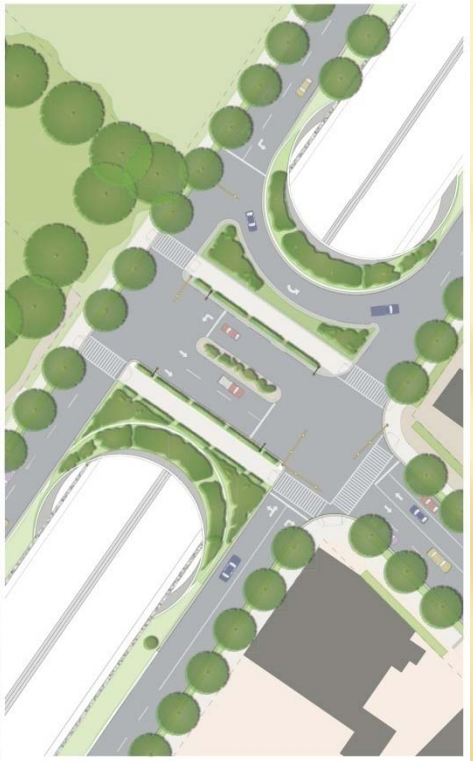
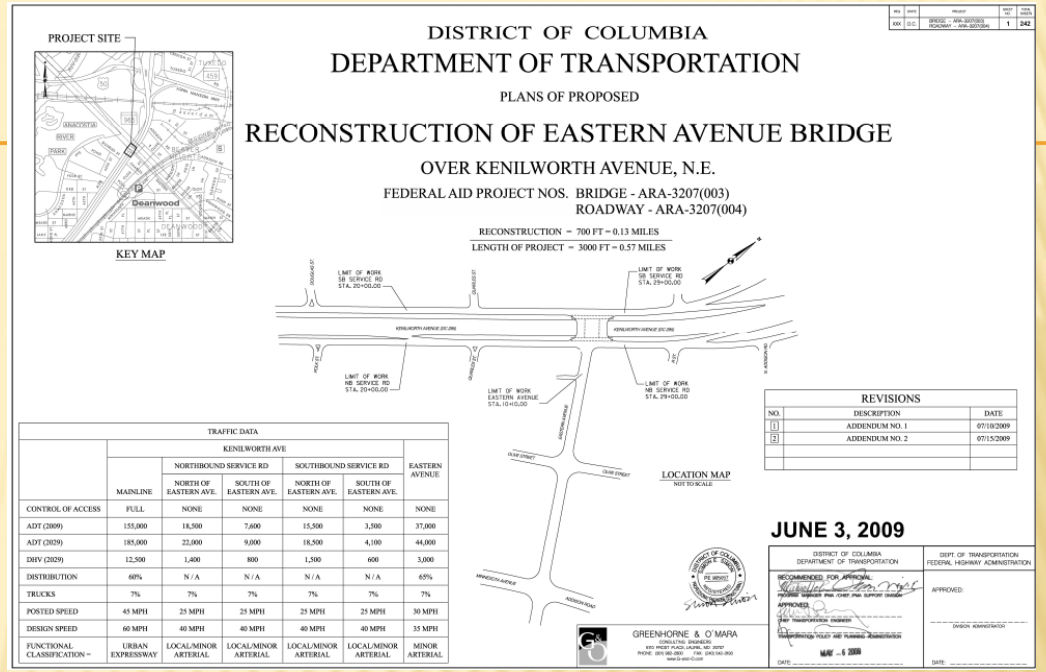


RECONSTRUCTION OF EASTERN AVENUE BRIDGE OVER KENILWORTH AVENUE (I-295), N.E.

Construction Management Practices for Accelerating Project Delivery

DISTRICT DEPARTMENT OF TRANSPORTATION

AGENDA



DISTRICT OF COLUMBIA
DEPARTMENT OF TRANSPORTATION
PLANS OF PROPOSED
RECONSTRUCTION OF EASTERN AVENUE BRIDGE
OVER KENILWORTH AVENUE, N.E.
FEDERAL AID PROJECT NOS. BRIDGE - ARA-3207(003)
ROADWAY - ARA-3207(004)

PROJECT SITE
KEY MAP
RECONSTRUCTION = 700 FT = 0.13 MILES
LENGTH OF PROJECT = 3000 FT = 0.57 MILES
LOCATION MAP
NOT TO SCALE

REVISIONS

NO.	DESCRIPTION	DATE
1	ADDENDUM NO. 1	07/10/2009
2	ADDENDUM NO. 2	07/15/2009

JUNE 3, 2009

TRAFFIC DATA

	KENILWORTH AVE					EASTERN AVENUE
	MAINLINE	NORTHBOUND SERVICE RD		SOUTHBOUND SERVICE RD		
		NORTH OF EASTERN AVE.	SOUTH OF EASTERN AVE.	NORTH OF EASTERN AVE.	SOUTH OF EASTERN AVE.	
CONTROL OF ACCESS	FULL	NONE	NONE	NONE	NONE	NONE
ADT (2009)	155,000	18,500	7,600	15,500	3,500	37,000
ADT (2029)	185,000	22,000	9,000	18,500	4,100	44,000
DHV (2029)	12,500	1,400	800	1,500	600	3,000
DISTRIBUTION	60%	N / A	N / A	N / A	N / A	65%
TRUCKS	7%	7%	7%	7%	7%	7%
POSTED SPEED	45 MPH	25 MPH	25 MPH	25 MPH	25 MPH	30 MPH
DESIGN SPEED	60 MPH	40 MPH	40 MPH	40 MPH	40 MPH	35 MPH
FUNCTIONAL CLASSIFICATION =	URBAN EXPRESSWAY	LOCAL/MINOR ARTERIAL	LOCAL/MINOR ARTERIAL	LOCAL/MINOR ARTERIAL	LOCAL/MINOR ARTERIAL	MINOR ARTERIAL

GREENHORNE & O'MARA

- INTRODUCTION
- EXISTING BRIDGE
- PROJECT OBJECTIVES
- ACCELERATED CONSTRUCTION ALTERNATIVES
- PROPOSED STRUCTURE
- MAINTENANCE OF TRAFFIC
- PROJECT CONSTRUCTION
- DIFFICULTIES ENCOUNTERED / LESSONS LEARNED
- CONCLUSIONS AND RECOMMENDATIONS

d.

