore (now I 495 and I 695). The Twelve-Year Road Construction and Reconstruction Program that resulted was enacted into law in 1953 and was designed to rebuild Maryland's highway system by 1965 (LeViness 1958:165-167, 175-176; State Roads Commission 1952:5; 1954:2). The SRC plan recommended improvements and new construction affecting 3,450 miles, about three-quarters of Maryland's road system (Engineering News-Record, February 5, 1953:26; April 16, 1953:23).

The Twelve-Year Program was broken up into three four-year phases, with a legislative review required at the end of each period. The Twelve-Year Program's priorities continued the unfinished portions of projects begun during the Lane administration and included several new ones:

- The Baltimore Beltway (now I 695) completed 1962;
- Washington, D.C. Beltway (now I 495) completed 1964;
- The dualization of US 301 from Baltimore to the Potomac River Bridge (now Governor Nice Memorial Bridge);

- Extension of a highway between Glen Burnie and the Potomac River Bridge (now I 97, US 301, MD 3);
- US 50 between Washington and US 301;
- A new highway between Baltimore and Wilmington, Delaware, later called the John F. Kennedy Highway (now I 95) completed in 1963;
- The Baltimore-Harrisburg Expressway (I 83) completed in 1959;
- Improvements to US 15 in Frederick County and US 11 in Washington County;
- Improvements to the Frederick-Washington Expressway, also known as the Washington National Pike, later renamed the Dwight D. Eisenhower Highway (now I 270).

At the top of the SRC's list during the period of the Twelve-Year Program was the construction of an expressway to link the new Chesapeake Bay Bridge to the newly completed Delaware Memorial Bridge to connect with the New Jersey Turnpike. This would provide an important link for long-haul vehicular traffic along the Atlantic seaboard and provide a bypass of congested cities. The Twelve-Year Program also provided for reconstruction of 2,200 miles of secondary and farm-to-market roads (Engineering News-Record, April 16, 1953:23; Engineering News-Record, November 20, 1952:27; State Roads Commission 1956:3-5; 1958:3-4).

By 1960, the "keystone" of travel through Maryland before the interstate system was completed was a system of three bridges and a tunnel-expressway built by the SRC. Together the system offered travelers through the state two major options when traveling north to south across Maryland and relieved much of the traffic congestion on urban streets and rural roads. The first optional route crossed the Susquehanna River Bridge (US 40) and bypassed busy Baltimore through the Baltimore Harbor Tunnel, connecting with US 301 on its way south to the Potomac River Bridge into Virginia. The second option was to travel from Delaware across the Eastern Shore on US 301, crossing the Chesapeake Bay Bridge and continuing on US 301 to Virginia. Before the interstate system was completed in the late 1960s, these routes made Maryland a viable part of the national travel system on the East Coast.

Much of the Maryland highway system modernized in the 1950s was ultimately absorbed into the interstate highway system. The Federal-Aid Highway Act of 1956 established a partnership with highway departments of several states to construct the interstate system according to plans approved by the Bureau of Public Roads. Maryland's SRC built approximately 354 miles of interstate highway (State Roads Commission 1960:4).

In 1955, the General Assembly approved plans for Maryland's first toll-road. The proposed 48-mile toll road (I 95) would parallel US 40 between Baltimore and the Delaware state line and be completed in time for the scheduled 1957 opening of the Baltimore Harbor Tunnel (now I 95/I 895) (Engineering News-Record, April 14, 1955, page 24). The complex of controlled-access toll expressways on the East Coast that had begun with the opening of the Pennsylvania Turnpike in 1940, culminated in expressways in Delaware and Maryland by 1963. By that year, motorists could travel from Maine south to Virginia, or west to Illinois, without stopping at a traffic light, except at Breezewood, Pennsylvania.

By 1958, the SRC had to admit that they were lagging behind their goals for the first four years of their Twelve-Year Program but had completed 70% of the planned mileage (Engineering News-Record, March 20, 1958:25). In 1960, the SRC revised the Twelve-Year Program in response to the growing impatience of Maryland's residents with inadequate and obsolete roadways. The "Go Roads" program, a 5-year program, was instituted that concentrated on primary highway construction. It was expected that almost 100 miles of primary and interstate highways could be constructed for each of the five years. The "Go Roads" program had as its goal the extension of modern primary highways or expressways into every region of the State with urban areas being served by beltways (State Roads Commission 1960:3).

Bridge construction in Maryland between 1948 and 1960 grew rapidly along with this intensification of highway construction. In this period, 586 bridges were constructed on state and county roads and 203 on interstates. Maryland bridges won several "aesthetic bridge" contests in the period. For example the Shell Road Ramp Bridge at the entrance to the Baltimore Harbor Tunnel was awarded "First Honorable Mention" by the American Institute of Steel Construction in 1958 (LaViness: 138). However, the design of bridges in this period was relatively homogeneous and was driven primarily by cost, constructability, future maintenance, and environmental concerns. Bridges in this period exploited the latest technologies, yet the use of innovative and artistic designs was not common. Maryland bridges in this period can be described as a group as being designed in a way to exhibit a clean, uncluttered appearance with minimal decoration, many of them with elements of the streamlined form characteristic of the Moderne style of the 1930s and 1940s.

Two significant themes of bridge building in this period were the development of high-level bridges and the linkage of formerly isolated communities and regions of the state by new bridges. As has been discussed, the development of a modern road system in the state was contingent on bridges that crossed the Chesapeake Bay and other bodies of water without impeding river traffic. By the 1950s and 1960s, motorists no longer patiently waited while drawbridges moved up and down for water traffic. The solution at the widest and most active water crossings was the construction of high-level bridges, usually built away from populated areas because of their long approaches. Since tall bridges were also needed to span highways, railways and urban neighborhoods that could not be demolished, the construction of tall bridges with long approaches became the most practical way to make both the road and river systems work efficiently (LaViness 1958: 139-140).

Historian Charles LaViness discusses high-level bridges as a distinguishing bridge type in this period in his book *A History of Road Building in Maryland* (1958). Among the important bridges from his perspective were the "four high-level bridges [built] across the Potomac," especially the Keyser-McCool Bridge in Alleghany County that spans the Potomac, two railroads, and portions of the towns on each side of the river. He also mentions the "Blue Bridge" in downtown Cumberland, the US 50 bridge built in 1953 across the Severn River, and seven others.

Other examples of significant high-level bridges in this period include the MD 213 Bridge (Chesapeake City Bridge). The US Army Corps of Engineers constructed the Chesapeake City Bridge in 1949 after ocean-going tankers damaged the earlier steel lift bridge at the location. A lift bridge, built in 1927, was on the main automobile route through town (MD 213), and although it was an improvement to the earlier bridge (as it allowed large ships to access the canal) it was a hindrance to vehicular traffic forced to wait for ships to pass beneath it (Legler 2002: 44; Pratt Free Library 1933). The high-level, fixed-span bridge built by the Corps in 1949 spanned the canal at such a height that most vessels easily passed beneath its span.

The Kent Narrows Bridge serving US 50/US301 (now MD 18B), built in 1951, was also designed to provide a higher span (18 feet at mean tide) and a moveable drawbridge, replacing a two-lane drawbridge built in 1932. This span was at a location involving both water and vehicular traffic immediately east of the Bay Bridge and subject to increasingly heavy traffic as the Bay Bridge opened and brought ever-larger numbers of vehicles. The 1951 Kent Narrows Bridge became obsolete by the 1980s when even higher volumes of traffic were subject to long backups stretching for miles. A new high-level, fixed-span bridge replaced it in 1989-1990 (Pratt 1952; Corddry 1983; SHA 1990).

The Chesapeake Bay Bridge is the most significant bridge that connected formerly isolated parts of the state and is discussed below. Other examples include the MD 231 (Patuxent River) Bridge, built in 1950, that joined formerly disconnected parts of the state, in this case Charles and Calvert Counties, which historically relied on ferries for transport across a major body of water (Lowery 1998:6). The bridges crossing the Potomac cited by LaViness as significant for their height, also are examples of the theme of linkage. Both the Blue Bridge, built in 1954 in Cumberland, and the Keyser-McCool Bridge, built between 1949 and 1951, allowed vehicular traffic to travel between Maryland and West Virginia. These bridges enabled easier commercial and private travel in this mountainous area, removing much of the isolation of the area and supporting the economic vitality of the region.

Of the many bridges built in the period to support Maryland's highway projects, the Chesapeake Bay Bridge stands out as the most significant from many perspectives. The most spectacular road project of the era, it is both an example of improved bridge construction technologies and of a cultural connector between two areas of the state that had been historically separate. Officially named the William Preston Lane, Jr. Memorial Bridge and popularly called the Bay Bridge, it is located east of Annapolis and spans the bay as part of US 50/US 301. The bridge's dual spans provide a direct connection between Maryland's recreational areas along the ocean and the metropolitan areas of Baltimore, Annapolis, and Washington, D.C.

Serious interest in a bridge across the Chesapeake Bay had begun as early as 1908 and proponents considered many location options. The location chosen was centrally located and served traffic to and from Baltimore and Washington. Work began on the bridge in 1949 and replaced two vehicular ferries that ran from near Annapolis to the Eastern Shore. The bridge opened to traffic in 1952 and a parallel structure opened in 1973. With a shore-to-shore length of 4.3 miles, the bridges are among the world's longest and considered by many to be among the most scenic of large bridge structures. Both bridges were designed by Greiner: the 1952 span cost $44 million and was built with two lanes; the second three-lane bridge, was built to be a "modernized look alike" and cost $117 million.

The Bay Bridge made travel between the Eastern and Western Shores of Maryland easier than ever before, changing the economic and cultural relationship between the two areas of the state and the orientation of the Eastern Shore from Philadelphia and Wilmington, Delaware to Baltimore and Washington. It also enabled commercial traffic to move more readily across the state and thereby became a direct connection to the tourist, recreational and agricultural regions of the Eastern Shore. The Chesapeake Bay Bridge was controversial; some Eastern Shore residents resisted the changes that would result, including economic development some felt was out of character with the small town, rural atmosphere of the Shore and the inevitable presence of outsiders (Brugger 1988: 654). Even so, when completed the Bay Bridge succeeded in drawing the Eastern and Western Shores together by (Calcott l985: 105-106).

The 1952 structure is multi-span, consisting of concrete beam approaches, Weichert and simple deck trusses, and two types of cantilever trusses, which form a suspension bridge at the main crossing, allowing large ocean-going ships to continue to pass beneath the bridge (Bruder 2000:16). Bethlehem Steel directed the bridge's erection using a design from Greiner (Engineering News-Record: August 7, 1952: 42). A team of contractors worked to accomplish various components of the job including marine contractors Merritt-Chapman & Scott Corp, Frederick Snare Corp, and J. Rich Steers, Inc. Onshore contractors included Booth & Flinn Co. and Baltimore Contractors, Inc (Engineering News-Record, October 26, 1950:32).

The bridge was unique due to its length of 21,286 feet from end to end and for Greiner's design of a coffer dam that reduced foundation construction costs (Engineering News-Record, October 26, 1950:32-34). The project included a timesaving innovation developed by cable manufacturer, John A. Roebling & Sons, of Trenton, New Jersey, who refined methods for measuring the tension and length of the cable strands (Engineering News-Record, January 8, 1953:43). Other design and construction innovations included new methods for the cable-spinning process and the completion of sections of the suspension bridge off site at a pier in Baltimore before being floated to the site (Engineering News-Record, August 7, 1952:40-42). The scale of the project inspired an innovative cantilevered scaffold system devised by the Kaufman Construction Company, which had the contract to pave 67 approach spans (Engineering News-Record, September 6, 1951:48). The suspension bridge was completed on June 2, 1952 and the first traffic crossed the bridge on July 30, 1952.

By 1960, Maryland's highway system was entirely rebuilt and a vast improvement on the outdated network of roads that existed at the end of World War II. The improved system of roads and bridges was one of the country's most modern systems of limited access highways with high-level bridges spanning every major body of water and unifying the entire state into an integrated and efficient transportation network. The political and financial support at the state level for a modernized highway system set the stage for the increased sub-urbanization that continued unabated after 1960. Formerly isolated rural areas and disconnected communities were integrated as never before, enabling dramatic economic growth as the twentieth century came to close.

5.1 DEVELOPMENTS IN DESIGN

The most important technological development in bridge design and construction after World War II was bridge design standardization. This phenomenon occurred years before the postwar period but design standardization paved the way for the rapid-fire, postwar technological developments that increased the economy, quality, and quantity of bridge construction.

In the late nineteenth century railroad bridge designers began to standardize their plans in the interest of efficiency. Roadway bridge designers followed suit in the early twentieth century. The roadway bridge standardization movement began as a component of the Good Roads movement in the early twentieth century. State and municipal roadway bridge design systems became highly standardized between 1900 and 1960. Bridge standardization increased construction economy. Lower construction costs and rapid construction rates enabled bridge constructors to keep better pace with the demands of increased road usage.

Consultant engineers did continue to be hired by states and municipalities when the realities of a construction plan required uniquely intensive study and design planning efforts. In these cases consultants were hired to do the work that states and municipalities could not balance alongside regular workloads. A notable example of the type of contribution that consultants added to unique bridge design and construction in Maryland is the Chesapeake Bay Bridge project (1949-1952) (Spero and Berger & Associates 1995: 29-30).

After World War II, technological innovations had an immense impact on bridge project planning. Advances included the introduction of the computer, the tellurometer, and photogrammetry. An electronic computer was installed in the Road Design Division in 1957. The computer could make calculations 10 times faster than the engineers could and the new technology assisted with design problems; its effectiveness led to the expansion of its applications and its adoption by other divisions. A tellurometer used microwaves to measure distances. In 1958, the Bureau of Public Roads chose Maryland as one of three highway departments to test the tellurometer's usefulness in plotting new highways. The State Roads Commission found the tellurometer to be extremely accurate. The new tool was proven to be faster and less expensive than conventional triangulation or traverse methods (LeViness 1958:200).

Aerial photography and photogrammetry were applied to the preparation of new highway plans beginning in the 1950s. Photogrammetry allowed engineers to survey alternate routes without sending out survey parties. The first use of photogrammetry in Maryland was applied to the planning of the Rising Sun Bypass, a three-mile relocation of US 1, opened in 1957 (LeViness 1958: 200, 195 – 198).

5.2 MATERIALS AND TECHNIQUE DEVELOPMENTS

During the postwar period, advances in bridge building materials and building techniques assisted in the improvement, development and construction of many types of bridges. These advancements are in evidence along roadways throughout Maryland.

The development and availability of high-strength and corrosion-resistant steel to bridge builders increased both bridge capacity and lifespan. Fabrication was further empowered by the adoptions of welding technology and the introduction of the high-strength bolt (Burroughs 1975: 463-464).

Welding and bolting eliminated the need for the slow and tedious work of the rivet gangs. Improved falsework increased construction efficiency. Wood falsework was replaced by metal falsework sections after 1930 (Bigelow 1975, 242-243). The production of large prefabricated bridge sections necessitated advances in delivery strategy and improved construction efficiency. Large sections were delivered by road or railroad. Crane technology continued to improve throughout the period and the utility of the bridge deck as an integral structural component increased span strength (Burroughs 1975: 463-465, 474).

The use of prestressed (and post-tensioned) concrete in bridges in the 1950s was the most notable technological advance in Maryland and North America. A series of prestressed concrete bridges were built between 1950 and 1954 that spanned Tampa Bay between St. Petersburg and Palmetto, Florida. At the time, it was one of the world's longest crossings, with an overall length of 15 miles (Hammond 1960:85 – 88). According to noted American bridge designer T. Y. Lin: "The most important development [in concrete bridge development between 1925 and 1975] is certainly the introduction and expansion of prestressed concrete for bridge construction" (Lin and Kulka 1995:491).

Historian David J. Brown summarizes the theory of prestressing and its attractiveness to bridge designers as follows:

> Any building (or bridge) material can be "pre-stressed." A single rope across a river, stretched from one tree to another, has tensile stresses locked into it to reduce its flexibility. The principle of prestressing concrete, expressed at its simplest, is much the same: longitudinal steel strands in a concrete beam are stretched or tensioned and then anchored to the ends of the beam. This neutralizes the tensile forces created by dead, live, and environmental loads—and thus the propensity of concrete for cracking—by the application of greater compressive forces. Far more effectively than with simple reinforcement, prestressing maximizes concrete's strength in compression and compensates for its weakness in tension.
>
> Prestressed concrete is economical because of its sturdiness and also because it is lighter than conventional reinforced concrete (1998:124).

Prestressed concrete can be created in two ways: it can be accomplished via pretensioning, in which the concrete is cast around steel cables that are already in tension; or the concrete can be post-tensioned. In post-tensioning, concrete is poured with intentional voids that allow for the threading, stretching, and anchoring of cables after the concrete has hardened. Both means are utilized in bridge construction—the former at elements precast in the factory; the latter for the casting and later tensioning of members in place.

American engineer P. A. Jackson was likely the first to formulate the idea of prestressing concrete in 1872. French engineer Eugène Freyssinet pioneered and propelled the use of prestressed concrete in bridges during the second quarter of the twentieth century (Brown 1998:124). It was not until after World War II, however, that the technique crossed (or re-crossed) the Atlantic. The first prestressed concrete bridge erected in the United States was the Walnut Street Bridge, erected in Philadelphia in 1950 (Barker and Puckett 1997:20). Prior to 1975, virtually all precast beam and girder bridges erected in the United States utilized prestressed concrete. The Walnut Street Bridge, which utilized post-tensioned construction, was a notable and unusual exception. Post-tensioning was much more common in Europe than North America in the material's early years (Lin and Kulka 1975:495 – 496).

The major impetus behind the push towards increased concrete construction was the Bureau of Public Road's *Criteria for Prestressed Concrete Bridges*. This tome, written in 1955, encouraged the broadened use of prestressed, precast concrete bridge member use in the construction of interstate highway overpasses across the nation (Spero and Berger & Associates 1995: 138).