Reconstruction of Eastern Avenue Bridge over Kenilworth Avenue, N.E.

PROJECT TEAM

- **District DOT**
  - Maduabuchi Udeh, Program Manager
  - Bruke Siraga, Project Engineer
  - Giles Njumbe, Deputy Program Manager
- **Consultants**
  - Design: Greenhorne & O'Mara
  - CM/CEI: Jacobs Engineering
- **Contractor**
  - Fort Myer Construction Corporation
  - Fort Miller Co. (Prefab Sections)

d.

Reconstruction of Eastern Avenue Bridge over Kenilworth Avenue, N.E.

PROJECT FUNDING

- PROJECT WAS AWARDED FHWA HIGHWAYS FOR LIFE GRANT
- CONSTRUCTION FUNDS WERE PROVIDED UNDER THE AMERICAN RECOVERY AND REINVESTMENT ACT

HIGHWAYS FOR LIFE

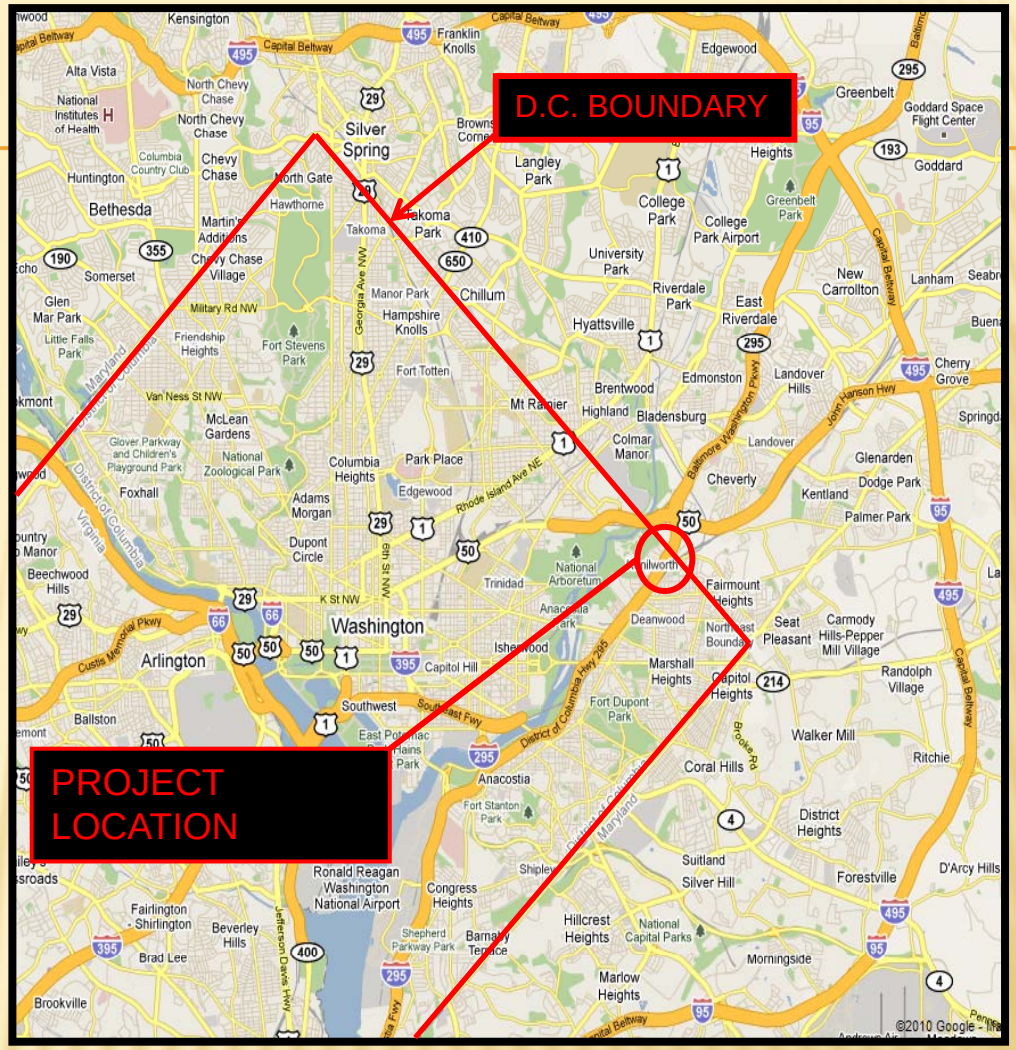
Accelerating Innovation for the American Driving Experience.

RECOVERY.GOV

d.

Reconstruction of Eastern Avenue Bridge over Kenilworth Avenue, N.E.

TRAFFIC DATA		
	KENILWORTH AVENUE	EASTERN AVENUE
ADT (2009)	155,000	37,000
ADTT (2009)	11,000	3,000
ADT (2029)	185,000	44,000
ADTT(2029)	13,000	3,100



LOCATION MAP

d.

Reconstruction of Eastern Avenue Bridge over Kenilworth Avenue, N.E.

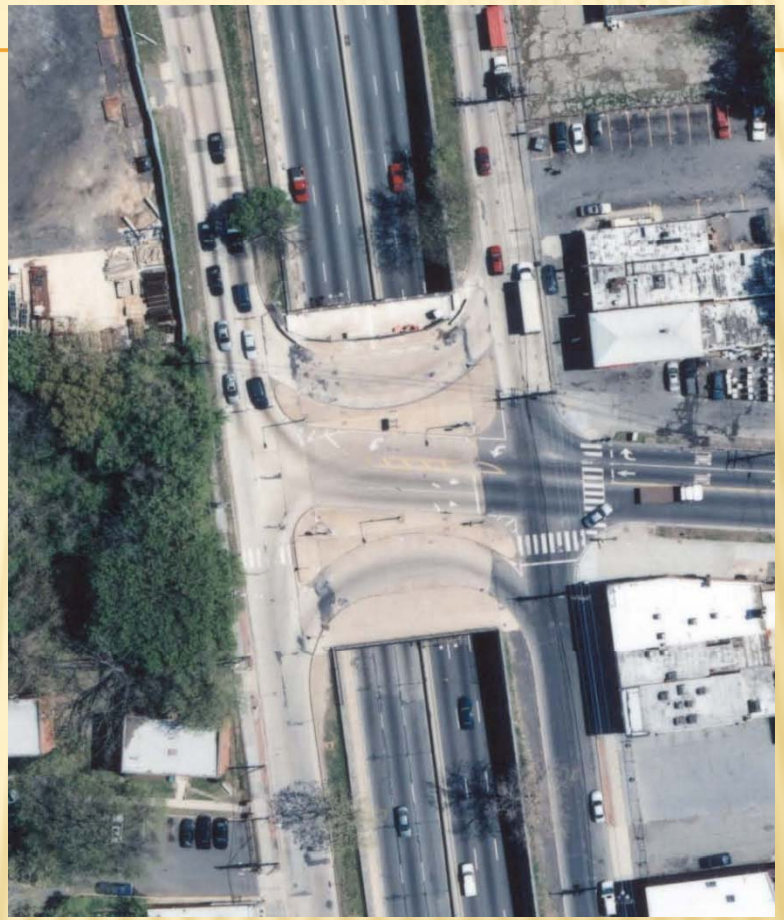
EXISTING BRIDGE

- VITAL VEHICLE AND PEDESTRIAN LINK BETWEEN COMMUNITIES SEPARATED BY KENILWORTH AVENUE
- 84'± SINGLE SPAN, PRESTRESSED CONCRETE GIRDER SUPERSTRUCTURE WITH THREE SECTIONS
- 14'± MINIMUM VERTICAL CLEARANCE DOES NOT MEET AASHTO REQUIREMENT OF 16'
- PRESTRESSED GIRDERS HAVE IMPACT DAMAGE

d.

Reconstruction of Eastern Avenue Bridge over Kenilworth Avenue, N.E.

EXISTING BRIDGE



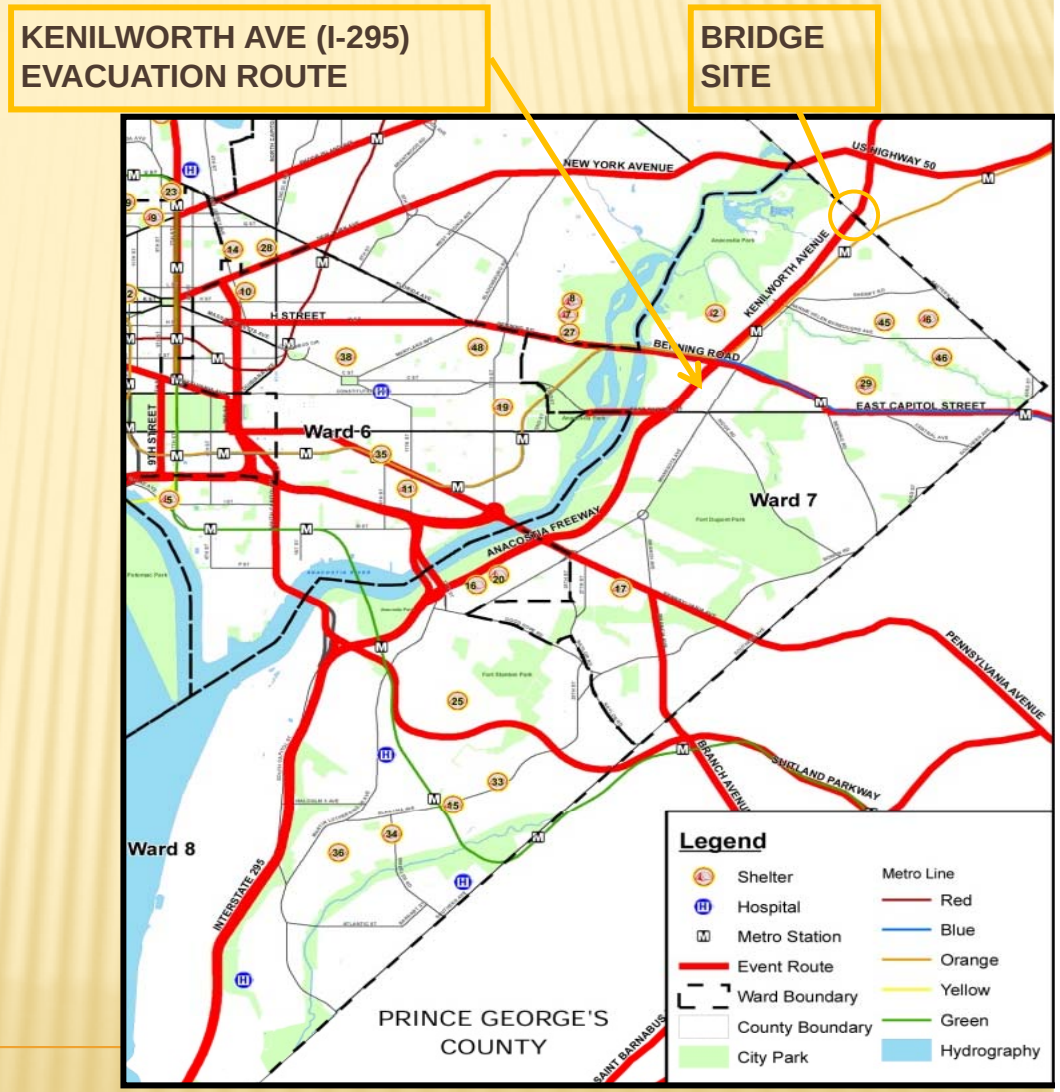
- **174’± BRIDGE WIDTH CARRYING 3 LANES ACROSS AND 2 DEDICATED U-TURN LANES**

d.