Maryland began to build prestressed concrete bridges in 1954. The first example was the Shawan Road overpass on the Baltimore-Harrisburg Expressway; it used the post-tension technique. The pretensioned technique was used for the bridges on the Princess Anne and Flintstone bypasses. Maryland had 20 prestressed concrete highway bridges by 1958 (LeViness 1958:199; State Roads Commission 1954:63-64).

The techniques of prestressing and post-tensioning have evolved through the development of different high-strength steel and concrete compositions and formwork systems, as well as the creation of methods for compacting concrete via vibration before setting. These developments, and the development of prestressing itself, are largely a result of the use of different materials rather than design. The prestressed bridges of the 1950s looked, on the surface, like their reinforced-concrete companions.

Improvements in bridge planning technology, engineering technology, and materials technology spawned positive reciprocating relationships between materials developers and bridge builders. An advance in one field prompted advances in others but the start of the trickle-down began with the introduction of the computer. Computer aided engineering initiated engineering efficiency. Engineering advances necessitated the inventiveness of steel producers to provide products that met new engineering demands. These advances facilitated the construction of increasingly longer, lighter and more economical bridge spans (Burroughs 1975: 463-465, 474).

5.3 INDIVIDUAL BRIDGE-TYPE DEVELOPMENTS

5.3.1 Metal Truss Bridges (Including Steel)

- 1948-1960: 3 Metal truss bridges constructed (Maryland State Highway Administration 2003).

Between 1900 and 1960, the State of Maryland standardized metal truss highway bridge plans. This bridge type was mainly used for lengthy spans. During the period, the State of Maryland utilized Weichert truss systems most especially in west portions of the state (Spero and Berger & Associates 1995: 84-85).

A notable metal truss bridges in the United States during this period include the Nishanic Station, N.J., lenticular truss bridge. This bridge is similar to Roebling's Smithfield Street Bridge in Pittsburgh, Pennsylvania. Another is the Hanalei, Kauai, Hawaii, dual-truss, combination bridge. Restorationists have recently received awards from the Federal Highway Administration for their efforts in preserving these bridges (Flynn, 2004).

During the postwar period, stronger, lighter steel, high-strength bolt technology, crane efficiency and improved falsework were developed and applied to metal truss bridge building projects.

These advancements greatly improved metal truss bridge building economy (Bigelow 1975: 242-243). As a rule, however, truss bridges are only rarely built today.

5.3.2 Metal Girder Bridges

- 1948-1960: 468 metal girder bridges constructed (Maryland State Highway Administration 2003).

Following the close of World War II metal girder bridge technology was adopted by counties and municipalities across the United States. From 1920-1965, metal girder bridges and bridge support structures were constructed using metal I-beams and metal plate girders. These bridges commonly featured I-beams and plate girders that were encased in concrete.

After World War II, aluminum and other alternative metals were occasionally utilized by bridge builders. In Maryland, an aluminum girder bridge (Bridge # 13046) was constructed over the Patapsco River's South Branch near Sykesville in 1963. This bridge was constructed by the State Roads Commission and International Aluminum Structures Inc.

Bridge #13046 is the only bridge of its type in Maryland and one of only seven in North America. Bridge #13046 is a three-span structure made of riveted and triangular box stiffened sheet girders. These members support a light concrete slab sheathed with a bituminous deck that serves as the riding surface (Spero and Berger & Associates 1995: 109-112).

5.3.3 Metal Suspension Bridges

- 1948-1960: 1 metal suspension bridge project completed (Maryland State Highway Administration 2003).

The best example of a metal suspension bridge in Maryland is the wire cable strung, Chesapeake Bay Bridge (Spero and Berger & Associates 1995: 114-118), completed in 1952. Due to the fact that these long spanning bridges rely on a roadway suspended from cables, these bridge types must be aerodynamically stable. An infamous aerodynamically unstable bridge is the Tacoma Narrows Bridge in the State of Washington. This bridge is well known for its convulsions in the face of high winds (Matsuo Bridge Company 1999).

5.3.4 Steel Arch Bridges

- 1948-1960: 3 steel arch bridges constructed (Maryland State Highway Administration 2003).

Steel arch bridges were usually constructed to span long distances, such as wide river corridors. Examples elsewhere in the US include the Hell Gate Bridge in New York, New York; the Henry Hudson Bridge over the Hudson River in New York, New York; and the Rainbow Bridge at Niagara Falls (Hollingsworth 1975: 89-94). The construction of these spans has slowed since the advent of the cable-stayed bridge (National Information Service for Earthquake Engineering 2004).

Steel arch bridge construction benefited from the many technological innovations that were adopted during the postwar period. Innovations that benefited this type of bridge construction included; improvements in steel quality, strength and corrosion resistance, planning, plan standardization and prefabrication of structural elements, the incorporation of bolt technology and improvements in welding techniques. These developments economized and enabled an increase in the efficiency of construction of these bridge types (Hollingsworth 1975: 87-89).

5.3.5 Movable Bridges

- 1948-1960: 5 movable bridges constructed (Maryland State Highway Administration 2003).

Movable bridges are put in place to fit unique situations where static span bridges would impede the movement of objects in the waterways below the span. Vertical lift and bascule bridges are the most frequently constructed types (Suffness 1992: 4, 11). The replacement Woodrow Wilson Bridge Project, a bascule bridge, is currently underway between the States of Maryland and Virginia. This bridge links the two states, carries I-95/I-495 and spans the Potomac River (Woodrow Wilson Bridge Project: Project Overview: What and Why 2004).

Many technological improvements refined movable bridge construction between the years of 1924-1974. Many patented designs became available after the expiration of their owner's patents in the 1940s and 1950s. Plan standardization economized fabrication. The abandonment of riveting and the adoption of welding, use of new metal types and alloys, gearing efficiency improvements and improvements in bearings, lubrication and efficiency all played a vital role in the development of this bridge type. Additionally, electrical power was incorporated into bridge movement devices and later, remote controls of these electrical devices were adopted into the control mechanisms of these bridges (Hardesty, Fischer and Christie 1975: 520, 522).

5.3.6 Prestressed Concrete Bridges

- (See below for bridge counts.)

The development of prestressed concrete broadened the use of concrete in bridge construction nationwide (Spero and Berger & Associates 1995: 138). In 1955, the Bureau of Public Roads published the *Criteria for Prestressed Concrete Bridges*. This publication further encouraged nationwide adoption of the technology (Spero and Berger & Associates 1995: 138). The Walnut Street Bridge, in Philadelphia, Pennsylvania, which utilized post-tensioned construction in 1949, was a notable and unusual exception. Post-tensioning was much more common in Europe than North America in the material's early years due to German and English strides in material development (Lin and Kulka 1975: 496, 491).

The development of prestressed concrete is directly related to the development of high-strength steel. Prestressed concrete can be created in two ways: it can be accomplished via pretensioning, in which the concrete is cast around steel cables that are already in tension; or the concrete can be post-tensioned. In post-tensioning, concrete is poured with intentional voids that allow for the threading, stretching, and anchoring of cables after the concrete has hardened. Both means are utilized in bridge construction—the former are elements that are precast in the factory; the latter for the casting and later tensioning of members in place (Lin and Kulka 1975: 491-495).

Within the United States, precast structural components were most commonly used in prestressed bridge construction. The precasting process was economical because it allowed structural members to be fabricated off-site and for the member forms to be re-used. The members, if not cast on-site, needed to be transported via road or rail to the bridge construction site. Forms were also used in place at the construction site and it was possible for an entire span to have been cast in place as part of the bridge structure. Steel trusses were also used to support prefabricated segments as they were installed (Lin and Kulka 1975: 494-495).

Early precast beam and girder bridges were simple fifty to 100 foot spans. These short spans were later improved upon by the placement of reinforcing bars over pier locations (Lin and Kulka 1975: 495-496). An example of a pretensioned concrete bridge is Bridge 0802200, the MD 225 bridge over Mattawoman Creek (Maryland State Highway Administration 2003).

5.3.7 Reinforced Concrete Bridges

- (See below for bridge counts.)

In Maryland, reinforced concrete bridge plans were standardized early in the 20th century. This explains the large number of small 20th century concrete bridges of this type found within the state. Reinforced concrete bridges were used liberally on the Eastern Shore and the technology was used in the constructions of small, long and movable span bridges (Spero and Berger & Associates 1995: 29-30).

An example of a reinforced concrete slab bridge is the Horseshoe Road over Stone Creek Bridge located near Octoraro, in Cecil County ((Legler and Highsmith 2002: Cecil County).

5.3.8 Concrete Rigid Frame Bridges

- (See below for counts.)

The first concrete rigid frame bridge constructed in Maryland is dated to 1934. Following the close of World War II construction of this bridge type mushroomed. These bridges were both cast and constructed from prefabricated components and cast in place. Casts consisted of singular or multiple sections. Smaller structures were slab-beam types reinforced with tension steel.

These structures were very stable, did not feature arches and could be buried, constructed at grade or constructed above the ground surface (Parsons, Brinckerhoff, Quade & Douglas 1997: 3-23). An example of a concrete rigid frame bridge is the MD 97 bridge that spans Big Pipe Creek in Carroll County, Maryland. This bridge is located near Union Mills, Maryland and was built in 1934 (Legler and Highsmith 2002: Carroll County).

Counts of Concrete Bridges Constructed Between 1948-1960

- Concrete Arch: 2
- Concrete Slab: 28
- Concrete Beam (including Tee Beam): 14
- Concrete Rigid Frame: 20
- Concrete Girder or Box Beam: 18

(Maryland State Highway Administration 2003).

5.3.9 Wood Bridges

- 1948-1960: 30 constructed (Maryland State Highway Administration 2003).

During the postwar period, wood bridges continued to be constructed in Maryland, but were mainly located in Southern Maryland and on the Eastern Shore. Wood bridges were functional and economical and gave the “appearance from the roadway of a much more costly bridge.”

Two types of wood bridges were constructed during this period. Both types were composite wood and reinforced concrete structures and are known as T-beam bridges and Composite Slab Deck bridges. T-beam bridges utilize timber stringers and concrete slabs while Composite Slab Decks utilize wood formed, cast concrete sections supported by wood piers (Spero and Berger & Associates 1995: 39, 43). An example of a timber bridge is the Bestpitch Ferry Road Bridge that spans the Transquaking River in Dorchester County, built in 1946 (Legler and Highsmith 2002: Dorchester County).

The following is a list of contractors and engineering firms that were active in either highway or bridge construction in Maryland during the twentieth century. Some of these firms have been absorbed by other firms or have fallen out of business while some remain strong competitors.

AMERICAN BRIDGE COMPANY

The American Bridge Company was formed in 1870. In 1900, financier J.P. Morgan combined his firm with 28 other bridge companies, while retaining the American Bridge Company name (American Bridge Company 2004).

The Pittsburgh Bridge Company, a Pittsburgh, Pennsylvania-based company, was incorporated in 1881 following a founding date of 1878. The company specialized in metal truss bridges before they were integrated with the American Bridge Company in 1900. The Pittsburgh Bridge Company continued to use its own moniker until 1903.

The Wrought Iron Bridge Company was also bought out by the American Bridge Company in 1900. In 1864, David Hammond organized this Canton, Ohio based company; it was later incorporated in 1871. This company is known to have constructed many late-nineteenth century Pratt through truss bridges in the State of Maryland. The company patented a metal arch-truss bridge and made it available to markets in the eastern United States. It also was an innovator and leader among later nineteenth century bridge manufacturers. Hammond staunchly advocated the virtues of wrought iron over wood and cast iron (Spero and Berger & Associates 1995: B-10).

In 1900 the Youngstown Bridge Company was purchased by the American Bridge Company. This Youngstown, Ohio based bridge company operated as the Morse Bridge Company from 1878 until circa 1888 when it changed its name to the Youngstown Bridge Company. In 1891, the Youngstown Bridge Company constructed the Waverly Street Bridge that passes over George’s Creek in Westernport, Allegany County, Maryland. The firm produced bridges until 1900 when it was consolidated into the larger firm (Spero and Berger & Associates 1995: B-10).

Following these purchases and incorporations under the American Bridge Company umbrella, the American Bridge Company became a subsidiary of the newly consolidated steel trust, United States Steel Corporation in 1901. Prior to this, the American Bridge Company pioneered the use of steel as a construction material (American Bridge Company 2004).

The American Bridge Company built the MD 213 Bridge completed in 1949 over the Chesapeake and Delaware Canal. This metal tied arch bridge is the most visible Maryland bridge designed by the American Bridge Company during this period(Mountford 2002).

BETHLEHEM STEEL CORPORATION

This Bethlehem, Pennsylvania-based steel producing giant constructed the Paper Mill Bridge over the Gunpowder Falls River and the no longer extant Deep Creek Lake Bridge formerly located on US 219 (Spero and Berger & Associates 1995: B-2). The Paper Mill Bridge was built in 1922 (Janburg 2004). The Deep Creek Lake Bridge was built in the late 19th century (Garrett County Historical Society Museum 2004). A large Bethlehem Steel plant was located at Sparrows Point, Maryland (Spero and Berger & Associates 1995: B-2).

CHANEY ENTERPRISES

From the early 1950s to 1962, this company held the road maintenance contract for Prince George's County. In 1962, "Babe" Chaney, his son Richard, Jack Havenner, and Jack Mister expanded their business ventures to include concrete services. Construction business was phased out and the Charles County Concrete and Charles County Sand & Gravel companies were begun. The Charles County Block Company was created in 1964; later that same year, the Annapolis Concrete and Annapolis Sand & Gravel operation became part of the business group. Chaney Enterprises is now comprised of the following companies; Charles County Block, Charles County Concrete, Charles County Sand & Gravel, Annapolis Concrete, Annapolis Sand & Gravel and Leonardtown Sand & Gravel.

CHARLES PERRING COMPANY

This Baltimore, Maryland based company constructed the movable span bridge that crossed the Choptank River at Cambridge, Maryland (Spero and Berger & Associates 1995: B-2). This bridge was known as the Emerson C. Harrington Bridge and was constructed in 1935 before being abandoned in 1987 (Dukes 2004).

Charles Perring was a notable engineer who worked for a number of engineering companies. Perring also served as Chief Engineer for the City of Baltimore from 1920 to 1928 (Spero and Berger & Associates 1995: B-2).

CONTEE SAND AND GRAVEL

Established in 1928, Contee Sand and Gravel Company, Inc., operated a quarry in Prince George's County, Maryland. The company ran mining and processing operations on a 293-acre area near Laurel, Maryland until July of 1982. This company is now known as the Konterra Corporation.

FAIRCHILD ENGINEERING AND AIRPLANE CORPORATION

Harry Kahn, an employee of the Fairchild Engineering and Airplane Corporation, designed Bridge # 13046. (Spero and Berger & Associates 1995: B-3). This aluminum girder bridge was constructed over the Patapsco River's South Branch near Sykesville in 1963. This bridge was constructed by the State Roads Commission and International Aluminum Structures Inc. The bridge is the only bridge of its type in Maryland and one of only seven in North America. This bridge is a three-span structure made of riveted and triangular box stiffened sheet girders. Bridge members support a light concrete slab sheathed with a bituminous deck that serves as the riding surface (Spero and Berger & Associates 1995: 109-112).

GEORGE & LYNCH, INC.

George & Lynch, Inc. is a 78-year-old construction company based in New Castle, Delaware. The company's services include concrete construction, site work, road building, marine work, water and wastewater plants, buildings, landfill construction and operation, and directional boring.

HARDESTY & HANOVER CONSULTING ENGINEERS

Hardesty & Hanover Consulting Engineers is located in New York, New York (Hardesty & Hanover 2004). Established in 1887, Hardesty & Hanover has been responsible for planning and engineering many of the major bridges, highways, and expressways throughout the nation. This firm was the successor to Waddell & Hardesty, who were industry leaders in movable bridge design. Hardesty & Hanover designed the bridge over Kent Narrows that carries MD 18 (formerly US 50/301) in 1951 (Suffness 1992:3).

HARRIS STRUCTURAL STEEL

Harris Structural Steel, based in South Plainfield, New Jersey, has been in operation since 1910. Harris Structural Steel is part of the larger Harris Camden Terminal, Inc. The company has provided its services for such structures as the Betsy Ross Bridge, the Verrazano Narrows Bridge, the Throgs Neck Bridge, and the Roosevelt Island Bridge. Harris Structural Steel was the prime contractor and also produced plate girders for the bridge over the lower Patuxent River at Solomons Island, Maryland (Harris Terminal 2004). This bridge was completed in 1977 (Southern-Maryland.info 2004).

J.E. GREINER COMPANY (LATER KNOWN AS GREINER ENGINEERING)

John Edwin Greiner founded this Baltimore, Maryland company in 1908. Greiner, as an engineer formerly built bridges for regional railroads. Following the foundation of his company, Greiner and Hershel Heathcote Allen built notable bridges for the State Roads Commission. The Greiner Company planned the Paper Mill Bridge over Loch Raven Reservoir in 1921; this was a steel through truss bridge, the first of its kind in the state. It was built by Bethlehem Steel Bridge Company in 1922 (Suffness 2000: 8-9). Greiner also authored the 1938 Maryland's Primary Bridge Program. This text illustrated the need for major water crossings in the state (Spero and Berger & Associates 1995: B-4). It also called for ferries to be replaced with bridge spans. Greiner's early firm had focused on the development of moveable bridges (Bruder 2000: 12, 8). Some Greiner bridge examples include the Governor Harry W. Nice Memorial Bridge, the Thomas J. Hatem Memorial Bridge, the first Chesapeake Bay Bridge (1947-1952) and the 1916 Rall-type rolling lift bascule bridge at Hanover Street in Baltimore, Maryland (Spero and Berger & Associates 1995: B-4). Additionally, Greiner designed the Wise Avenue over Bear Creek Bridge (MIHP BA-2681, Bridge B0079) in 1948. This bridge is located in Baltimore County, Maryland east of the communities of Dundalk and Inverness (Wise Avenue over Bear Creek Construction Drawings 1946)In 1950 the Greiner Company constructed the MD 231 Bridge over the Patuxent River (Bridge 4008), a movable bridge with a swinging span and the movable 1932 MD 331 "Dover Bridge" over the Choptank River (Bridge 20023) (Suffness 1992: 7).