Reconstruction of Eastern Avenue Bridge over Kenilworth Avenue, N.E.

PROJECT OBJECTIVES

- PROVIDE MINIMUM 16’-6” VERTICAL CLEARANCE MEETING AASHTO STANDARDS
- IMPROVED SAFETY FOR VEHICLES AND PEDESTRIANS



d.

Reconstruction of Eastern Avenue Bridge over Kenilworth Avenue, N.E.

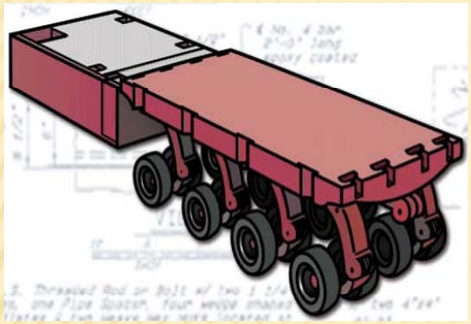
PROJECT OBJECTIVES

- MINIMIZE THE CONSTRUCTION DURATION
  - FEW CROSSINGS FOR VEHICLES AND PEDESTRIANS
- MINIMIZE TRAFFIC IMPACTS ESPECIALLY ALONG KENILWORTH AVENUE (I-295)
  - KENILWORTH AVENUE IS MAJOR NORTH-SOUTH CORRIDOR BETWEEN MARYLAND AND VIRGINIA
  - MAJOR COMMUTER ROUTE INTO WASHINGTON, D.C. FROM NORTH, SOUTH AND EAST
  - KENILWORTH AVENUE IS HOMELAND SECURITY EVACUATION ROUTE FOR WARDS 7 AND 8
- NO SIGNIFICANT CHANGES TO PROFILES OF EXISTING EASTERN AVENUE, ADJACENT SERVICE ROADS, OR KENILWORTH AVENUE

ACCELERATED BRIDGE CONSTRUCTION (ABC) PROJECT DELIVERY

DDOT utilized the innovative ABC engineering and management methodology incorporated into the construction of this bridge project to benefit the public by minimizing closure time and construction impact to the surrounding community. The primary advantage of completing the work utilizing the ABC methodology includes:

- Minimize the construction duration time
- Minimize traffic impacts to Kenilworth Ave (DC 295)
  - Kenilworth Ave is a major north-south commuter corridor between Maryland and Virginia
  - Major commuter route into Washington, DC from north, south, and east
  - Kenilworth Ave is a homeland security evacuation route for the Capitol.
- Less impact to the surrounding community
- Less impact to the environment, and
- Higher standards of quality assurance and quality control achieved through construction of key bridge structure components in a highly control environment away from the project site.



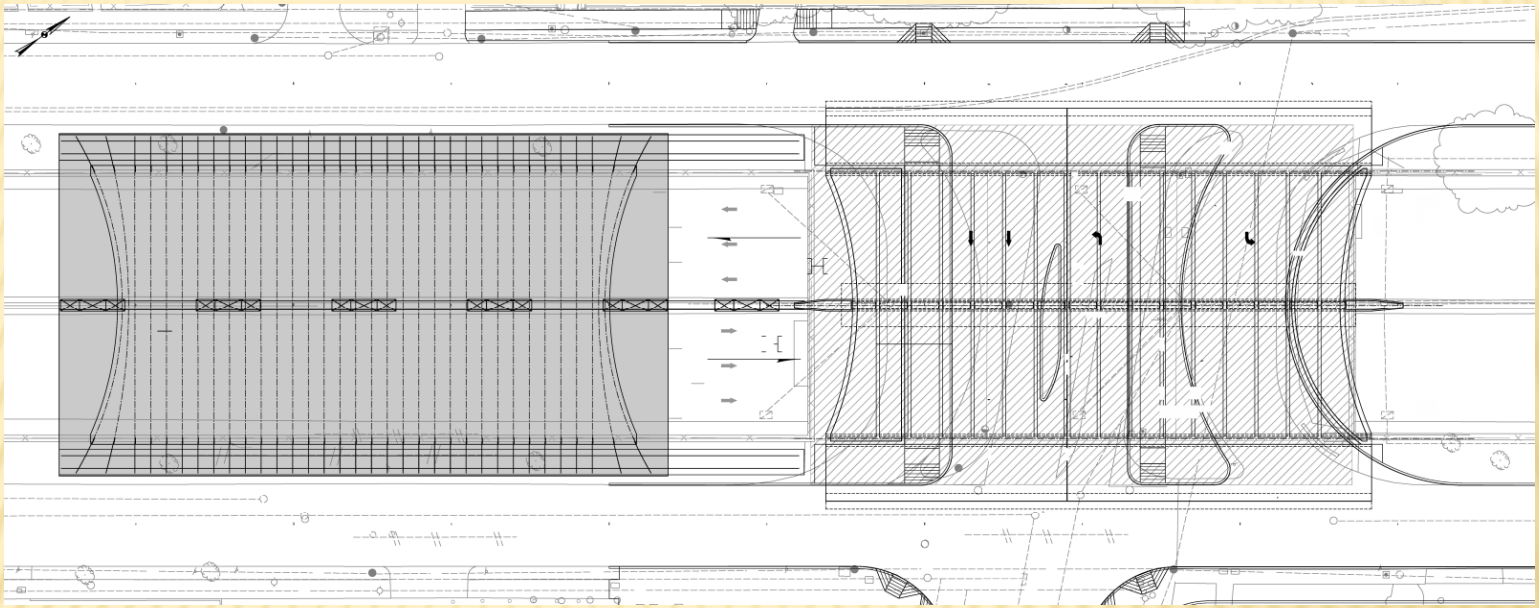
ACCELERATED CONSTRUCTION TECHNIQUES

d.

OFF-SITE CONSTRUCTION WITH SELF-PROPELLED MODULAR TRANSPORTERS (SPMTs)

- **SHORTEST ON-SITE CONSTRUCTION DURATION**
- **LEAST IMPACT TO EASTERN AVENUE AND KENILWORTH AVENUE**
- **NEARBY SITES FOR FURTHER DEMOLITION AND CONSTRUCTION WERE UNAVAILABLE**
  - **CONSOLIDATION OF SEVERAL INDUSTRIAL SITES TO NORTHEAST UNREASONABLE**
  - **USE OF LARGE WOODED AREA OWNED BY WASHINGTON SUBURBAN SANITARY COMMISSION WAS NOT ALLOWED DUE TO POTENTIAL IMPACT TO 66” DIA. SEWER PIPE**

Reconstruction of Eastern Avenue Bridge over Kenilworth Avenue, N.E.



ACCELERATED CONSTRUCTION TECHNIQUES:

- **PROPOSED SUPERSTRUCTURE BUILT ON TEMPORARY STRUCTURE TO SOUTH OF EXISTING BRIDGE**
  - **EASTERN AVENUE BRIDGE REMAINS OPENS – NO DETOUR DURING SUPERSTRUCTURE CONSTRUCTION**
  - **TEMPORARY SUPPORT CONSTRUCTION WOULD SIGNIFICANTLY IMPACT KENILWORTH AVENUE**
  - **MINIMUM CLEARANCE REQUIREMENTS AND KENILWORTH AVENUE PROFILE COMPLICATE SHIFTING PROPOSED STRUCTURE FROM TEMPORARY SUPPORTS TO EXISTING STRUCTURE LOCATION.**

d.

Reconstruction of Eastern Avenue Bridge over Kenilworth Avenue, N.E.

ACCELERATED CONSTRUCTION TECHNIQUES: PREFABRICATED CONSTRUCTION

- PREFABRICATED SUPERSTRUCTURE AND PIER ELEMENTS
  - SUPERSTRUCTURE – CONCRETE DECK ON TWO ROLLED BEAMS
  - PIER – HAMMERHEAD COLUMN SUPPORTING TWO BEAMS
  - MINIMIZES ON-SITE CONSTRUCTION DURATION WITH OFF-SITE FABRICATION
  - PREFABRICATED ELEMENTS CAN BE INSTALLED DURING NONPEAK HOURS TO MINIMIZE TRAFFIC IMPACTS
  - SUCCESSFULLY USED IN SEVERAL STATES INCLUDING VIRGINIA, NEW YORK, VERMONT, TEXAS AND WASHINGTON

d.

Reconstruction of Eastern Avenue Bridge over Kenilworth Avenue, N.E.

MAINTENANCE OF TRAFFIC

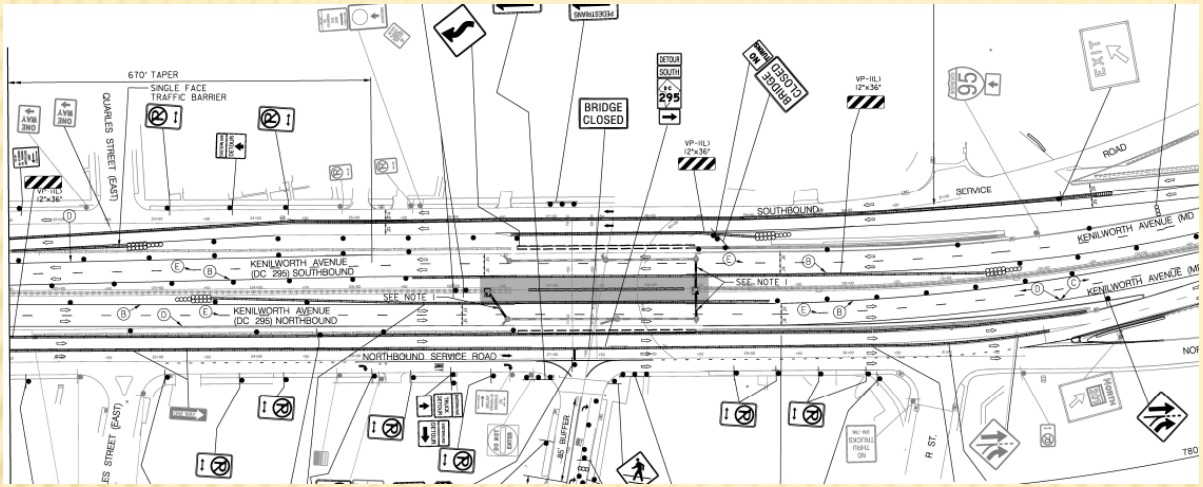
- PROJECT USED PHASED TRAFFIC CONTROL INCORPORATING SERVICE ROADS TO AND FROM KENILWORTH AVENUE, AN INTERCHANGE TO THE NORTH AND AN OFF-RAMP/ON-RAMP TO THE SOUTH.
- TRAFFIC DIVERTED FROM EASTERN AVENUE BRIDGE FOR CLOSURE OF BRIDGE DURING DEMOLITION AND RECONSTRUCTION
- DURING ABUTMENT AND PIER CONSTRUCTION A LANE OF KENILWORTH AVENUE IN EACH DIRECTION WILL BE DIVERTED ONTO SERVICE ROADS
- ALL LANES OF KENILWORTH CAN BE MAINTAINED THROUGHOUT CONSTRUCTION
- CONTRACTOR CAN RECONSTRUCT BRIDGE WITHOUT STAGED CONSTRUCTION SAVING AN ESTIMATED DURATION OF UP TO 4 MONTHS LONGER TO COMPLETION
- SAFER ENVIRNOMENT FOR VEHICLES, PEDESTRIAN AND CONSTRUCTION PERSONNEL

d.

Reconstruction of Eastern Avenue Bridge over Kenilworth Avenue, N.E.