MCLEAN CONTRACTING

This 110-year old Glen Burnie, Maryland-based firm was established by Colin McLean in 1903 in Baltimore, Maryland. McLean also constructed parts or all of the Naval Academy Bridge in Annapolis, and the South River Bridge in Edgewater (Wilson 2003: B1-B2). They were also associated with numerous bridges along US 50 on the Eastern Shore.

MERRITT, CHAPMAN & SCOTT

Captain Israel Merritt founded Merritt, Chapman & Scott in 1880 when he purchased the Coast Wrecking Company. Merritt had been the overseer of the company's salvage operations in 1860. Merritt's firm merged with Chapman Derrick and Wrecking Company 17 years later. In 1922, the company again merged with the New London, Connecticut-based T. A. Scott Company. Merritt, Chapman & Scott was instrumental in the construction of the Chesapeake Bay Bridge as well as the Baltimore Harbor Tunnel. The Merritt-Chapman & Scott Corporation was a leader in its field until the late twentieth century, when the company collapsed due to financial hardships.

PALMER & LAMBDIN

In 1947, this company constructed Bridge No. 3071 (Spero and Berger & Associates 1995: B-6). This bridge is located in Glyndon, Maryland and passes over the CSX Railroad tracks (Baltimore County, Maryland 2004). This company is headquartered in Baltimore, Maryland https://cromwellvalleypark.org/sherwood_history/.

ROANOKE IRON AND BRIDGE COMPANY (ALSO KNOWN AS ROANOKE BRIDGE COMPANY)

This Roanoke, Virginia based company specialized in metal truss bridges and was established in 1906. In 1914 it joined Salem, Virginia's Camden Iron Works but maintained the moniker of the Roanoke Bridge and Iron Works. Throughout the 1920s and 1930s, this company constructed several bridges in Maryland. Three examples of their work include two Camelback pony truss bridges built in 1932 (MIHP-CE-999 and MIHP-HA-1577) and the bridge that carries MD 214 over the Patuxent River. The Patuxent River Bridge is an example of their riveted camelback through truss bridgework (MIHP-AA-761) (Spero and Berger & Associates 1995: B-8). This bridge was completed in 1977 (Southern-Maryland.info 2004).

STROBEL STEEL CONSTRUCTION COMPANY

This Chicago, Illinois based company manufactured Rall-type rolling lift machinery components that were used on the Hanover Street Bridge in Baltimore, Maryland. This bridge was constructed by the J.E. Greiner Company for the Maryland State Roads Commission in 1916 (Spero and Berger & Associates 1995: B-9).

WADDELL & HARDESTY

This New York, New York based firm was founded in 1887 and was the third incarnation of a firm originally founded by Dr. J.A.L. Waddell. This firm lasted from 1927 to 1945 under the Waddell and Hardesty name and engineered the vertical lift bridges that were this firm's specialty. Waddell and Hardesty constructed Bridge 2053, this bridge carries Maryland 181 across Spa Creek in Annapolis, Maryland as well as the 1952 Bridge 17006 that carries Maryland 18B over Kent Narrows (this bridge was built by Hardesty & Hanover, the seventh incarnation of the Waddell & Hardesty firm;). Both bridges are Chicago trunnion bascule bridge types (Spero and Berger & Associates 1995: B-9 – B-10).

WHITMAN, REQUARDT & ASSOCIATES, LLP

Ezra Whitman was given the first Chairmanship of the Maryland's State Roads Commission in 1939. Whitman founded his firm in 1915. The company was reorganized twice: once in 1925, when it became Whitman, Requardt and Smith, and again in 1943, when Benjamin Smith bought out portions of the company (URS Corporation 2004: 23).

This company designed the I 895 Bridge (B-4632) (Bridge No. BC07800) over the CSX (formerly Baltimore & Ohio) Railroad tracks in 1957 (Maryland Transportation Authority no date). The designers chose a highly unusual K truss design (Whalen 2000).

In the 1960s, Whitman, Requardt & Associates, LLP, began to provide services in highway transportation and building design. In the 1970s the company expanded into marine engineering. The firm designed two of the largest graving docks in the world for their clients, Bethlehem Shipbuilding and the Newport News Shipbuilding and Dry Dock Company (URS Corporation 2004: 23).

Whitman, Requardt & Associates, LLP, also participated in the planning and design of subways, stations, and aerial line structure for both the Baltimore Region Rapid Transit and the Washington Mass Transit Authority Systems. The firm presently provides planning and design services to the Maryland Mass Transit Authority. Whitman, Requardt & Associates, LLP, is based out of Baltimore, Maryland, and has six branch offices that serve the Mid-Atlantic region.

WILSON T. BALLARD

Cornell University engineering graduate Wilson T. Ballard served as the chief engineer of Maryland's State Roads Commission for eight years in the early, mid-twentieth century. Ballard started his civil engineering company, Wilson T. Ballard Company, in the spring of 1948. Over the past 55 years, Wilson T. Ballard Company has primarily worked with government agencies within the Middle Atlantic region. The company provides consultant civil engineering services, with an emphasis in the planning and design of highways, bridges, water distribution, sewage collection, and related facilities. Clients have included the University of Maryland, Towson University, and the U.S. Army Corp of Engineers (URS Corporation 2004: 22-23). In 1958, this company worked on the designs for Bridge No. B147. This bascule span bridge carries the Peninsula Expressway over Bear Creek (Suffness 1992: 8).

SHA in consultation with MIHP and FHWA had previously chosen a total of 21 bridges representing 12 bridge types built during period 1948 – 1960 to be included in an update of the existing bridge survey.

7.1 NATIONAL REGISTER OF HISTORIC PLACES ELIGIBILITY

As part of the scope of work for this project, the 21 highway bridges built in the 1948-1960 period surveyed in 2003 by URS for SHA were evaluated for their eligibility for listing in the National Register of Historic Places (National Register). The National Register Criteria for Evaluation (contained in *Bulletin 15-How to Apply the National Register Criteria for Evaluation*) identify the range of resources and kinds of significance that will qualify properties for listing in the National Register. The Criteria (known individually as Criteria A, B, C, and D) are written broadly to recognize the wide variety of historic properties associated with the nation's history and pre-history. In addition, both the Maryland Historical Trust and the *Maryland Historic Bridge Inventory1809-1960* (Spero and Berger & Associates 1995) have developed general evaluation standards for historic bridges. These standards involve a series of research questions that aid in defining the historical significance of the bridge not only as an individual built entity, but as part of the larger transportation network. These research questions guided URS in the development of National Register eligibility recommendations for the surveyed bridges.

Criterion A

"Properties can be eligible for the National Register if they are associated with events that have made a significant contribution to the broad patterns of our history."

A bridge may be eligible if it is the span directly associated with a political, economic, social or military event (or series of events) significant in local, regional, state, or national history. Bridges can be considered eligible if they are associated with significant transportation events such as the development of turnpikes and highways, highway improvements, or an important crossing of a railroad or waterway. Many bridges are associated with State and local government attempts to improve roadway safety, to improve accessibility, or to provide more direct routes to or around a community.

Evaluating a single structure, such as a bridge, for the National Register under Criterion A involves conducting intensive research on the bridge's construction history, the history of previous bridges at this location (if any) and the history of the surrounding communities which this bridge or the associated roadway is linked. The evaluation should establish "specific associations with the continuance of watercourse crossings related to historic transportation, communities, industrial or agricultural sites"(Spero and Berger & Associates 1995: C-4).

As with the other three National Register Criteria, a bridge can be significant on the local, regional, state, or national level. An example of a highway bridge in Maryland dating from the 1948-1960 period considered eligible for the National Register under Criterion A on the local level is the Sang Run Road Bridge (Bridge G06400) in Garrett County. The bridge is associated with the historical development of the surrounding Sang Run community. Research reveals that a bridge at this location crossing the Youghiogheny River was first built as early as 1828. This first bridge was rebuilt in 1863, and the stone piers of this bridge probably serve to support the present bridge. The Sang Run area grew in popularity with the improvements made to Swallow

Falls and Herrington Manor State Parks in the 1930s. Increased automobile traffic between US 219 and the two state parks necessitated the building of the present Sang Run Road Bridge in 1955.

An example of a highway bridge in Maryland dating from the 1948-1960 period eligible for the National Register under Criterion A on the state level is the MD 213 Bridge over the Chesapeake & Delaware Canal (Bridge CE0100). The bridge is associated with the historically significant Chesapeake & Delaware Canal and the Atlantic Intracoastal Waterway of which the canal is now a part. The canal, completed in 1829 and widened numerous times during the twentieth century, links the Delaware River and the Chesapeake Bay, and was built to provide a shortened inland route between Philadelphia and Baltimore. The MD 213 Bridge, completed in 1949, is associated with the canal's period of ownership (1919-present) by the US Army Corps of Engineers, which maintains and operates the canal and the several bridges that cross over it in both Delaware and Maryland. The present MD 213 Bridge was built to replace an earlier mechanical lift bridge also built by the USACE and destroyed following a 1942 freighter collision.

Criterion B

"Properties can be eligible for the National Register if they are associated with the lives of persons significant in our past."

A bridge may be eligible for the National Register under Criterion B if it is associated with individuals or groups important to the history of a Maryland community, region, the State of Maryland or the nation (Spero and Berger & Associates 1995: C-5). A bridge may also be eligible if it can be associated with persons of local, state, or national importance if they are associated with political, economic, military or social historical events. Evaluating a single structure, such as a bridge, for the National Register under Criterion B involves conducting intensive research on the bridge's construction history, and its association with prominent individuals. A bridge may be considered eligible for the National Register under Criterion B for its association with individual engineers, architects and builders or like commercial firms of local, state or national importance. However, because this association is almost always in the context of the individual's capacity as a designer, Criterion C (see below) is usually more applicable. For this reason, application of Criterion B in evaluating the eligibility of an individual bridge for listing in the National Register is rare.

Criterion C

"Properties can be eligible for the National Register if they embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic value, or that represent a significant and distinguishable entity whose components may lack individual distinction."

Evaluating a single structure, such as a bridge, for the National Register under Criterion C involves conducting intensive research on the bridge's construction history and its association with prominent bridge designers or design/engineering companies. Research should establish both the rarity and importance of the bridge type during the study period. For example, metal truss highway bridges are associated with the adoption of uniform engineering standards and the use of simplified, functional (primarily Warren and Pratt type truss) designs during the early and mid-twentieth century. The use of truss technology is increasingly rare in Maryland after World War II and thus a truss bridge from this period would more likely be considered eligible for the National Register under Criterion C than would a similar bridge from the pre-World War II period. The MD 144 Bridge over the Monocacy River (Bridge 1003803) in Frederick County is National Register-eligible under Criterion C on the state level, as it is one of only two deck truss highway bridges built in Maryland during the 1948-1960 period, and is distinguished by its arched Warren truss design.

Metal truss bridges may also be considered eligible if they reflect a unique design or a significant development in the history of bridge engineering (Spero and Berger & Associates 1995: C-14). One such bridge is the I 895 Bridge (BC07800) over the CSX tracks in Baltimore County which is National Register-eligible under Criterion C on the state level as the only highway bridge using a “K” truss design built in Maryland.

Historic research also can reveal the bridge’s attribution to a particular designer, design firm, or government entity. This is particularly true for bridges not prepared according to standardized plans or that spanned particularly challenging waterways or land forms. In these cases, the State Roads Commission usually contracted out the bridge design to a commercial engineering design firm, such as the well-known J.E. Greiner firm of Baltimore. The Wise Avenue over Bear Creek Bridge (B0079) in Baltimore is National Register-eligible under Criterion C, not only as a rare example of a bascule bridge in Maryland, but also for its design association with the J.E. Greiner firm.

A bridge may be National Register-eligible if it is associated with designers who developed patented or proprietary bridge features. These bridge types may be examples of rare or common types used on spans across the State of Maryland. The Kent Narrows Bridge (Bridge 1700600) in Queen Anne’s County is National Register-eligible under Criterion C as it is one of only two movable bridges in Maryland designed by the New York engineering firm of Hardesty & Hanover. Hardesty & Hanover and its predecessor firms were national leaders in the development of movable bridge technology from the late nineteenth century through the present.

Carrying equal weight with a bridge’s historical (Criterion A or B) or engineering significance (Criterion C) is the bridge’s integrity. Integrity is usually defined as the ability of a resource to convey its historical significance. Within the concept of integrity, the National Register Criteria recognize seven aspects of integrity that in various degrees define integrity: location, design, workmanship, materials, setting, feeling, and association.

In evaluating the aspects of integrity for a historic bridge, it is necessary to define those character defining elements of a bridge which are necessary components of its type. The most prominent feature of a metal arch bridge is its bowstring arch, but additional elements include the approach spans, the substructure of piers and abutments, and the railing if any. Character-defining elements of a concrete beam bridge would include the superstructure of slab, beams, and parapet, and the substructure elements of abutments and piers. Alterations of these features detract from the integrity of the bridge as a whole and thus its National Register eligibility, while mere surface changes such as a redecking of a truss bridge would not.

Criterion D

"Properties can be eligible for the National Register if they have yielded or are likely to yield information important in prehistory or history."

Because this Criterion applies ordinarily to archeological resources, eligibility under this Criterion was not evaluated as part of this study.

The *Historic Highway Bridges in Maryland: 1631 – 1960, Historic Context Report* contains additional criteria for common bridge types and technologies found in Maryland. The fieldwork and contextual research conducted by URS and Hardlines as part of the Historic Highway Bridges of the 1948-1960 Period Project revealed that the following factors are particularly important in evaluating postwar bridges in Maryland, and may be used to augment the above-mentioned National Register Criteria. These evaluation factors include:

- Association with statewide transportation planning efforts:
  - Private automotive clubs or local/county governments constructed many bridges in the nineteenth and early twentieth centuries. As transportation planning matured by mid-century, postwar transportation planning projects were often initiated on the state level (following federal planning guidelines). This is indicative of new transportation laws that took a more standardized approach to transportation planning.
- Association with large transportation infrastructure projects:
  - Many of these bridges may not be significant examples when evaluated individually. However, postwar transportation planning in Maryland was sometimes characterized by larger projects that encompassed more than one bridge. It is important to evaluate the thematic and design relationships between an individual bridge and any potential larger transportation project (which may include an evaluation of the larger resource). An individual bridge, while lacking individual significance, could be evaluated as a contributing resource within a larger district of related resources.
- Scale:
  - Bridges that display a larger scale should be more carefully evaluated. The postwar period of transportation planning in Maryland was frequently associated with the design and construction of wider, dualized roadway design. This effort later included limited access interstate highways, which were preceded by the design of roadways that were larger—and wider—and could better accommodate a higher rate of travel and a larger capacity.
- Safety improvements:
  - Many postwar bridges were designed to replace smaller, earlier structures. Roadway improvements in Maryland often demonstrate an increased sense of safety; tight, narrow, and dangerous curves associated with earlier roadways (intended for a slower rate of speed) were often replaced in the postwar era. Postwar automotive travel (and transportation design) was distinctly different than prewar travel—much of this relates to different life-safety features associated with a higher rate of speed.
  -

- Technology:
  - Bridges that display the early use of technological advances in design and construction methods in the postwar era before or immediately concurrent with the formal adoption of those standards by a statewide design authority are more likely to be considered eligible as significant examples of innovative design. Other bridges, built after particular technological methods became accepted standard practices, may be considered representative examples of that design type, but may be less significant on an individual basis.
- Integrity and type:
  - Transportation design in Maryland took place on an unprecedented scale in an attempt to correspond to the unrivaled ownership and use of automobiles. Accordingly, Maryland features a large number of standardized examples of bridge types. Bridges that are representative of typical—or representative—bridge types may be individually eligible, but should be scrutinized closely with a strict application of integrity criteria. There is more likely to be a lower percentage of truly significant individual examples of these popular bridge types than those bridge types that are unique or distinctive (and, hence, smaller in the total number built).

7.2 DESCRIPTIONS OF SURVEYED PROPERTIES

Bridge #: BC07800

Bridge Name: I 895 Bridge over the CSX Railroad Tracks (MIHP# B-4632)

County: Baltimore City

Date of Construction: 1957

Bridge Type: K-truss

NRHP Eligibility/ Criterion: Criterion A and Criterion C

Summary Description:

Bridge No. BC07800, a steel "K" truss bridge built in 1957, carries I 895 over the CSX (formerly Baltimore and Ohio) Railroad tracks. The bridge connects the Harbor Tunnel thruway Brooklyn area to the toll plaza for the Baltimore Harbor Tunnel. The bridge runs east-west and carries four lanes of vehicular traffic, two in each direction. A concrete median separates the two directions of traffic. The bridge does not possess sidewalks. The bridge spans the CSX Railroad tracks with a vertical clearance of approximately 22 feet. The "K" truss portion of the bridge measures just over 977 feet in length. Piers that consist of four square concrete columns each support the approach spans to the bridge and concrete girders. A large, centrally located concrete pier supports the "K" truss. The superstructure of the truss is composed of 28 full-sized "K" panels. Two smaller panels forming the end curve of the truss are located at each end of the structure. The substructure of the truss is composed of steel stringers and floor beams supporting a concrete-filled steel grid deck.

Statement of Significance:

The I 895 Bridge (MIHP # B-4632, Bridge BC07800) over the CSX (formerly Baltimore & Ohio) Railroad tracks is historically associated with the construction of the Baltimore Harbor Tunnel. Completion of the tunnel was one of four major bridge/tunnel construction projects envisioned in the 1938 Primary Bridge Program by the State Roads Commission. Its completion in 1957 was an important milestone in the nation's interstate highway system. The construction of the tunnel's approach road, the Harbor Tunnel Thruway (now I 895), was an integral part of the Baltimore Harbor Tunnel project. Whitman, Requardt & Associates (WR&A) served as the consulting bridge engineer in the design of the bridge which carried the Harbor Tunnel Thruway over the tracks of the Baltimore & Ohio (B&O Railroad). The B&O placed several restrictions on the bridge's design, allowing only one pier skewed 45 degrees to fit between the existing tracks and a large sanitary trunk sewer in the 1,000 foot-long railroad track area. Based on these and other considerations, WR&A chose a "K" truss design, a highly unusual and complex design for this bridge. Completed in 1957, the I 895 Bridge over the CSX tracks remains the only highway bridge utilizing a "K" truss design built in Maryland.