MAINTENANCE OF TRAFFIC

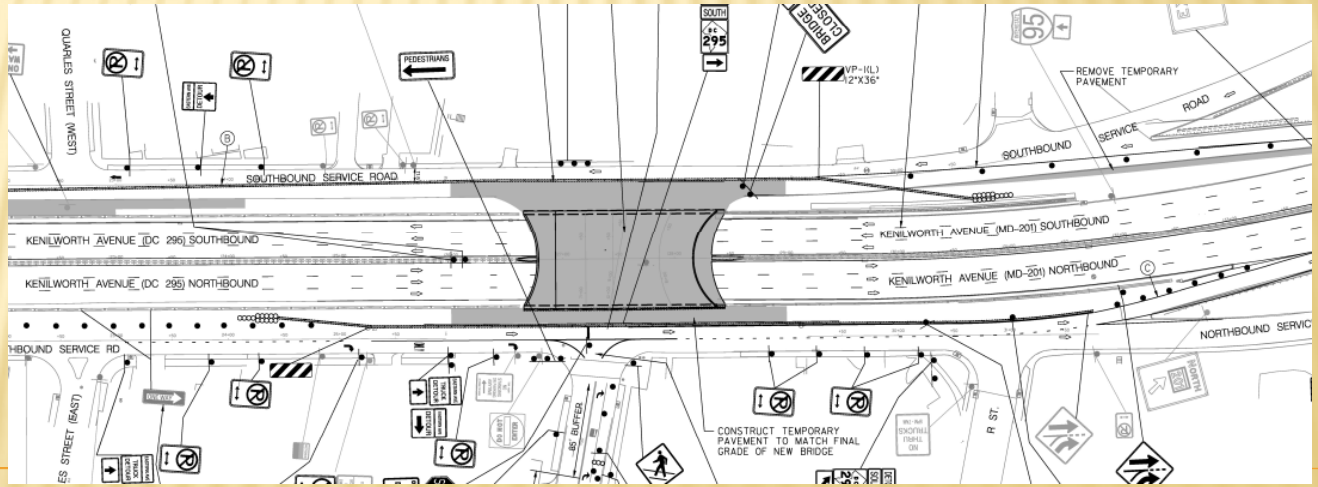
KENILWORTH AVENUE DIVERSION FOR PIER CONSTRUCTION



- LANE OF KENILWORTH AVENUE IN EACH DIRECTION DIVERTED ONTO SERVICE ROADS

EASTERN AVENUE DIVERSION FOR SUPERSTRUCTURE CONSTRUCTION

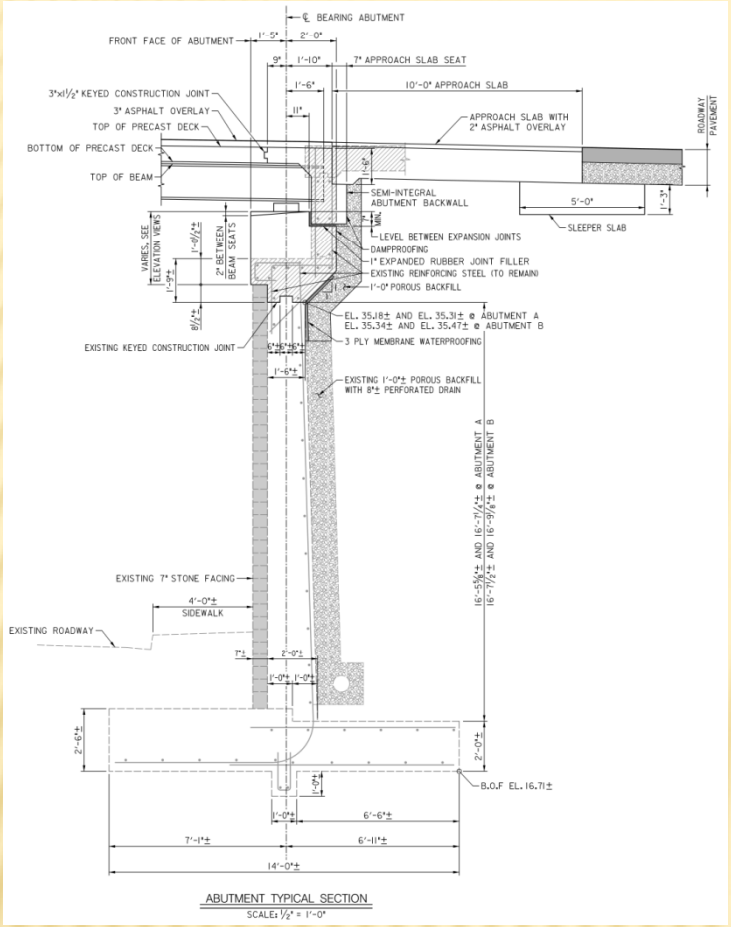
- SERVICE ROADS DETOURED TO NORTH AND SOUTH TO ELIMINATE STAGED CONSTRUCTION

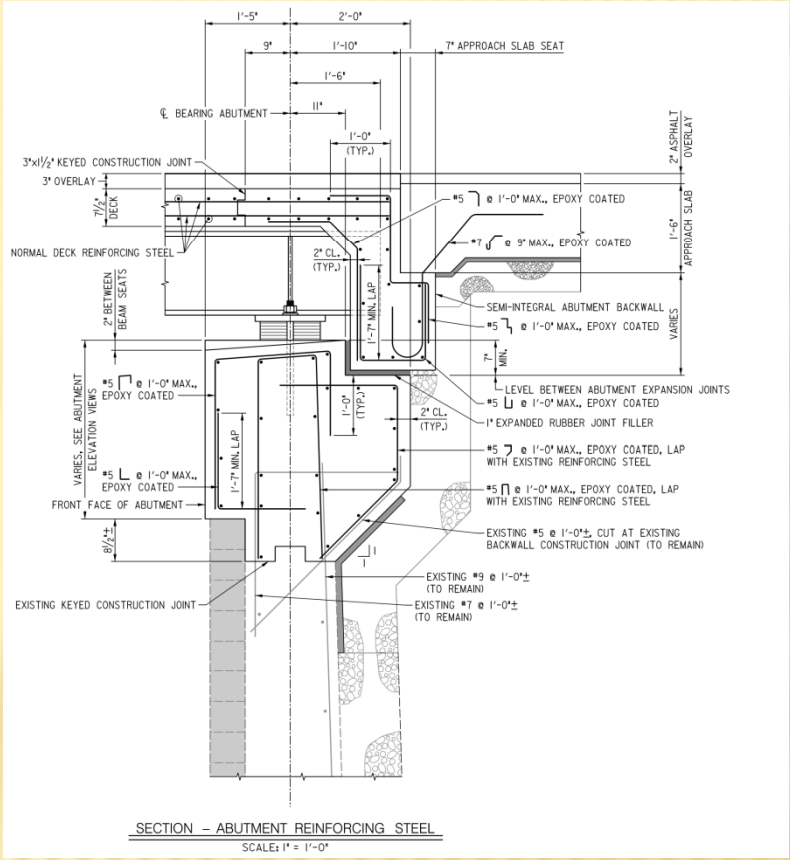


d.

Reconstruction of Eastern Avenue Bridge over Kenilworth Avenue, N.E.

PROJECT CONSTRUCTION: ABUTMENTS