National Register of Historic Places Eligibility:

The I 895 Bridge (MIHP # B-4632, Bridge BC07800) over the CSX (formerly Baltimore & Ohio) Railroad tracks is National Register-eligible under Criterion A on the state level for its historical association with the construction of the Baltimore Harbor Tunnel, with the period of significance of 1957. Completion of the tunnel was one of four major bridge/tunnel construction projects envisioned in the 1938 Primary Bridge Program by the State Roads Commission. Its completion in 1957 was an important milestone in the nation's interstate highway system. The construction of the tunnel's approach road, the Harbor Tunnel Thruway (now I 895), was an integral part of the Baltimore Harbor Tunnel project.

The I 895 Bridge over the CSX tracks is not associated with an individual on the local, state, or national level and is not National Register-eligible under Criterion B.

The I 895 Bridge over the CSX tracks is National Register-eligible under Criterion C on the state level as the only highway bridge using a "K" truss design built in Maryland, with a period of significance of 1957. Whitman, Requardt & Associates (WR&A) served as the consulting bridge engineer in the design of the bridge which carried the Harbor Tunnel Thruway over the tracks of the Baltimore & Ohio (B&O Railroad). The B&O placed several restrictions on the bridge's design, allowing only one pier skewed 45 degrees to fit between the existing tracks and a large sanitary trunk sewer in the 1,000 foot-long railroad track area. Based on these and other considerations, WR&A chose the "K" truss design, a highly unusual and complex design for this bridge.

National Register-eligibility under Criterion D was not investigated as a part of this study.

Bridge #: B-07900

Bridge Name: Wise Avenue Bridge over Bear Creek (MIHP# BA-2681)

County: Baltimore

Date of Construction: 1943

Bridge Type: Double Leaf Bascule Trunnion

NRHP Eligibility/ Criterion: Criterion A and Criterion C

Summary Description:

The Wise Avenue over Bear Creek Bridge (MIHP # BA-2681, Bridge B-07900) is a double-leafed bascule trunnion bridge, built in 1948, that carries Wise Avenue over Bear Creek, east of the communities of Dundalk and Inverness, in Baltimore County. The bridge runs northwest-southeast and carries two lanes of traffic, one in each direction. The bridge spans Bear Creek with a vertical clearance of approximately 14 feet in the boat channel. The bascule span is approximately 91 feet long, while the entire bridge is approximately 429 feet long. The superstructure west of the bascule span consists of a 10 foot high reinforced concrete bearing. The substructure is comprised of two 15-foot-high reinforced concrete piers, each of which is constructed from two concrete piers. The deck of this span is a metal grid. The bascule portion of the span is supported by a 25-foot-high reinforced concrete bearing and a 30-foot-high reinforced concrete bearing with an operator’s house. The superstructure east of the bascule span consists of a 10 foot high reinforced concrete bearing. The substructure is comprised of a 15-foot-high reinforced concrete pier, which is constructed from two concrete piers. The deck of this span is a metal grid.

A dedication plaque is located at the northeast corner of the bridge. It states "Wise Avenue Bridge A.D. 1948 County Commissioners Baltimore County Maryland Christian H. Kahl, President Bremen A. Trail, John R. Haut J. Fred Offutt, Roads Engineer J.E. Greiner Company, Consulting Engineer McLean Contracting Company, Contractors W.J. Dahle & Son."

Statement of Significance:

The Wise Avenue over Bear Creek Bridge (MIHP # BA-2681, Bridge B-07900) was constructed in 1948 on Wise Avenue, east of the communities of Dundalk and Inverness, in Baltimore County. The bridge replaced an existing 1895 drawbridge located at this site as a part of post-World War II roadway improvements. The Wise Avenue over Bear Creek Bridge is a six span movable double leaf bascule bridge running west to east across Bear Creek. This bridge is one of three examples of this type constructed in Maryland from 1948 to 1960 and one of two examples of its type constructed in Baltimore County.

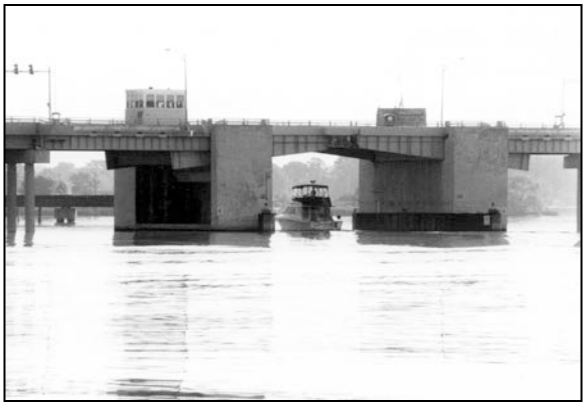
National Register of Historic Places Eligibility:

The Wise Avenue over Bear Creek Bridge (MIHP # BA-2681, Bridge B-07900) is eligible for listing in the National Register under Criterion A on the state level, with the period of significance of 1948. The bridge is associated with post-World War II roadway improvements on the North Point peninsula due to the importance of Bethlehem Steel's Sparrow's Point shipyard and steel mill, the largest in the world by the 1950s, to the regional economy.

The Wise Avenue over Bear Creek Bridge is not National Register-eligible under Criterion B, as it is not associated with an individual significant on the local, state, or national level.

The Wise Avenue over Bear Creek Bridge is National Register-eligible under Criterion C on the state level, with the period of significance of 1948, as a notable late example of the bascule bridge type displaying an unusual degree of architectural style. It displays elements of the Streamline Moderne style in its design, making this a late example of this architectural style by the time this bridge was constructed. This bridge is one of three examples of this type constructed in Maryland from 1948 to 1960 and one of two examples of its type constructed in Baltimore County. It is also eligible under Criterion C for its association with its designer, the J.E. Greiner Company, and the associate engineer for the project, McLean Contracting. A six span movable double leaf bascule bridge, it was designed specifically for its site by the J.E. Greiner Company, one of the major bridge design firms for the Maryland State Road Commission in the 20th century. The company designed several bridges for the Maryland State Roads Commission during this period. The bridge retains all of the character-defining elements of its type intact and retains its integrity of location, design, association, setting, materials, workmanship, and feeling.

National Register-eligibility under Criterion D was not investigated as part of this study.



Bridge #: 0336500

Bridge Name: MD 157 Bridge over Bear Creek (MIHP# BA-2713)

County: Baltimore

Date of Construction: 1960

Bridge Type: Double Leaf Bascule Trunnion

NRHP Eligibility/ Criterion: Not Eligible

Summary Description:

The MD 157 Bridge over Bear Creek, also known as the Cort Memorial Bridge, (MIHP BA-2713, Bridge 0336500) is a double leaf bascule trunnion bridge, built in 1960 and rehabilitated in 1999, that carries MD 157 (the Peninsula Expressway) over Bear Creek. The bridge runs northwest-southeast and carries four lanes of vehicular traffic, two in each direction. The bridge spans Bear Creek with a vertical clearance of almost 25 feet in the boat channel. The bridge is composed of 16 spans and measures almost 1,348 feet in length between bearings at the abutments. The overall width of the structure is nearly 50 feet with four-foot sidewalks. The substructure is composed of nine visible piers east of the bascule span. The approach spans of the bridge have prestressed concrete girders and a reinforced concrete deck. The spans flanking the bascule span have seven new steel interior rolled beams and the original riveted steel plate girders at each fascia. The bascule span is a double-leaf trunnion with an open concrete deck. It consists of riveted built-up steel plate fascia bascule girders with a steel rolled beam stringer and floor-beam system. The two story control house for the bridge, composed of pre-cast concrete panels, is located on the northwest pier of the bascule span. A concrete parapet with a two-bar guardrail is located on the approach spans. The bascule span has a metal railing topped with a two-bar guardrail.

Statement of Significance:

The MD 157 Bridge over Bear Creek, also known as the Cort Memorial Bridge, (MIHP BA-2713, Bridge 0336500) was constructed in 1960, east of the communities of Dundalk and Inverness, in Baltimore County. The bridge was constructed as a part of the development of the

Peninsula Expressway which connects the Dundalk area and Southeast Baltimore with I-695, the Baltimore Beltway. The MD 157 Bridge over Bear Creek is a sixteen span movable double leaf bascule bridge running northwest to southeast across Bear Creek. This bridge is one of three examples of this type constructed in Maryland from 1948 to 1960 and one of two examples of its type constructed in Baltimore County. The bridge was significantly altered in 1999.

National Register of Historic Places Eligibility:

The MD 157 Bridge over Bear Creek, also known as the Cort Memorial Bridge, (MIHP BA-2713, Bridge 0336500) is not eligible for listing in the National Register under Criterion A. While the bridge is associated with post-World War II roadway improvements on the North Point peninsula it does not retain sufficient integrity to convey its period of significance. The bridge has lost its integrity of design, materials, workmanship, and feeling due to the 1999 rehabilitation of the bridge which included the complete replacement of twelve piers and the removal of four piers, reducing the total number of spans to sixteen. The original light fixtures, railings, and signage were also changed in order to meet 1999 state highway standards.

The Wise Avenue over Bear Creek Bridge is not National Register-eligible under Criterion B, as it is not associated with an individual significant on the local, state, or national level.

The Wise Avenue over Bear Creek Bridge is not National Register-eligible under Criterion C, as it is not an intact example of its typology in Baltimore County or Maryland. The bridge was built by the Wilson T. Ballard Company, which was known for the comprehensive planning and design of highways and bridges for the Maryland State Roads Commission during this period. However, this bridge does not retain sufficient integrity to convey its period of significance. Both the substructure and the superstructure of the bridge have been replaced and four of the spans removed during the 1999 rehabilitation. At that time, the original light fixtures, railings, and signage were also changed in order to meet 1999 state highway standards.

National Register-eligibility under Criterion D was not investigated as part of this study.

Bridge #: 0400500

Bridge Name: MD 2 Bridge over the Narrows (CT-784)

County: Calvert

Date of Construction: 1958; 1986

Bridge Type: Reinforced Concrete Slab

NRHP Eligibility/ Criterion: Not Eligible

Summary Description:

Bridge No. 0400500, built in 1958 and 1986, carries MD 2 over the Narrows at Solomons Island at the site of an earlier 1910s bridge. It connects Johnstown to the north with Solomons Island to the south. The bridge carries two lanes of traffic, one each direction. The bridge has a 20-foot clear span and measures approximately 25 feet from abutment to abutment. The western half of the bridge, dating to 1958, is a reinforced concrete slab with integral concrete caps that drop below the soffit of the slab at the abutments. The western portion of the bridge deck is paved in blacktop. The eastern half of the bridge, dating to 1986, is also a reinforced concrete slab, which largely replaced the original 1910s structure. The stem wall of the abutments directly supports this slab. The eastern portion of the bridge deck is concrete, about 2'-2" thick. A metal railing composed of squared pipes is located on each side of the bridge. A concrete wingwall extends at a 45-degree skew at the east end of the north abutment to meet a concrete seawall.

Statement of Significance:

The MD 2 Bridge (MIHP ID # CT-784, Bridge 0400500) over the Narrows at Solomons Island in southern Calvert County is a reinforced concrete slab bridge. The State Roads Commission first built a bridge in this location over the shallow waterway in the 1910s, replacing an improvised bridge that was likely built by residents of the area in the late nineteenth century. The bridge physically connected what had been a small, relatively isolated community that had mainly relied on boats and other water vessels for transport off of and on to the Island. The bridge offered residents of Solomons Island and the surrounding communities another means of accessing the Island-- the automobile. Automobile use became increasingly popular in the twentieth century. Increased automobile use required an expansion of the bridge in 1958. The widened portion also utilized reinforced concrete slabs. In 1986, portions of the super and substructures of the original 1910s bridge were largely replaced in a rehabilitation effort.

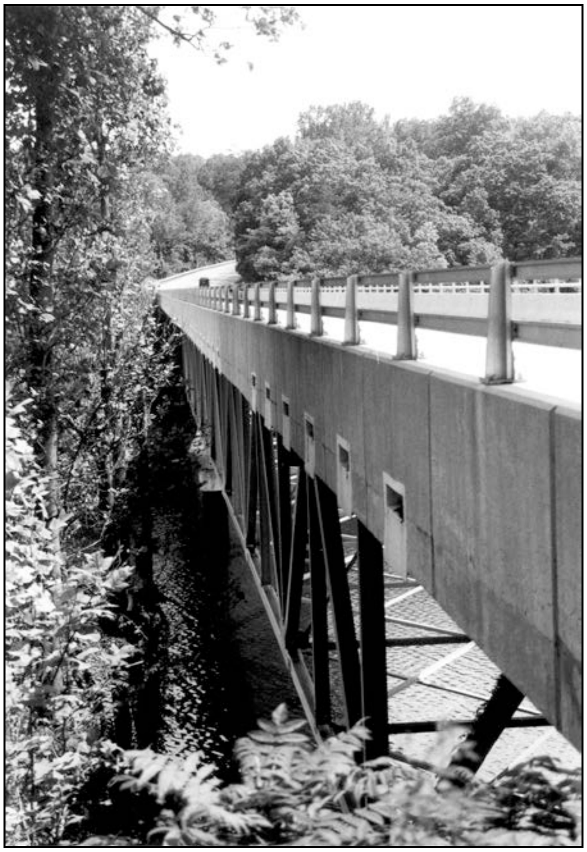
National Register of Historic Places Eligibility:

The MD 2 Bridge (MIHP ID # CT-784, Bridge 0400500) over the Narrows is not eligible for listing in the National Register for Historic Places under Criterion A. While the bridge is associated with the expansion and development of southern Calvert County, and specifically Solomon's Island, and is important as a historical crossing that connected the once relatively isolated community with the main land, the bridge does not retain integrity of design, setting, materials, workmanship or feeling as much of the original portion, ca. 1910, of the bridge was replaced during a partial replacement of the super and substructure in 1986.

The MD 2 Bridge is not National Register-eligible under Criterion B, as it is not associated with an individual significant on the local, state, or national level.

The MD 2 Bridge is not National Register-eligible under Criterion C as it is not significant in the history of bridge engineering or design, nor is it an example of the work of a renowned engineer, craftsman, bridge company, or contractor. It does not exemplify significant engineering solutions developed in response to conditions characteristic of the locality or region. It also does not retain sufficient integrity to stand as a representative example of a specific bridge type which may survive in substantial numbers. It is not an example of a rare bridge type nor does it possess architectural or artistic distinction. While the MD 2 Bridge over the Narrows does reflect common construction techniques of the early twentieth century in the United States, it does not demonstrate innovative technical solutions and lacks integrity of design, setting, materials, workmanship and feeling.

National Register-eligiblity under Criterion D was not investigated as part of this study.



Bridge #: 0604900

Bridge Name: MD 32 over the Liberty Reservoir (CARR-1673)

County: Carroll

Date of Construction: 1952

Bridge Type: Steel Deck (Warren) Truss

NRHP Eligibility/ Criterion: Criterion A and Criterion C

Summary Description:

Bridge No. 0604900, built in 1952, runs northwest-southeast and carries the two lanes of MD 32 over Liberty Reservoir just south of Louisville. The bridge consists of two main Warren-type truss spans (about 216 feet in length) supporting the bridge deck, with smaller steel girder approach spans (about 70 feet in length) located on each end. The main truss spans consist of eight panels. The trusses, made from riveted steel, sit on a central reinforced concrete bent pier with two columns. The other piers are composed of two independent concrete pedestals spaced 20 feet apart on center. The truss spans sit on the central columns via steel rockers and have flat bottom chords. The outer ends of the truss spans are supported on small concrete foundations. The steel girder spans are supported on these concrete foundations on one end and reinforced concrete abutments on the outer end. The truss supports a concrete deck that has two traffic lanes and one emergency lane, totaling 36 feet with a four-foot overhang on each side. The deck also has a concrete parapet that also features a standard metal guardrail.

Statement of Significance:

The MD 32 Bridge (MIHP # CARR-1673, Bridge 0604900) over the Liberty Reservoir in Carroll County is a rare example of a truss bridge designed and constructed in the 1948-1960 period. It is one of only three truss bridges, and one of the only two deck truss bridges to incorporate a Warren truss, built during this period. While the bridge has undergone some alterations to the road deck and concrete abutments during a 1993-94 rehabilitation, it remains largely intact. It is also significant for its association with the Liberty Reservoir, an important public works project of the post-World War II period in Baltimore, and as an example of the work of J.E. Greiner Company, a prominent Baltimore engineering firm.

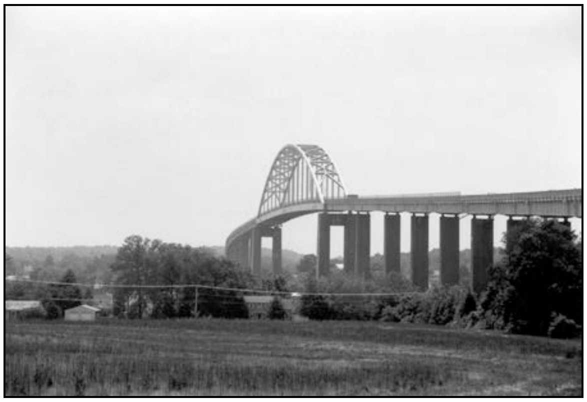
National Register of Historic Places Eligibility:

The MD 32 Bridge (MIHP # CARR-1673, Bridge 0604900) over the Liberty Reservoir is eligible for listing in the National Register under Criterion A on the local level with a period of significance of 1941-56 for its association with the Liberty Dam and Reservoir, an important public works projects for the City of Baltimore. The Liberty Reservoir was the result of a joint public-private campaign between City officials and the Citizens' Planning and Housing Association (CPHA), a citizens group formed in 1941 with the aim of improving housing and health conditions throughout the City.

The MD 32 Bridge is not National Register-eligible under Criterion B, as it is not associated with an individual significant on the local, state, or national level.

The MD 32 Bridge is National Register-eligible under Criterion C on the local level with a period of significance of 1952. Although the MD 32 Bridge has undergone some alterations to the road deck and concrete abutments during a 1993-1994 rehabilitation, the bridge retains its integrity of location, design, setting, association, materials, and feeling. Replacement of its original railings and parapets has adversely impacted the bridge's integrity of workmanship. It is a rare example of a truss bridge designed and constructed in the 1948-1960 period. It is one of only three truss bridges, and one of only two deck truss bridges to incorporate a Warren truss, built in Maryland during this period. It is additionally significant as an example of the work of J.E. Greiner Company, a prominent Baltimore engineering firm that designed numerous bridges throughout Maryland during the twentieth century.

National Register-eligibility under Criterion D was not investigated as part of this study.



Bridge #: CE0100

Bridge Name: MD 213 Bridge over the Chesapeake & Delaware Canal (MIHP# CE-1083)

County: Cecil

Date of Construction: 1949

Bridge Type: Metal Deck Arch (Tied Arch)

NRHP Eligibility/ Criterion: Criterion A and Criterion C

Summary Description:

Bridge No. CE0100, built between 1946-1949, carries MD 213 over the Chesapeake & Delaware Canal in Chesapeake City. The south approach spans of the bridge along MD 213 form the western boundary of the South Chesapeake City Historic District, which is listed in the National Register of Historic Places. The 540-foot long bridge consists of a series of steel girder approach spans to the north and south of the main span. The main span is a large tied steel arch span that crosses the Chesapeake and Delaware Canal. This span rests on two concrete piers via a series of steel rockers. The tied arch span consists of a steel segmental arch with the steel girder road deck supported by two sets of 13 vertical steel ties. The main span is positioned 135 feet above the canal to accommodate shipping traffic. The bridge carries a concrete road bed with two traffic lanes and a raised concrete pedestrian walkway. The bridge retains its original heavy steel guardrails throughout the tied arch span and the approach spans. A chain link fence has been installed above the guardrails.

A bronze plaque located at the end of the bridge's south approach ramp is mounted on a concrete end post at the southeast corner of the bridge. The plaque reads "Chesapeake City Highway Bridge, constructed by Corps of Engineers, 1946-1949. Colonel F.F. French, C.E., Philadelphia District Engineer. Engineers: Parsons Brinckerhoff, Hall and McDonald. Contractors: American Bridge Company, Superstructure, Fehlhaber Pile Company, Substructure, George and Lynch, Approaches."

Statement of Significance:

The MD 213 Bridge over the Chesapeake & Delaware Canal (MIHP # CE-1083, Bridge CE0100) is associated with the historically significant Chesapeake & Delaware Canal and the Atlantic Intracoastal Waterway of which the canal is now a part. The canal, completed in 1829 and widened numerous times during the twentieth century, links the Delaware River and the Chesapeake Bay, and was built to provide a shortened inland route between Philadelphia and Baltimore. The MD 213 Bridge, completed in 1949, is associated with the canal's period of ownership (1919-present) by the US Army Corps of Engineers (USACE), which maintains and operates the canal and the several bridges that cross over it in both Delaware and Maryland. The present MD 213 Bridge was built to replace an earlier mechanical lift bridge also built by the USACE and destroyed following a 1942 freighter collision. The bridge's tied arch (also known as bowstring arch) design is also significant, as it is one of only two tied arch bridges built in Maryland during the 1948-1960 period. The bridge contractors for the Chesapeake City Bridge, the American Bridge Company, are among America's premier bridge builders. Formed in 1870, the company is responsible for two of the most famous arch bridges in the United States: the Bayonne Bridge in New Jersey (1932) and the New River Gorge Bridge (1977) in West Virginia.

National Register of Historic Places Eligibility:

The MD 213 Bridge over the Chesapeake & Delaware Canal (MIHP # CE-1083, Bridge CE0100) is National Register-eligible under Criterion A on the state level with the period of significance being 1949. The bridge is associated with the historically significant Chesapeake & Delaware Canal and the Atlantic Intracoastal Waterway of which the canal is now a part. The canal, completed in 1829 and widened numerous times during the twentieth century, links the Delaware River and the Chesapeake Bay, and was built to provide a shortened inland route between Philadelphia and Baltimore. The MD 213 Bridge, completed in 1949, is associated with the canal's period of ownership (1919-present) by the US Army Corps of Engineers, which maintains and operates the canal and the several bridges that cross over it in both Delaware and Maryland. The present MD 213 Bridge was built to replace an earlier mechanical lift bridge also built by the USACE and destroyed following a 1942 freighter collision.

The MD 213 Bridge over the Chesapeake & Delaware Canal is not eligible under Criterion B as it is not associated with an individual significant on the local, state, or national level.

The MD 213 Bridge is National Register–eligible under Criterion C on the state level with the period of significance as 1949. The bridge's tied arch (also known as bowstring arch) design is significant, as it is one of only two tied arch bridges built in Maryland during the 1948-1960 period. The tied arch is a variation of the simple arch bridge which allows for construction even if the ground is not solid enough to deal with the horizontal forces. Rather than relying on the foundation to restrain the horizontal forces, the girder itself "ties" both ends of the arch together.

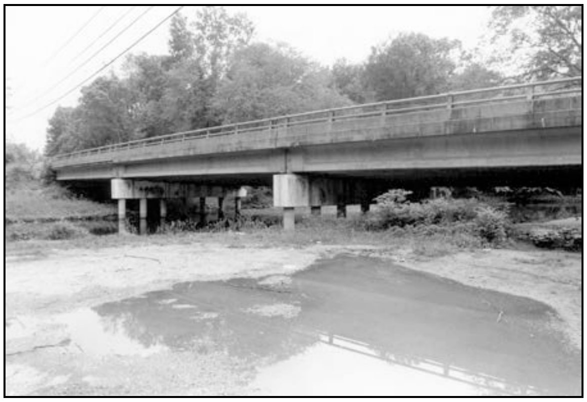
Only about eighty tied arch bridges have been built in the United States. Besides the MD 213 Bridge, the only other tied arch bridge built in Maryland during the 1948-1960 period is the so-called Blue Bridge (Bridge 1006) in Cumberland, Allegany County. Completed in 1954, the Blue Bridge consists of two tied arch spans and crosses the North Branch of the Potomac River between Cumberland and Ridgeley, West Virginia.

The MD 213 Bridge over the Chesapeake & Delaware Canal is also eligible under Criterion C on the state level with period of significance as 1949 as the work of the American Bridge Company.

The American Bridge Company is among America's premier bridge builders. Formed in 1870, the company is responsible for two of the most famous arch bridges in the United States: the Bayonne Bridge in New Jersey (1932) and the New River Gorge Bridge (1977) in West Virginia. The MD 213 Bridge over the Chesapeake & Delaware Canal is a notable example of work by the company due to the rarity of its type.

MD 213 serves as the western boundary of the South Chesapeake City Historic District, listed in the National Register. The MD 213 Bridge is located just north of the northwest corner of this district. The MD 213 Bridge is not recommended eligible as a contributing resource in this historic district as its construction date of 1949 places it outside of the district's 1829-1900 period of significance. The South Chesapeake City Historic District is associated with the period of private ownership of the Chesapeake & Delaware Canal until 1919. The MD 213 bridge was built by the US Army Corps of Engineers which assumed control of the canal and its bridges after 1919.

National Register-eligibility under Criterion D was not investigated as part of this study.



Bridge #: 0802200

Bridge Name: MD 225 Bridge over Mattawoman Creek (MIHP# CH-781)

County: Charles

Date of Construction: 1957

Bridge Type: Prestressed Concrete Girder

NRHP Eligibility/ Criterion: Criterion A and Criterion C

Summary Description:

Bridge No. 0802200 is a three-span, prestressed concrete girder bridge, built in 1957, that carries MD 225 over Mattawoman Creek. The bridge runs northeast-southwest and carries two lanes of vehicular traffic, one in each direction. The bridge spans Mattawoman Creek with a vertical clearance of approximately 8.5 feet. The bridge is approximately 180 feet long and 38 feet wide, with a clear roadway width of 30 feet. Metal joint plates are located at the meeting point of each of the spans and at each end of the bridge. It appears that the deck has been surfaced with blacktop within the past ten years. The substructure of the bridge is composed of two large bents. Each bent consists of seven concrete-filled, fluted, steel Monotubes, 18-inch diameter columns. The columns are capped by concrete slabs that support nine concrete beams that run the length of the bridge and support the concrete deck. The bridge appears to retain its original parapet. The rail portion consists of two horizontal pipes, with vertical members spaced approximately four feet apart. The railing terminates into concrete end panels.

Statement of Significance:

The MD 225 Bridge over Mattawoman Creek (MIHP ID# CH-781, Bridge 0802200) was built in 1957 at the site of at least two earlier bridges over Mattawoman Creek in Charles County, MD. The present MD 225 Bridge is a three-span prestressed concrete girder bridge with a concrete deck. The deck carries two lanes of traffic and is supported by two piers that contain seven concrete Monotube columns. It is one of only two bridges built in Charles County during the 1948-1960 period and one of twelve pre-stressed concrete bridges built throughout Maryland in 1957. The bridge is significant as a historically important crossing, associated with the developments and improvements to roadways in northeastern Charles County, especially those that serviced the Indian Head Naval Powder Factory, now known as the Naval Surface Warfare Center, Indian Head Division (NSWC).

National Register of Historic Places Eligibility:

The MD 225 Bridge (MIHP ID# CH-781, Bridge 0802200) is eligible for listing in the National Register for Historic Places under Criterion A on the local level, with a period of significance of 1957. The bridge is a historically important crossing, associated with the development of Charles County, and specifically the area around the Indian Head naval facility (now known as Naval Surface Warfare Center, Indian Head Division), in the northeastern area of the county. The crossing connected portions of the county with the village of Indian Head and the naval facility which employed many local residents in its initial construction in 1890 and after. The first bridge, likely erected in the 1910s was replaced in 1928 by two concrete slab bridges. The two bridges were destroyed by a flood in 1955 and were replaced by the existing bridge.

The MD 225 Bridge is not National Register-eligible under Criterion B, as it is not associated with an individual significant on the local, state, or national level.

The MD 225 Bridge is National Register-eligible under Criterion C on the state level with a period of significance of 1957. As one of the first fifteen prestressed concrete bridges built in the mid-to-late 1950s in Maryland, it is significant in the history of bridge engineering and its use of prestressed concrete exemplifies an innovative technological solution. The bridge also retains its integrity of location, design, setting, materials, workmanship, feeling and association and is therefore a representative example of a three-span prestressed concrete girder bridge.

National Register-eligibility under Criterion D was not investigated as part of this study.

Bridge #: 1003803

Bridge Name: MD 144 Bridge over the Monocacy River (MIHP# F-3-205)

County: Frederick

Date of Construction: 1955

Bridge Type: Steel Deck (Warren) Truss

NRHP Eligibility/ Criterion: Criterion A and Criterion C

Summary Description:

Bridge No. 1003803, built in 1955 and reconstructed in 1987, carries MD 144 over the Monocacy River in Frederick County. The bridge runs northwest-southeast just west of the highway's intersection with Linganore Road, just east of the city of Frederick. The structure is a three-span Warren truss with arched lower chords and a top-mounted steel deck. The center span is about 208 feet long, and the east and west spans are about 156 feet long. The end trusses widen towards the center of the bridge. The outer end of each of the side span trusses sits on a concrete abutment, while the inner edges are supported on two sets of twin reinforced concrete columns on spread footings with steel noses. Each truss support consists of a concrete base, with two columns rising out of the base. The columns are joined at the middle by a concrete beam, and support a concrete slab. The bridge truss sits on this slab on steel rockers. The center span widens at its outer edges and narrows at the center. This truss supports steel stringers framed into steel floor beams connected to the truss panel points. The sides of the road deck are lined with a 14-inch wide concrete parapet and standard metal railing that were replaced in a 1987 reconstruction of the bridge. The bridge carries a standard 24 foot wide concrete road bed with two traffic lanes and one emergency lane.

Statement of Significance:

The MD 144 Bridge over the Monocacy River (MIHP # F-3-205, Bridge 1003803) in Frederick County was constructed in 1955 as part of improvements undertaken by the State Roads Commission to upgrade roads and bridges throughout the state. The bridge was built in 1955 according to standardized plans of the State Roads Commission dated May, 1954 and was intended to carry the eastbound lane of the new dual highway US 40 over the river. The bridge's design is significant, as it is one of only two metal deck truss highway bridges built in Maryland during the 1948-1960 period . While the bridge has undergone emergency stringer repairs in 1986 and replacement of the road deck and approach roadways in 1987, its primary character-defining elements as a metal deck truss bridge, especially its arched Warren truss system and concrete supports, remain largely intact. It is also significant for its association with US 40, one of the country's important intercontinental highways of the early twentieth century prior to the introduction of the interstate system.

National Register of Historic Places Eligibility:

The MD 144 Bridge over the Monocacy River (MIHP # F-3-205, Bridge 1003803) in Frederick County is eligible for listing in the National Register under Criterion A on the state level with a period of significance of 1955 to 1970, for its association with US 40, one of the early transcontinental highways built prior to the construction of the interstate highway system. The bridge is the third at this location that spanned the Monocacy River and that were components of historic roads, including the Baltimore to Frederick Town Turnpike, Baltimore Turnpike and US 40, linking the local community to Baltimore and to the Western United States, thereby supporting economic development of the region.

The MD 144 Bridge over the Monocacy River is not National Register-eligible under Criterion B, as it is not associated with an individual significant on the local, state, or national level.

The MD 144 Bridge is National Register-eligible under Criterion C on the local level with a period of significance of 1955. It is one of only three deck truss highway bridges built in Maryland during this period, and is distinguished by its arched Warren truss design. Although the MD 144 Bridge has undergone some alterations to the road deck and stringers during rehabilitations in 1986 and 1987, the bridge retains its integrity of location, design, setting, association, materials, and feeling. Replacement of its original railings and parapets has affected the bridge's integrity of workmanship.

National Register-eligibility under Criterion D was not investigated as part of this study.

Bridge #: G-06400

Bridge Name: Sang Run Road Bridge over the Youghiogheny River (MIHP# G-III-A-199)

County: Garrett

Date of Construction: 1955

Bridge Type: Steel Girder / Floorbeam System

NRHP Eligibility/ Criterion: Criterion A and Criterion C

Summary Description:

Bridge No. G-06400, also known as the Sang Run Road Bridge, was built in 1955 and carries Sang Run Road across the Youghiogheny River in a rural portion of Garrett County. This is a four-span steel beam bridge with a steel grid deck supported by two concrete cantilever abutments and three stone masonry solid shaft piers with concrete aprons. Its overall length is 222'-8" with a clear roadway of 17'-0". The abutments are composed of a combination of poured concrete and sandstone, although the sandstone is barely visible. The anchor bolts for the exterior bearings are placed less than two inches from the edge of the beam seat. The three stone piers are roughly rectangular in form, and are composed of rubble blocks with a chiseled surface and laid in a somewhat irregular pattern. The south side of each pier comes to a point to minimize erosion from the flow of the river, while the north ends of the piers are rounded in profile. These masonry piers appear to have been hand dressed and show chisel marks. There are seven W24x79.5 steel beams in each span, resting on steel plates with hold-down straps at each pier. The steel grid deck is open except for the concrete filled 5.75'-wide section along the north side of the bridge that forms a pedestrian walkway. The bridge has a modern double W-beam railing in good condition that appears to have been installed within the last ten years.

Statement of Significance:

The Sang Run Road Bridge (MIHP # G-III-A-199, Bridge G-06400) was built in 1955 at the site of at least two earlier bridges across the Youghiogheny River, just west of the Sang Run community. Sang Run is one of six early-nineteenth century villages established along the river in present-day Garrett County. During the nineteenth and early twentieth centuries, Sang Run consisted of a dozen residences and also supported a church, a school, and a coal mine. In the 1930s, the development of nearby Swallow Falls and Herrington Manor State Parks breathed new economic life into the surrounding community and increased automobile traffic through Sang Run. The present Sang Run Road Bridge, built in 1955, is a steel girder bridge with a floor beam and stringer system erected on the stone piers of the predecessor bridge. It is one of only two such bridges built in Garrett County during the 1948-1960 period and one of only four such bridges built in Maryland during this period.

National Register of Historic Places Eligibility:

The Sang Run Road Bridge (MIHP # G-III-A-199, Bridge G-06400) is eligible for listing in the National Register under Criterion A on the local level with the period of significance being 1863-1955. The bridge is associated with the historical development of the Sang Run community. Settlement at Sang Run dates from the early 1800s, with a bridge at this location crossing the Youghiogheny River first built as early as 1828. This first bridge was rebuilt in 1863, and the stone piers of this bridge probably serve to support the present bridge. The Sang Run area grew in popularity with the improvements made to Swallow Falls and Herrington Manor State Parks in the 1930s. Increased automobile traffic between US 219 and the two state parks necessitated the building of the present Sang Run Road Bridge in 1955.

The Sang Run Road Bridge is not National Register-eligible under Criterion B, as it is not associated with an individual significant on the local, state, or national level.

The Sang Run Road Bridge is National Register-eligible under Criterion C on the local level with a period of significance of 1955. The bridge is one of only two metal girder bridges in Garrett County built in the 1948-1960 period with a metal stringer and floor system. It is one of only four such bridges built statewide from this period. Additionally, the bridge design is highly unusual in that it incorporates the historic stone piers of its predecessor bridge, indicating the bridge designers' recognition of the superior workmanship and stability of these piers. The Sang Run Road Bridge retains its integrity of location, design, setting, association, materials, and feeling. Replacement of its original railings has diminished the bridge's integrity of workmanship.

National Register-eligibility under Criterion D was not investigated as part of this study.