- **THE EXISTING ABUTMENTS ARE PARTIALLY DEMOLISHED AND RECONSTRUCTED TO SUPPORT THE NEW SUPERSTRUCTURE**

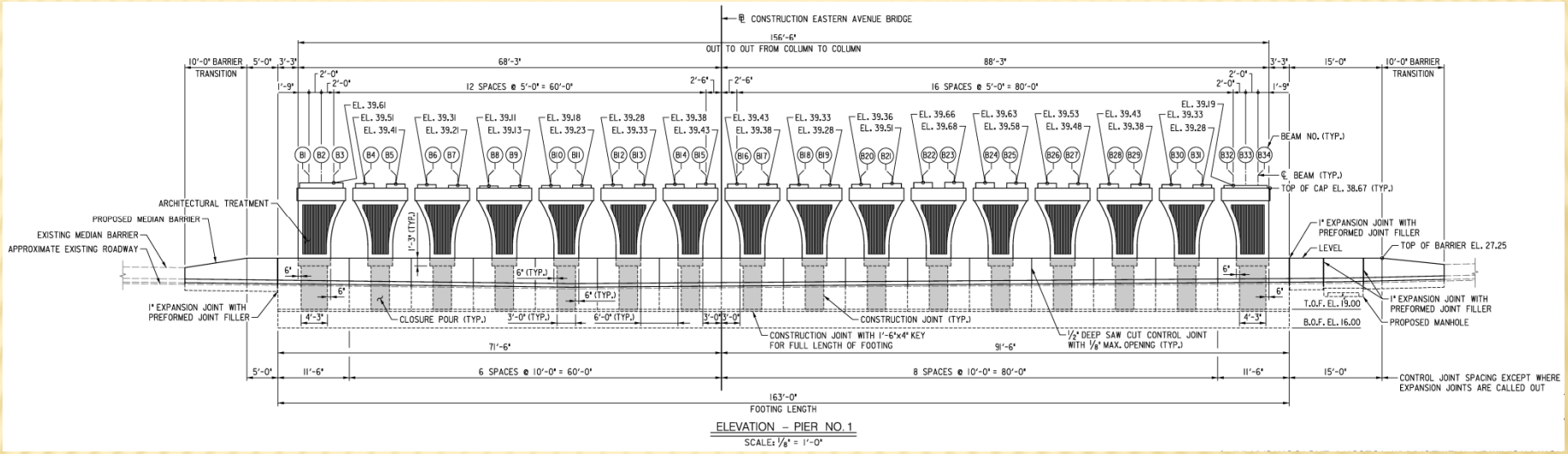
d.

Reconstruction of Eastern Avenue Bridge over Kenilworth Avenue, N.E.

PROJECT CONSTRUCTION: ABUTMENTS

- THE EXISTING ABUTMENT WALL BEAM SEATS WERE REMOVED FROM THE EXISTING STRUCTURE.
- EXISTING ABUTMENT WALL MODIFIED TO ACCOMODIATE NEW SUPERSTRUCTURE.
- CONSTRUCTION COMPLETED IN THIS MANNER SAVED TIME AND COSTS

PROJECT CONSTRUCTION: PREFAB PIER



ELEVATION – PIER NO. 1

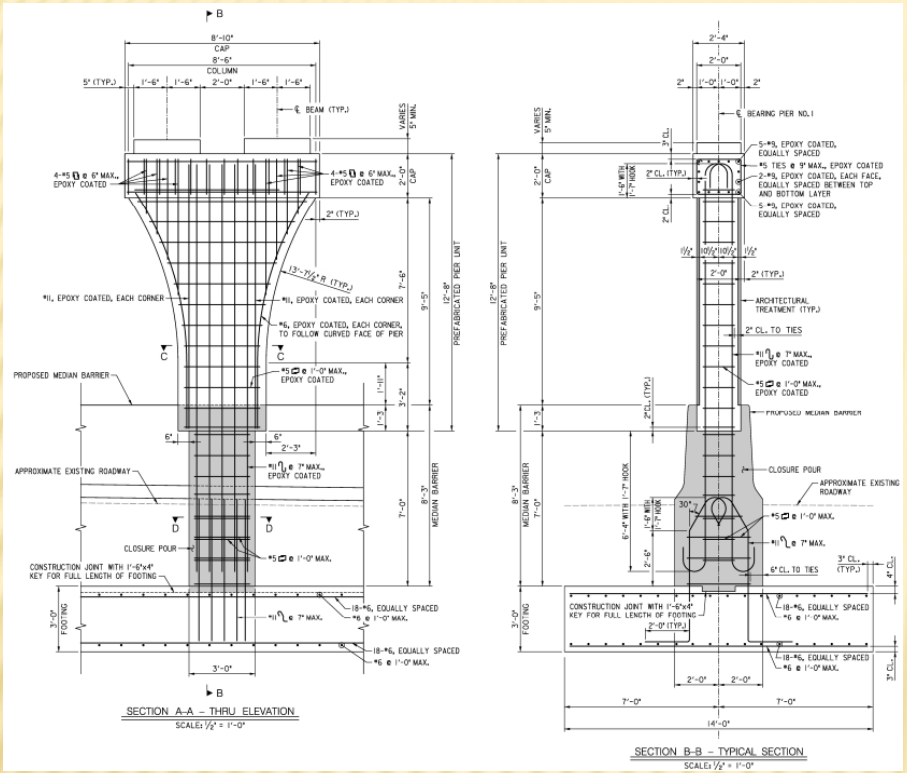
SCALE: ⅛" = 1'-0"