Bridge #: G-02000

Bridge Name: Swallow Falls Road Bridge over the Youghiogheny River (MIHP# G-IV-A-290)

County: Garrett

Date of Construction: 1960

Bridge Type: Steel Girder / Floorbeam System

NRHP Eligibility/ Criterion: Criterion A and Criterion C

Summary Description:

Bridge No. G-02000, also known as the Swallow Falls Road Bridge, was built in 1960 and carries Swallow Falls Road across the Youghiogheny River in a rural area of Garrett County. This is a two-span steel beam bridge with an open steel grate deck. The substructure has two precast crib wall abutments with concrete bases and a pier consisting of a concrete cap and footing with five RCCP columns. The overall length of the bridge is 101'-4" with a clear roadway of 19'-11". Each span is composed of five W30x108 steel beams that support W8x13 floor beams with the steel deck on top. The main beams, which bear on steel plates, have W14 diaphragms spanning between them. The four-foot cantilever on each side is diagonally braced from the main beam at about a 45-degree angle. The bridge has its original two-strand steel railing and posts, which rises about 5'-5" from the bottom of the floor beams. The wingwalls are precast concrete cribbing with a concrete base, similar to the abutments. A small sandstone rubble masonry pier is located to the north of the bridge on the east side of the river. It appears to be a remnant of an earlier, probably nineteenth century bridge that once stood at this site.

Statement of Significance:

The Swallow Falls Road Bridge (MIHP # G-IV-A-290, Bridge G-02000) was built in 1960 near the site of an earlier nineteenth-century bridge across the Youghiogheny River, near the Swallow Falls community, in western Garrett County. In the 1930s, the development of nearby Swallow Falls and Herrington Manor State Parks breathed new economic life into the surrounding area and increased automobile traffic through the small Swallow Falls community. The present Swallow Falls Road Bridge, built in 1960, is a steel girder bridge with floor deck system erected near one of the stone foundations of a predecessor bridge. This replacement bridge is one of only two such bridges using this girder system built in Garrett County during the 1948-1960 period, and only one of four such bridges built during this period in Maryland.

National Register of Historic Places Eligibility:

The Swallow Falls Road Bridge (MIHP # G-IV-A-290, Bridge G-02000) is eligible for listing in the National Register under Criterion A on the local level with the period of significance being 1960. The bridge is associated with the historical development of the Swallow Falls community after the 1930s. The Swallow Falls area grew in popularity as a vacation destination with the improvements made to Swallow Falls and Herington Manor State Parks in the 1930s. Increased automobile traffic between US 219 and the two state parks necessitated the building of the present Swallow Falls Road Bridge in 1960. The bridge serves as the eastern entrance to Swallow Falls State Park, which annually accommodates over 200,000 visitors.

The Swallow Falls Road Bridge is not National Register-eligible under Criterion B, as it is not associated with an individual significant on the local, state, or national level.

The Swallow Falls Road Bridge is National Register-eligible under Criterion C on the local level with a period of significance of 1960. The present Swallow Falls Road Bridge, built in 1960, is a steel girder bridge with floor deck system and was erected near one of the stone foundations of a 19th-century bridge. This replacement bridge is one of only two such bridges using this girder system built in Garrett County during the 1948-1960 period, and only one of four such bridges built during this period in Maryland. In addition, the RCCP columns that make up the central pier are not seen on any other bridge in Garrett County. The Swallow Falls Road Bridge retains virtually all of the character-defining elements of its superstructure and substructure intact. It has retained its integrity of location, design, association, setting, materials, and feeling. Alterations to its original railings have diminished the bridge's integrity of workmanship.

National Register-eligibility under Criterion D was not investigated as part of this study.

Bridge #: H-01300

Bridge Name: Hookers Mill Bridge over Bynum Run (MIHP# HA-2045)

County: Harford

Date of Construction: 1957

Bridge Type: Prestressed Concrete Box Girder

NRHP Eligibility/ Criterion: Criterion A and Criterion C

Summary Description:

Bridge No. H-01300 is a two-span prestressed concrete box girder bridge built in 1957. It carries Hookers Mill Road over Bynum Run in Harford County, north of Edgewood, a suburban residential area. The bridge runs northwest-southeast along the length of Hookers Mill Road through the Bynum Run Conservation Area. There are two reinforced concrete abutments at each end of the bridge, and the outer wing wall of each abutment is six feet long. At the center of the bridge, a rectangular reinforced concrete pier, each end of which is pointed and has a steel bull nose, supports the two spans. The box girder spans each consist of a series of nine pre-stressed concrete box girders that form a 28'-2" foot wide deck that accommodates a two-lane asphalt road about two inches thick. The overall clear span of the bridge is 84 feet, with each of the two spans being 42 feet in length, while the overall length of the bridge including abutments and wing walls is about 100 feet.

Statement of Significance:

The Hookers Mill Road Bridge over Bynum Run (MIHP # HA-2045, Bridge H-01300) in Harford County was built in 1957 at the site of an earlier covered bridge that burned in 1955. With the development of roadways in the eighteenth century, mills began to spring up on almost every usable stream. Hookers Mill and the Hookers Mill Bridge were constructed ca. 1860 by Aquila Hall. The present Hookers Mill Bridge is a two span prestressed concrete box girder bridge which is supported by a rectangular reinforced concrete pier that is pointed at each end and covered with a steel bull nose-shaped. The bridge is one of only two pre-stressed concrete box girder bridges built in Maryland in 1957.

National Register of Historic Places Eligibility:

The Hookers Mill Bridge over Bynum Run (MIHP # HA-2045, Bridge H-01300) in Harford County is eligible for listing in the National Register for Historic Places under Criterion A on the local level with a period of significance of 1957. The bridge is associated with an important historical crossing near the town of Bush. The original bridge, built ca. 1860, was constructed to facilitate the transportation of goods to and from Hookers Mill which was an important center of commerce for the town of Bush and Harford County. The original covered bridge built at the location burned in 1955 and the existing bridge was rebuilt on the site in 1957.

The Hookers Mill Bridge over Bynum Run is not National Register-eligible under Criterion B, as it is not associated with an individual significant on the local, state, or national level.

The Hookers Mill Bridge over Bynum Run is National Register-eligible under Criterion C on the state level with a period of significance of 1957. The bridge is one of the earliest examples of the pre-stressed concrete box girder bridges built in Maryland between the 1948-1960 period, thus it is eligible under Criterion C. The Hookers Mill Bridge retains sufficient integrity of design, materials, workmanship, association, setting, and location to stand as a representative example of a specific bridge type which may survive in substantial numbers.

National Register-eligibility under Criterion D was not investigated as part of this study.

Bridge #: H-07000

Bridge Name: Phillips Mill Road Bridge over the East Branch of Winters Run (MIHP# HA-2046)

County: Harford

Date of Construction: 1958

Bridge Type: Prestressed Concrete Box Girder

NRHP Eligibility/ Criterion: Criterion C

Summary Description:

Bridge H-07000, also known as the Phillips Mill Road Bridge, was built in 1958 and carries Phillips Mill Road over the East Branch of Winters Run. The bridge is a single span concrete box girder bridge that carries a two-lane road over a stream in a rural area with sparse residential development. The two concrete abutments have outer walls that are six feet long. A small concrete abutment to the west of the bridge marks the location of a former bridge (date unknown) that stood at this site and that was demolished to make way for the current span. Nine concrete box girders, each 27" deep and 36" wide with a half-inch joint, sit on the abutments to support an asphalt roadway. The roadway has two 11-foot wide traffic lanes, and the overall width of the bridge is 16 feet. A concrete parapet at each edge of the bridge sits on top of the concrete box girders and projects out slightly over the girders. The parapet supports steel pipes that are connected by concrete beams that form a guardrail for the bridge. The clear span of the bridge is 25 feet.

Statement of Significance:

The Phillips Mill Road Bridge over the East Branch of Winters Run (MIHP # HA-2046, Bridge H-07000) was built in 1958 at the site of at least one earlier bridge over the East Branch of Winter's Run in Harford County. The present Phillips Mill Bridge is a single span prestressed concrete box girder bridge. It is one of five prestressed concrete box girders built in the state in 1958.

National Register of Historic Places Eligibility:

The Phillips Mill Road Bridge over the East Branch of Winters Run (MIHP # HA-2046, Bridge H-07000) in Harford County is not eligible for listing in the National Register for Historic Places under Criterion A as it does not reflect trends in the social, economic, industrial, and transportation development of its locality or of the state, region, or nation. The crossing is not a historic river crossing as the road and crossing have been moved.

The Phillips Mill Road Bridge over the East Branch of Winters Run is not National Register-eligible under Criterion B, as it is not associated with an individual significant on the local, state, or national level.

The Phillips Mill Road Bridge over the East Branch of Winters Run is National Register-eligible under Criterion C on the state level with a period of significance of 1958.The bridge is one of the earliest examples of the pre-stressed concrete box girder bridges built in Maryland during the 1948-1960 period. The Phillips Mill Bridge retains sufficient integrity of design, materials, workmanship, association, setting, and location to stand as a representative example of a specific bridge type which may survive in substantial numbers.

National Register-eligibility under Criterion D was not investigated as part of this study.

Bridge #: 1600501

Bridge Name: US 1 Northbound Bridge over the Northwest Branch of the Anacostia River (MIHP# PG:68-100)

County: Prince George's

Date of Construction: 1956-57

Bridge Type: Concrete Beam

NRHP Eligibility/ Criterion: Criterion A and Criterion C

Summary Description:

Bridge No. 1600501, a prestressed concrete beam bridge built in 1956-1957, carries US 1 Northbound over the Northwest Branch of the Anacostia River. The bridge runs northeast-southwest and carries two lanes of traffic. The bridge is a short span that does not have piers for support. The bridge measures approximately 85 feet long and 43 feet wide. The bridge is composed of ten prestressed concrete beams with cast-in-place concrete between the beam flanges. It appears the deck of the bridge has been resurfaced with blacktop within the past ten years. Metal joint plates are located at each end of the bridge. The bridge's superstructure features a parapet with a concrete wall and bowed Alcoa railing. The railing, which is original, looks much like the one depicted in a historic photograph of the no-longer-extant bridge carrying US 50 over the Severn River in Annapolis, which opened in 1953. The date "1957" is inscribed in the concrete parapet at the southeast corner of the bridge.

Statement of Significance:

Bridge No. 1600501 was part of the first small group of prestressed concrete bridges erected in Maryland in the mid 1950s and is therefore significant in the history of bridge engineering in the state. This prestressed concrete beam bridge, built in 1956-1957, carries US 1 northbound over the Northwest Branch of the Anacostia River. The bridge's superstructure features a parapet with a concrete wall and bowed Alcoa railing. The railing, which is original, looks much like the one depicted in a historic photograph of the no-longer-extant bridge carrying US 50 over the Severn River in Annapolis, which opened in 1953. The bridge is also significant for its association with an important mid twentieth-century trend in Maryland's history—the modernization by the State

Roads Commission of the highway system of the counties ringing the District of Columbia in response to the heavy post-World War II sub-urbanization of the area. In particular, it is associated with the efforts of the Commission to comprehensively address problems of flooding in Prince George's County along the Anacostia River and its branches.

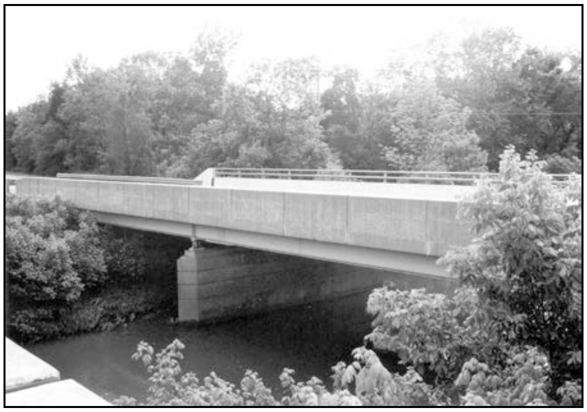
National Register of Historic Places Eligibility:

The US 1 Northbound Bridge over the Northwest Branch of the Anacostia River is eligible for listing in the National Register under Criterion A at the local level with a period of significance from 1956 to 1957. The bridge is eligible under Criterion A for its association with a significant mid twentieth-century trend in Maryland's history, the modernization by the State Roads Commission of the highway system of the counties ringing the District of Columbia in response to the heavy post-World War II sub-urbanization of the area. The bridge is not directly connected with the construction or reconstruction of a particular highway, but rather it is associated with the efforts of the Commission to comprehensively address problems of flooding in Prince George's County along the Anacostia River and its branches. The bridge has not been altered beyond the standard actions necessary to maintain a busy highway bridge and retains all seven aspects of integrity.

The US 1 Northbound Bridge over the Northwest Branch of the Anacostia River is not National Register-eligible under Criterion B, as it is not associated with an individual significant at the local, state, or national level.

The US 1 Northbound Bridge over the Northwest Branch of the Anacostia River is eligible for listing in the National Register under Criterion C at the state level with a period of significance from 1956 to 1957. Part of the first small group of prestressed concrete bridges erected in Maryland in the mid 1950s, it is significant in the history of bridge engineering and its use of prestressed concrete exemplifies an innovative technological solution.

National Register-eligibility under Criterion D was not investigated as part of this study.



Bridge #: 1605402

Bridge Name: US 301 Southbound Bridge over the Western Branch of the Patuxent River (MIHP# PG:82A-52)

County: Prince George's

Date of Construction: 1949; 1986

Bridge Type: Steel Beam

NRHP Eligibility/ Criterion: Criterion A

Summary Description:

Bridge No. 1605402, a steel beam bridge built in 1949, carries US 301 southbound over the Western Branch of the Patuxent River. The bridge runs northeast-southwest and carries two lanes of vehicular traffic. The bridge is approximately 136 feet long and 45 feet wide. The substructure is composed of two concrete piers. Each pier is scored with three recessed fillets and both ends of each pier come to a point to minimize erosion from the river. The piers support seven I-beams that run the length of the bridge and support a concrete deck. In 1986, a rehabilitation and replacement of the decks of this bridge and the northbound bridge (Bridge No. 1605401) was performed. At that time, the deck of the bridge was replaced and resurfaced and the parapets of the bridge were replaced. According to original drawings, the bridge once had a metal railing that terminated into curved concrete end posts. The current parapet is composed entirely of concrete with the west parapet possessing a two-bar metal rail at the top. A modern metal guardrail is present at both approaches to the bridge and it terminates into the concrete parapet. The dates "1949-1986" are inscribed in the concrete parapet at the northwest corner of the bridge.

Statement of Significance:

The US 301 Southbound Bridge over the Western Branch of the Patuxent River (MIHP # PG: 82A-52; Bridge 1605402) was erected in 1949 on US 301 southeast of the community of Upper Marlboro, Prince George's County. US 301 was created between 1922 and 1928. The bridge was built at the beginning of the second principal period of construction of the route, which extended from the late 1940s through the mid 1950s. In 1986 the bridge's railings and deck were replaced as part of a third period of improvements to the highway.

National Register of Historic Places Eligibility:

The US 301 Southbound Bridge over the Western Branch of the Patuxent River is eligible for listing in the National Register under Criterion A at the local level with a period of significance of 1949. The bridge is eligible under Criterion A for its association with a significant mid twentieth-century trend in Maryland's history, the modernization by the State Roads Commission of the state's highway system including the expansion of existing routes. The dualization of US 301 led to the construction of this bridge to carry the southbound lanes of traffic for the improved roadway. The dualization of this route led to improved transportation and access to communities along the Delmarva Peninsula and the Western Shore of Maryland. The bridge has not been altered beyond the standard actions necessary to maintain a busy highway bridge and retains all seven aspects of integrity.

The US 301 Southbound Bridge over the Western Branch of the Patuxent River is not National Register-eligible under Criterion B, as it is not associated with an individual significant at the local, state, or national level.

The US 301 Southbound Bridge over the Western Branch of the Patuxent River is not National Register-eligible under Criterion C. The bridge is not a rare or significant example of its type, design, or construction on the local, state, or national level, nor was it designed by a significant engineer, bridge company, or contractor.

National Register-eligibility under Criterion D was not investigated as part of this study.

Bridge #: 1605701

Bridge Name: US 301 Northbound Bridge over Timothy Branch (MIHP# PG:85A-58)

County: Prince George’s

Date of Construction: 1928; 1950; 1992

Bridge Type: Concrete Arch

NRHP Eligibility/ Criterion: Not Eligible

Summary Description:

Bridge No. 1605701 is a small, closed spandrel concrete arch/prestressed concrete beam bridge, built in 1928 and widened in 1950 and 1992. The bridge carries US 301 Northbound over the Timothy Branch of Mattawoman Creek, north of Cedarville-McKendree Road in the town of Mattawoman. The bridge runs north-south and carries two lanes of vehicular traffic. The bridge is approximately 35 feet long and 48 feet wide. The structure is composed of a closed spandrel concrete arch with prestressed concrete beams on the east to widen the structure. The closed spandrel arch dates to 1928. The arch was extended in 1950, and the prestressed concrete beams date to 1992, as the structure was widened twice. The bridge has a concrete parapet; the east parapet appears to be newer than the west one. A modern guardrail lines the approaches to the bridge. The dates "1928-91" are inscribed in the concrete parapet on the southeast corner of the bridge.

Statement of Significance:

The US 301 Northbound Bridge over Timothy Branch (MIHP # PG: 85A-58, Bridge 1605701) was erected in 1928 on US 301, across the Timothy Branch of the Mattawoman Creek, north of the community of Mattawoman, which is located in Charles County. The bridge was built as part of the development of US 301 in Maryland, which was designed to address the rapid growth in population and automobile ownership on the Western Shore in the late 1910s and 1920s. This bridge was erected in 1928 as a concrete-arch structure during the first period of construction of US 301. In 1949-1950, at the beginning of the route’s second principal period of construction, the bridge was widened as a part of the dualization of the roadway. In 1992, the bridge was altered a second time when it was widened through the use of prestressed concrete beams.

National Register of Historic Places Eligibility:

The US 301 Northbound Bridge over Timothy Branch is not eligible for listing in the National Register under Criterion A. While the bridge is associated with post-World War II roadway improvements to US 301, it does not retain sufficient integrity to convey its period of significance. The bridge has lost its integrity of design, materials, workmanship, and feeling due to two distinct alterations. The bridge’s 1928 appearance has been obscured by its 1950 widening and both its 1928 and 1950 appearance were obscured by a 1992 widening which included the addition of prestressed concrete beams and a prestressed concrete fascia beam to support the increased loads. Principal character-defining features of the bridge’s superstructure and substructure including the arch ribs, spandrel wall, and parapet, have lost their integrity through these alterations, which have significantly altered the bridge’s appearance and compromised its ability to convey its period of significance.

The US 301 Northbound Bridge over Timothy Branch is not National Register-eligible under Criterion B, as it is not associated with an individual significant at the local, state, or national level.

The US 301 Northbound Bridge over Timothy Branch is not National Register-eligible under Criterion C. While the bridge is one of only two examples of concrete arch bridge construction in Maryland from 1948-1960, it does not retain sufficient integrity to convey its period of significance. The bridge has lost its integrity of design, materials, workmanship, and feeling due to two distinct alterations. The bridge’s 1928 appearance has been obscured by its 1950 widening and both its 1928 and 1950 appearance were obscured by a 1992 widening which included the addition of prestressed concrete beams and a prestressed concrete fascia beam to support the increased loads. Principal character-defining features of the bridge’s superstructure and substructure including the arch ribs, spandrel wall, and parapet, have lost their integrity through these alterations, which have significantly altered the bridge’s appearance and compromised its ability to convey its period of significance.

National Register-eligibility under Criterion D was not investigated as part of this study.

Bridge #: 1605702

Bridge Name: US 301 Southbound Bridge over Timothy Branch (MIHP# PG:85A-59)

County: Prince George's

Date of Construction: 1950; 1989

Bridge Type: Concrete Arch

NRHP Eligibility/ Criterion: Not Eligible

Summary Description:

Bridge No. 1605702 is a small, closed spandrel concrete arch/prestressed concrete beam bridge, built in 1950 and widened in 1989. The bridge carries US 301 Southbound over the Timothy Branch of Mattawoman Creek, north of Cedarville-McKendree Road in the town of Mattawoman. The bridge runs north-south and carries two lanes of vehicular traffic. The bridge is approximately 35 feet long and 48 feet wide. The structure is composed of a closed spandrel concrete arch with prestressed concrete beams on the west to widen the structure. The closed spandrel arch dates to 1950, and the prestressed concrete beams date to 1989, as the structure was widened. The bridge has a concrete parapet; the west parapet appears to be newer than the east one. A modern guardrail lines the approaches to the bridge.

Statement of Significance:

The US 301 Southbound Bridge over Timothy Branch (MIHP # PG: 85A-59, Bridge 1605702) was erected in 1949-1950 on US 301, across the Timothy Branch of the Patuxent River, north of the community of Mattawoman, which is located in Charles County. The bridge was built as part of the dualization of US 301 in Maryland, which was designed to address the rapid growth in population. In 1989, the bridge was altered when it was widened through the use of prestressed concrete beams.

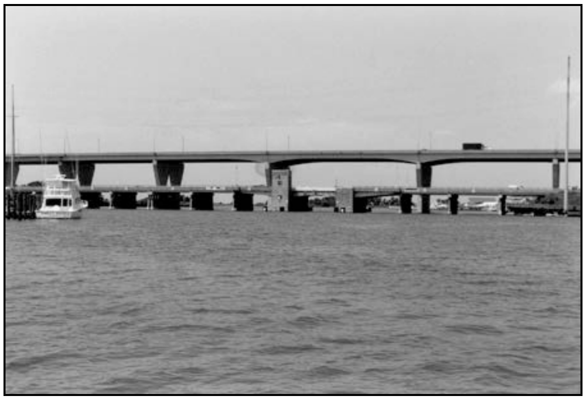
National Register of Historic Places Eligibility:

The US 301 Southbound Bridge over Timothy Branch is not eligible for listing in the National Register under Criterion A. While the bridge is associated with post-World War II roadway improvements to US 301 and the dualization of this roadway, it does not retain sufficient integrity to convey its period of significance. The bridge has lost its integrity of design, materials, workmanship, and feeling due to the 1989 alterations. The bridge's original appearance has been obscured by the 1989 widening which included the addition of prestressed concrete beams and a prestressed concrete fascia beam to support the increased loads. Principal character-defining features of the bridge's superstructure and substructure including the arch ribs, spandrel wall, and parapet, have lost their integrity through these alterations, which have significantly altered the bridge's appearance and compromised its ability to convey its period of significance.

The US 301 Southbound Bridge over Timothy Branch is not National Register-eligible under Criterion B, as it is not associated with an individual significant at the local, state, or national level.

The US 301 Southbound Bridge over Timothy Branch is not National Register-eligible under Criterion C. While the bridge is one of only two examples of concrete arch bridge construction in Maryland from 1948-1960, it does not retain sufficient integrity to convey its period of significance. The bridge has lost its integrity of design, materials, workmanship, and feeling due to the 1989 alterations. The bridge's original appearance has been obscured by the 1989 widening which included the addition of prestressed concrete beams and a prestressed concrete fascia beam to support the increased loads. Principal character-defining features of the bridge's superstructure and substructure including the arch ribs, spandrel wall, and parapet, have lost their integrity through these alterations, which have significantly altered the bridge's appearance and compromised its ability to convey its period of significance.

National Register-eligibility under Criterion D was not investigated as part of this study.



Bridge #:1700600

Bridge Name: MD 18B Bridge over Kent Island Narrows (MIHP# QA-542)

County: Queen Anne's

Date of Construction: 1951

Bridge Type: Double Leaf Bascule Trunnion

NRHP Eligibility/ Criterion: Criterion A and Criterion C

Summary Description:

Bridge No. 1700600 (MIHP # QA-542) is a 12-span steel beam and bascule bridge, built in 1952, that carries MD 18B over Kent Narrows. The bridge runs northwest-southeast, connecting Stevensville to Queenstown, and carries two lanes of vehicular traffic, one in each direction. A two-bar guard rail is located atop the concrete sidewalks. An original three-bar metal railing is located on the bascule span. The bridge is composed of 12 spans and is approximately 663 feet long. The overall width of the superstructure is almost 68 feet. The superstructure is composed of nine approach spans, two flanking spans, and one bascule span. The approach spans are steel stringers with a composite concrete deck. The flanking spans are composed of riveted plate girders and floorbeams and rolled steel stringers with a concrete deck. The bascule span is a double leaf trunnion with an open steel grate deck. The substructure consists of concrete abutments, nine concrete pile bents, and two bascule piers. A control house is located on the south end of the west bascule pier and appears to be unaltered from its original construction

Statement of Significance:

The Kent Narrows Bridge (MIHP # QA-542, Bridge 1700600) carries MD 18B (formerly part of US 50/301) over Kent Narrows and connects Kent Island with the mainland portion of Queen Anne's County. The Kent Narrows Bridge was built in 1951 as part of the state's massive road building campaign on the Western and Eastern Shores of Maryland carried out in the late 1940s and early 1950s leading up to the completion of the Chesapeake Bay Bridge in 1952. This road building campaign involved the widening and dualization of US 50 and US 301 and the replacement of obsolete and/or inadequate bridges along these routes. On Kent Island, US 50/301 absorbed a portion of existing MD 18 and the Kent Narrows Bridge was built in 1951 to replace an overhead bascule bridge at this location. In 1990 this bridge was replaced by a high level bridge over Kent Narrows and the 1951 bridge reverted to use as a bridge for local traffic only.

National Register of Historic Places Eligibility:

The Kent Narrows Bridge (Bridge 1700600) is eligible under Criterion A on the state level with the period of significance being 1951-1990. The bridge is associated with the road building campaign conducted by the State Roads Commission in connection with the building of the Chesapeake Bay Bridge. As part of this campaign, US 50 and 301 were widened and dualized. On the Eastern Shore, a new US 50/301 was constructed to replace MD 18 and 404 as the main cross-peninsula highways. Because of this, a new and wider bascule bridge was needed to replace the two-lane bascule bridge over Kent Narrows. This bridge was replaced by a new high-level bridge over Kent Narrows in 1990. The bridge was an integral part of this route between 1951 and 1990.

The Kent Narrows Bridge (Bridge 1700600) is not associated with an individual significant on the local, state, or national level and is not eligible under Criterion B.

The Kent Narrows Bridge (Bridge 1700600) is eligible under Criterion C on the state level with the period of significance as 1951. The Kent Narrows Bridge is a rare example of a trunnion double leaf bascule bridge in Maryland, one of only three such bridges built in the 1948-1960 period in the state and one of only eight of this type built in the state. It is one of two movable bridges in Maryland designed by the New York engineering firm of Hardesty & Hanover. The firm historically has been a national leader in the development of movable bridge technology.

The Kent Narrows Bridge was not evaluated under Criterion D as a part of this study.

Bridge #: 1900401

Bridge Name: US 13 Northbound Bridge over CSX Railroad Tracks (MIHP# S-512)

County: Somerset

Date of Construction: 1957

Bridge Type: Steel Beam

NRHP Eligibility/ Criterion: Criterion A and Criterion C

Summary Description:

Bridge No. 1900401, built in 1957, carries US 13 Northbound over the CSX Railroad tracks in Somerset County. The bridge runs east-west and carries two lanes of vehicular traffic. The bridge spans the CSX (originally Pennsylvania, then Norfolk and Southern, and then Conrail) Railroad tracks with a vertical clearance of approximately 24 feet. The bridge is approximately 215 feet in length and almost 35 feet wide. Patterned steel joint plates are located at each end of the bridge deck. It appears that the deck has been surfaced with blacktop within the past ten years. The substructure of the bridge is composed of two Monotube pile bents, each of which consists of 13 painted, concrete-filled fluted steel columns on concrete crash walls. Seven steel beams that run the length of the structure support the concrete deck. Shorter cross beams are staggered across the width of the structure. Concrete panel abutments are located at each end of the bridge. The bridge retains its original parapets.

Statement of Significance:

The US 13 Northbound Bridge (MIHP # S-512, Bridge 1900401) was erected in 1956-1957 over the Pennsylvania Railroad tracks, currently owned by CSX, just west of the Pocomoke River and downtown Pocomoke City in Somerset County. Built as part of the development of US 13 on Maryland's Eastern Shore, the highway was widened and, in places, rerouted in order to address rapidly increasing traffic demands in the 1950s. Additionally, the bridge was erected as part of the State Roads Commission's efforts to eliminate dangerous at-grade railroad crossings. The bridge is a steel girder structure, as were most of the other bridges built by the state as part of its at-grade elimination program. It has undergone no notable alterations since its construction and retains its integrity.

National Register of Historic Places Eligibility:

The US 13 Northbound Bridge over the CSX Railroad tracks is recommended eligible for National Register of Historic Places listing under National Register Criteria A and C. It has not been altered beyond the standard actions necessary to maintain a busy highway bridge and retains all seven National Register elements of integrity. The bridge is eligible under Criterion A for its association with two significant mid-twentieth-century trends in Maryland's history—the modernization by the State Roads Commission of the principal roads on the Eastern Shore of Maryland in response to heavy post-World War II-era traffic demands and the state's program of eliminating dangerous at-grade railroad crossings during the period. The bridge's eligibility under this Criterion is local with a period of significance of 1957.

The US 13 Northbound Bridge over the CSX Railroad tracks is not National Register-eligible under Criterion B, as it is not associated with an individual significant on the local, state, or national level.

This bridge is eligible under Criterion C at the local level, with a period of significance of 1957. It retains sufficient integrity to represent a common bridge type—the steel girder—that is supported by fluted Monotube pile bents. The principal character-defining elements of its superstructure (rolled I-beams) and of its substructure (abutments and concrete piers) are intact.

National Register-eligibility under Criterion D was not investigated as part of this study.

Bridge #: 1901201

Bridge Name: US 13 Northbound Bridge over the Manokin River (MIHP# S-513)

County: Somerset

Date of Construction: 1958; 1980

Bridge Type: Steel Beam

NRHP Eligibility/ Criterion: Not Eligible

Summary Description:

Bridge No. 1901201 is a steel beam bridge, constructed in 1958, that carries US 13 Northbound over the Manokin River in Somerset County. The bridge runs northwest-southeast and carries two lanes of vehicular traffic. The bridge is approximately 43 feet wide and has two 40-foot spans. The substructure of the bridge is composed of one large, centrally located pier. The pier is a Monotube pile bent consisting of 11 concrete-filled steel, fluted columns atop a concrete base. Eleven steel beams run the length of the bridge to support the concrete deck. The lower portions of the abutments at each end of the structure appear to be composed of older concrete. The upper portion of each abutment is composed of new concrete. According to a 2001 inspection report, the superstructure of the bridge was built in 1980. The bridge's concrete deck appears to date to this era. Metal joint plates are located at each end of the bridge. The parapet appears to date to 1980. The parapet is composed of a concrete base topped by a modern two-bar metal rail. The dates "1958" and "1980" are inscribed in the concrete parapet at the southeast corner of the bridge.

Statement of Significance:

The US 13 Northbound Bridge over the Manokin River (MIHP # S-513, Bridge 1901201) was erected in 1958 over the Manokin River at what is now the northern edge of Princess Anne in Somerset County. Built as part of the development of US 13 on Maryland’s Eastern Shore, the highway was dualized and, in places, rerouted in order to address rapidly increasing traffic demands in the 1950s. The rerouting included the construction of a bypass around Princess

Anne that included this bridge. The bridge is a steel girder structure, as were most of the other bridges built by the state during the decade. In 1980 its superstructure, as well as its deck and parapets were replaced.

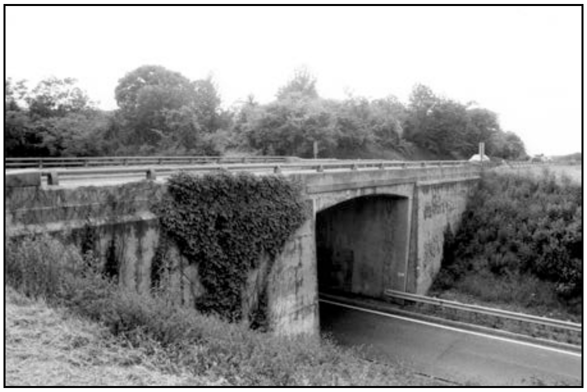
National Register of Historic Places Eligibility:

The US 13 Northbound Bridge over the Manokin River is not eligible for listing in the National Register under Criterion A. While the bridge is associated with post-World War II roadway improvements to US 13, the principal north-south route on the Delmarva Peninsula and the post-World War II dualization of this roadway, it does not retain sufficient integrity to convey its period of significance. The bridge has lost its integrity of design, materials, workmanship, and feeling due to the 1980 alterations which included the construction of a new steel superstructure and the replacement of the upper portions of the concrete abutments. At this time, the bridge deck and railing were replaced with designs that met the 1980 state highway standards. These alterations have significantly altered the bridge's appearance and compromised its ability to convey its period of significance.

The US 13 Northbound Bridge over the Manokin River is not National Register-eligible under Criterion B, as it is not associated with an individual significant on the local, state, or national level.

The US 13 Northbound Bridge over the Manokin River is not National Register-eligible under Criterion C. The bridge is not a rare or significant example of its type, design, or construction on the local, state, or national level, nor was it designed by a significant engineer, bridge company, or contractor. Additionally, the bridge has lost its integrity of design, materials, workmanship, and feeling due to the 1980 alterations which included the construction of a new steel superstructure and the replacement of the upper portions of the concrete abutments. These alterations have significantly altered the bridge's appearance and compromised its ability to convey its period of significance.

National Register-eligibility under Criterion D was not investigated as part of this study.



Bridge #: 2106103

Bridge Name: I 70 Bridge over Ramp E2 from Maryland 615 Eastbound Lanes (MIHP# WA-VI-56)

County: Washington

Date of Construction: 1960

Bridge Type: Concrete Rigid Frame

NRHP Eligibility/ Criterion: Criterion A and Criterion C

Summary Description:

Bridge No. 2106103 consists of a concrete overpass that carries two eastbound traffic lanes and one emergency lane of I 70 over Hollow Road. A nearly identical overpass (Bridge 2106104) carries the westbound lanes of I 70 over Hollow Road. This overpass consists of two reinforced concrete abutments approximately 40 feet long. The center span is a concrete rigid frame 26 feet wide, with a minimum clearance of 16 feet. The abutments feature a battered inner edge on the arch side, and the arch is slightly recessed, with the battered abutments projecting slightly. A slightly projecting concrete parapet surmounts the abutments and arch. On each side, an aluminum pipe railing arises from the concrete coping. The bridge supports a 40-foot wide road deck that accommodates an asphalt roadway with two traffic lanes and an emergency lane. The largely identical westbound bridge lies approximately fifty feet north of the eastbound span. At the end of the concrete parapet on the southwest corner of the bridge, the construction date "1960" is incised.

Statement of Significance:

The I 70 Bridge over Ramp E2, Eastbound Lanes (MIHP # WA-IV-56, Bridge 2106103) was completed in 1960 at MD 615, east of the community of Hancock, in Washington County. The bridge was built as part of the development of I 70 in Maryland and the adaptation of portions of US 40 into the Interstate System. The I 70 Bridge over Ramp E2, Eastbound Lanes is a concrete rigid frame structure erected to allow high-speed traffic to easily cross above MD 615. This bridge is one of the first two bridges completed in Washington County during the initial phase of construction of I 70 in Maryland.

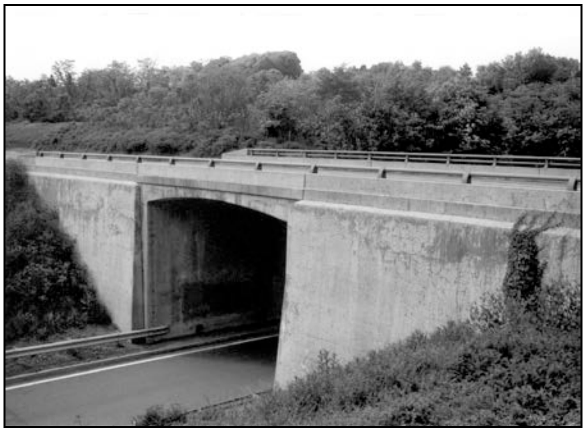
National Register of Historic Places Eligibility:

The I 70 Bridge over Ramp E2, Eastbound Lanes (MIHP # WA-IV-56, Bridge 2106103) is eligible for listing in the National Register under Criterion A on the state level with the period of significance as 1960. The bridge is associated with the historical development of I 70, the first Interstate in Maryland. It is one of the first two bridges completed in Washington County during the initial phase of construction of I 70 in Maryland. Work on the route began in Maryland in 1956 with official construction beginning in 1960. A single-span, concrete rigid frame structure, the bridge was designed specifically for its site by Michael Baker, Jr., Inc., an engineering firm specializing in bridge and highway design, for the Maryland State Road Commission in 1958. The company, which is still in existence, designed several bridges for the Maryland State Roads Commission during this period.

The I 70 Bridge over Ramp E2, Eastbound Lanes is not National Register-eligible under Criterion B, as it is not associated with an individual significant on the local, state, or national level.

The I 70 Bridge over Ramp E2, Eastbound Lanes is National Register-eligible under Criterion C on the local level as a notable example of the concrete rigid frame bridge type, a rare type in Maryland bridge design. The bridge was one of the last two examples of this type designed and constructed in Maryland in the 1948-1960 period. This bridge type was popular in the 1920s and 1930s but was constructed on a limited basis in Maryland into the 1950s and was rarely used after 1960. The I 70 Bridge over Ramp E2, Eastbound Lanes retains all of the character-defining elements of its type intact. Further, it retains its integrity of location, design, association, setting, materials, workmanship, and feeling.

National Register-eligibility under Criterion D was not investigated as part of this study.



Bridge #: 2106104

Bridge Name: I 70 Bridge over Ramp E2 from Maryland 615 Westbound Lanes (MHP# WA-VI-57)

County: Washington

Date of Construction: 1960

Bridge Type: Concrete Rigid Frame

NRHP Eligibility/ Criterion: Criterion A and Criterion C

Summary Description:

Bridge No. 2106104 consists of a concrete overpass that carries two westbound traffic lanes and one emergency lane of I 70 over Hollow Road. A nearly identical overpass (Bridge 2106103) carries the eastbound lanes of I70 over Hollow Road. This overpass consists of two reinforced concrete abutments approximately 45 feet long. The center span is a concrete rigid frame 26 feet wide, with a minimum clearance of 16 feet. The abutments feature a battered inner edge on the arch side, and the arch is slightly recessed, with the battered abutments projecting slightly. A slightly projecting concrete parapet surmounts the abutments and arch. On each side, an aluminum pipe railing arises from the concrete coping. The bridge supports a 40-foot wide road deck that accommodates an asphalt roadway with two traffic lanes and an emergency lane. The largely identical eastbound bridge lies approximately fifty feet south of the westbound span. At the end of the concrete parapet on the northeast corner of the bridge, the construction date "1960" is incised.

Statement of Significance:

The I 70 Bridge over Ramp E2, Westbound Lanes (MIHP # WA-IV-57, Bridge 2106104) was completed in 1960 at MD 615, east of the community of Hancock, in Washington County. The bridge was built as part of the development of I 70 in Maryland and the adaptation of portions of US 40 into the Interstate System. The I 70 Bridge over Ramp E2, Westbound Lanes is a concrete rigid frame structure erected to allow high-speed traffic to easily cross above MD 615. This bridge is one of the first two bridges completed in Washington County during the initial phase of construction of I 70 in Maryland.

National Register of Historic Places Eligibility:

The I 70 Bridge over Ramp E2, Westbound Lanes (MIHP # WA-IV-57, Bridge 2106104) is eligible for listing in the National Register under Criterion A on the state level with the period of significance as 1960. The bridge is associated with the historical development of I 70, the first Interstate in Maryland.It is one of the first two bridges completed in Washington County during the initial phase of construction of I 70 in Maryland. Work on the route began in Maryland in 1956 with official construction beginning in 1960. A single-span, concrete rigid frame structure, the bridge was designed specifically for its site by Michael Baker, Jr., Inc., an engineering firm specializing in bridge and highway design, for the Maryland State Road Commission in 1958. The company, which is still in existence, designed several bridges for the Maryland State Roads Commission during this period.

The I 70 Bridge over Ramp E2, Westbound Lanes is not National Register-eligible under Criterion B, as it is not associated with an individual significant on the local, state, or national level.

The I 70 Bridge over Ramp E2, Westbound Lanes is National Register-eligible under Criterion C on the local level as a notable example of the concrete rigid frame bridge type, a rare type in Maryland bridge design. The bridge was one of the last two examples of this type designed and constructed in Maryland in the 1948-1960 period. This bridge type was popular in the popular in the 1920s and 1930s but was constructed on a limited basis in Maryland into the 1950s and was rarely used after the 1948-1960 period. The I 70 Bridge over Ramp E2, Westbound Lanes retains all of the character-defining elements of its type intact. Further, it retains its integrity of location, design, association, setting, materials, workmanship, and feeling.

National Register-eligibility under Criterion D was not investigated as part of this study.

8.1 SUMMARY AND CONCLUSIONS

Between May and September 2003, URS Corporation (URS) of Gaithersburg, Maryland and Florence, New Jersey prepared an historic context of highway bridges from the 1948-1960 period for the Maryland State Highway Administration (SHA). The project updated and expanded upon the SHA's existing historic bridge context—*Historic Highway Bridges in Maryland: 1631 – 1960, Historic Context Report* (Paula Spero & Associates and Louis Berger & Associates, 1995). As part of the project, URS conducted a survey of 21 highway bridges throughout Maryland representing 12 different bridge types built between 1948 and 1960. The project had multiple goals: to develop more fully the historic context for bridges built in Maryland from the 1948-1960 period to reflect the technological innovations in bridge design and construction from this period; to establish criteria for the evaluation of the significance and integrity of 1948-1960 highway bridges in Maryland for their eligibility for listing in the National Register for Historic Places (NRHP); to document and record 21 highway bridges in Maryland from the 1948-1960 period representing 12 different bridge types; and to apply this criteria in the evaluation of the 21 surveyed highway bridges for their NRHP-eligibility.

URS served as project manager and provided agency coordination. URS also conducted background research on the history of road building in Maryland from the 1948-1960 period, conducted research on the history of the individual surveyed bridges, and wrote the historic context. Hardlines Design Company (Hardlines) of Columbus, Ohio, serving as a subconsultant for URS, conducted the field survey of 21 SHA highway bridges in Maryland. Fieldwork was conducted from May to July 2003. Following the survey work, Hardlines completed Maryland Inventory of Historic Properties (MIHP) forms.

8.2 RECOMMENDATIONS

URS evaluated the surveyed bridges on MIHP Determination of Eligibility (DOE) forms and recommends 17 bridges eligible for the National Register of Historic Places under one or more of the National Register Criteria. The bridges recommended eligible for listing in the National Register are listed in Table 4 below.

Table 4 – Highway Bridges in Maryland from 1948 – 1960 Recommended Eligible for the National Register

MIHP ID #	Bridge Name/Location	County	Bridge Type	Date Built	NRHP Eligible?	NRHP Criterion
B-4632	**I-895 Bridge over CSX Railroad Tracks**	**Baltimore City**	**K-truss**	**1957**	**Yes**	**A, C**
BA-2681	**Wise Avenue Bridge over Bear Creek**	**Baltimore**	**Double Leaf Bascule Trunnion**	**1948**	**Yes**	**A, C**
CARR-1673	**MD 32 Bridge over Liberty Reservoir**	**Carroll**	**Steel Deck (Warren) Truss**	**1952**	**Yes**	**A, C**
CE-1083	**MD 213 Bridge over Chesapeake & Delaware Canal**	**Cecil**	**Metal Deck Arch (Tied Arch)**	**1949**	**Yes**	**A, C**

CH-781	**MD 225 Bridge over Mattawoman Creek**	**Charles**	**Prestressed Concrete Girder**	**1957**	**Yes**	**A, C**
F-3-205	**MD 144 Bridge over Monocacy River**	**Frederick**	**Steel Deck (Warren) Truss**	**1955**	**Yes**	**A, C**
G-III-A-199	**Sang Run Road Bridge over Youghiogheny River**	**Garrett**	**Stringer/Floor Beam System**	**1955**	**Yes**	**A, C**
G-IV-A-290	**Swallow Falls Road Bridge over Youghiogheny River**	**Garrett**	**Stringer/Floor Beam System**	**1960**	**Yes**	**A, C**
HA-2045	**Hookers Mill Road Bridge over Bynum Run**	**Harford**	**Concrete Box Girder**	**1957**	**Yes**	**A,C**
HA-2046	**Phillips Mill Road Bridge over East Branch of Winters Run**	**Harford**	**Concrete Box Girder**	**1958**	**Yes**	**C**
PG:68-100	**US 1 Northbound Bridge over NW Branch of Anacostia River**	**Prince George’s**	**Concrete Beam**	**1956-57**	**Yes**	**A,C**
PG:82A-52	**US 301 Southbound Bridge over West Branch of Patuxent River**	**Prince George’s**	**Steel Beam**	**1949**	**Yes**	**A**
QA-542	**MD18B Bridge over Kent Narrows**	**Queen Anne’s**	**Double Leaf Bascule-Trunnion**	**1951**	**Yes**	**A, C**
S-512	**US 13 Northbound Bridge over Pennsylvania Railroad Tracks**	**Somerset**	**Steel Beam**	**1957**	**Yes**	**A, C**
S-513	**US 13 Northbound Bridge over Manokin River**	**Somerset**	**Steel Beam**	**1958**	**No**	**NA**
WA-VI-56	**I-70 Bridge over Ramp E2 from Maryland 61 Eastbound Lane**	**Washington**	**Concrete Rigid Frame**	**1960**	**Yes**	**A, C**
WA-VI-57	**I-70 Bridge over Ramp E2 from Maryland 61 Westbound Lane**	**Washington**	**Concrete Rigid Frame**	**1960**	**Yes**	**A, C**

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Maryland State Highway Administration- Cultural Resource Library and Bridge Engineering Department, Baltimore - Reports published by or for the State Roads Commission, bridge files
Maryland Transportation Authority- District Offices, photographic and written documentation
New Jersey State Library, Trenton - Engineering News-Record on microfilm
New York Public Library, (Science, Business, and Industry Library), New York - Additional SHA annual reports

Appendix A

1948-1960 Maryland Bridge Statistics

1948-1960 Bridge Statistics:

County	State Bridges	County Bridges	Total
Allegany	10	14	24
Anne Arundel	43	16	59
Baltimore	50	43	93
Baltimore City	0	63	63
Calvert	3	0	3
Caroline	4	10	14
Carroll	11	9	20
Cecil	3	5	8
Charles	2	0	2
Dorchester	0	0	0
Frederick	48	5	53
Garrett	5	14	19
Harford	0	25	25
Howard	7	10	17
Kent	5	0	5
Montgomery	36	15	51
Prince George's	52	18	70
Queen Anne's	10	4	14
Somerset	3	4	7
St. Mary's	4	0	4
Talbot	5	3	8
Washington	21	4	25
Wicomico	6	6	12
Worcester	3	2	5
TOTAL	**331**	**270**	**601**

Appendix B

Maryland Bridges By Type and Year

Maryland Bridges by Type and Year (1948-1960)

TYPE/YEAR	**1948**	**1949**	**1950**	**1951**	**1952**	**1953**	**1954**	**1955**	**1956**	**1957**	**1958**	**1959**	**1960**	**TOTAL**
Timber beam (includes Stringer/Multibeam or Girder)	1	4	8	5	2	1	1	1				1	3	**27**
Timber Slab			1	1									1	**3**
Stone Arch		2	2											**4**
Metal Thru Truss										1				**1**
Metal Deck Truss					1			1						**2**
Movable Swing					1									**1**
Movable Single Leaf Bascule														**0**
Movable Double Leaf Bascule	1			1									1	**3**
Metal Rolled Girder (Girder and Floorbeam System)			1					1	1				1	**4**
Metal Rolled Girder Concrete Encased (includes Stringer/ Multibeam or Girder)	5	18	54	10	15	20	28	56	12	96	49	47	34	**444**
Metal Plate Girder			1	1		3	1	2		1	1		1	**11**
Metal Plate Girder Concrete Encased												1		**1**
Metal Thru Arch	1					1								**2**
Metal Deck Arch		1												**1**
Concrete Arch			2											**2**
Concrete Slab			6	1	3	1	2	1		2	1	6	5	**28**
Concrete Beam (includes Tee Beam)		2	3		1	1		3	1	1	1	1		**14**
Concrete Rigid Frame	1		2	1		1	2	2		1	5	3	2	**20**
Concrete Box Beam or Girder								1	1	2	5	3	6	**18**
TOTAL	**9**	**27**	**80**	**20**	**23**	**28**	**34**	**68**	**15**	**104**	**62**	**62**	**54**	**586**

Appendix C
Resumes of Key Personnel

Appendix D

Notes From August 25, 2003 Interviews With Former J. E. Greiner Company Employees

INTERVIEW 1

Interviewee: S. Murray Miller, Geotechnical Engineer

Location: URS Corporation, Hunt Valley, Maryland

Education: B.A. and M.A. from Johns Hopkins University

Company History: started with Greiner in 1953

Background and General Information

Mr. Murray has had "every conceivable type" of association with bridge construction in his 50+ years at URS/Greiner Corporation. Although he works "mostly with bridge foundations," Mr. Murray also has experience with site selection, geotechnical investigations of sites, foundation reports, working with contractors to accommodate field problems, and supportive excavation for foundation work, including accommodations for working in water, sheeting, and shoring. He also works with contractors during the design process to monitor and correct lateral squeeze, settlement of piles, negative friction of piles, and tension considerations. After a bridge is built, it still requires diligent monitoring due to daily wear and tear, as well as shifts in the soil. For example, approaches can shift and squeeze the movable parts on a bridge.

Maryland 157 Over Bear Creek

Mr. Murray worked on this project with Wilson Ballard, Sr., a former partner and chief engineer with Greiner. Described by Murray as one of the "muckety mucks," Ballard "left to form his own firm, while his son Wilson Ballard, Jr., started, "or cut his teeth" at Greiner. The elder Wilson had his son start out at Greiner rather than his own firm; the younger Wilson eventually took over for his father and "made a bundle of money." Allegedly, father and son designed this bridge.

I-95 Over Baltimore & Ohio Railroad Tracks

A "great project… terrific bridge… a lot of people that like steel bridges think this is really something to see."

S. Murray Miller

For this project, Greiner was the overall consultant to the state of Maryland. Mr. Miller worked on the K-truss design for the bridge. The panels of this bridge have a K configuration because this design offers an "advantageous way to handle stresses." The bridge is very long and the "dumbest looking thing because it spans over a railroad yard that does not exist." The bridge has huge abutments and long spans, although there is very little under the bridge to necessitate long spans. This bridge was very expensive, due to the length of its spans. The longer the bridge span, the deeper a bridge must be to ensure proper support; "a bridge will sag under its own weight." "The depth of girder and truss is a function of span." The deeper the bridge, the more expensive it is to construct. At the time the bridge was built, the railroad did not want to make a decision on the future layout of the tracks, so they were built to accommodate a much larger railroad yard. Mr. Miller did reiterate that the Maryland Transportation Authority suffered in regard to the cost of this project, so history "shouldn't be too hard on them," as it is not their fault that the railroad would not make any concessions.

Wise Avenue Bridge

Although this bridge was built before Miller's time at Greiner, he was involved with one of its rehabilitations efforts. "Like every other bridge, it is outside in the air 24-7/365…and is subject to freeze/thaw, wet/dry, and environmental destruction." This bridge exhibited deterioration of underlying support piles; a rehabilitation of the caps was required due to the deterioration of the concrete in water. In order to repair the piles, a "coffer dam" had to be constructed around them, allowing the engineers to pump water out. This bridge required an "extensive amount of work to repair." Once a bridge is shut down, repairs on the mechanical portions of it are also possible.

Chesapeake City Bridge

"Greiner really wanted to work on this bridge," though they were not awarded the contract.

Liberty Reservoir Bridge

This bridge was actually constructed "in the dry," or before the water from the dam "came up." The dam was built downstream and a big lake was created. The lake flooded several of the state highways; now although those waters have receded, the ground is still "mushy" from their presence. The main bridge over the reservoir was very striking to see before the water from the dam was released, as one could observe the massive piers. As the water flooded, "less and less of the piers" were visible, making the bridge appear very ordinary.

Potomac-Type Piers

Mr. Miller also spoke with us about "Potomac-type piers" that J. E. Greiner was responsible for innovating. The piers, as their name implies, were originally used for bridge construction on the Potomac River. Over time these piers have been modified for use on the Woodrow Wilson Bridge and as far away as San Francisco. J. E. Greiner determined the Potomac piers to be such an asset to the profession that, rather than patenting them, he "gave," or donated, the design to the engineering profession.

INTERVIEW 2

Interviewee: Nick Deros, Bridge Project Manager

Location: URS Hunt Valley, Maryland

Education: B.A. and M.A. from Johns Hopkins University

History with Company: 19 years with URS

Background and General Information

Mr. Deros has completed several bridge inspections, although he has not necessarily done work on them.

Bear Creek (Wise Avenue)

URS was involved with a rehab project here in the mid-1980s. When rehab work is necessary, it means that there are structural deficiencies in the structure. When a bridge is “functionally obsolete,” it is time for bridge replacement. An example of a functionally obsolete bridge is one where the traffic has increased to such a degree that the bridge can no longer meet the demand.

“A lot of factors affect bridge replacement.” The most important of these are usage and location. For example, bridges that are salted down in the winter decay at a faster rate. There is no connection between bridge replacement and changes in technology; i.e. a bridge would not immediately be replaced due to increasing technology.