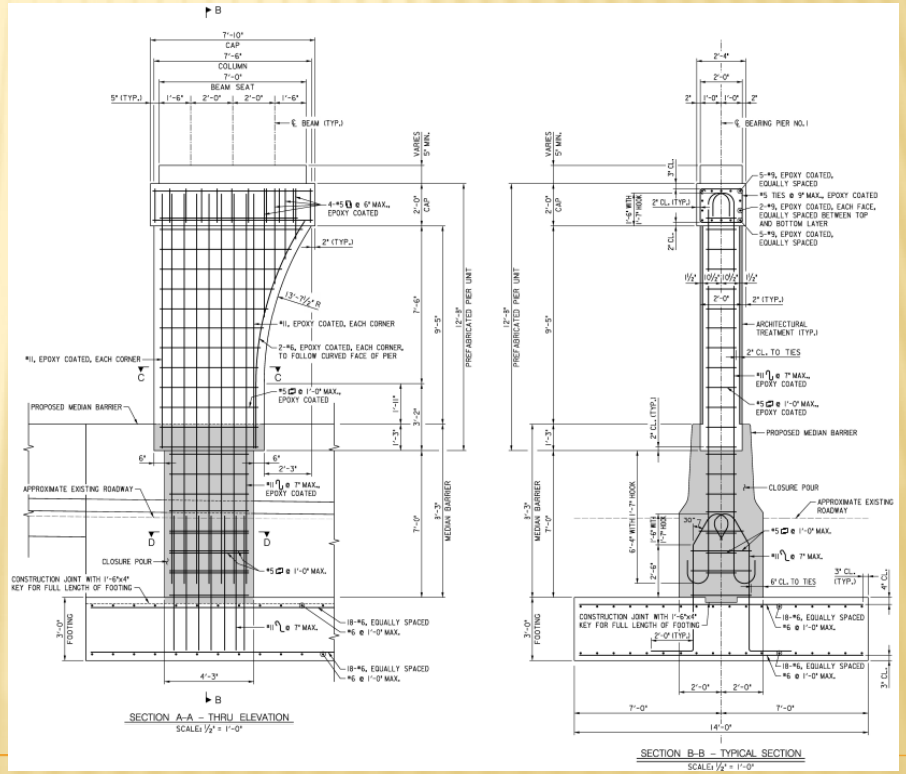
- PIER FOOTING AND MEDIAN BARRIER ARE CAST-IN-PLACE
- 16 PREFABRICATED PIER UNITS MANUFACTURED CONCURRENT TO FIELD CONSTRUCTION SAVING TIME FROM TRADITIONAL FORMWORK, REBAR, AND CAST IN PLACE INSTALLATIONS.
- PREFAB UNITS ARE SET INTO CIP SEATS IN ONLY 4 DAYS TIME
- PREFABRICATED PIER UNITS ARE ALL 12'-8" HIGH FROM BOTTOM TO TOP OF CAP AND THE TOP OF THE MEDIAN BARRIER IS LEVEL
- MECHANICAL COUPLERS WITH CLOSURE POURS WILL TIE PREFABRICATED PIER UNITS TO CAST-IN-PLACE FOUNDATION

d.

Reconstruction of Eastern Avenue Bridge over Kenilworth Avenue, N.E.

PROJECT CONSTRUCTION: PREFAB PIER

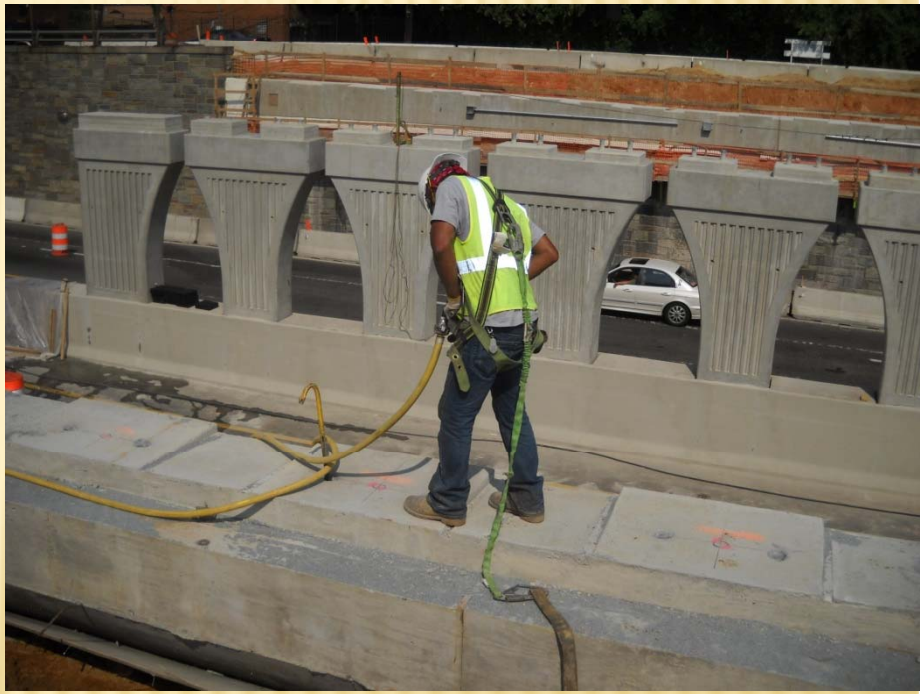




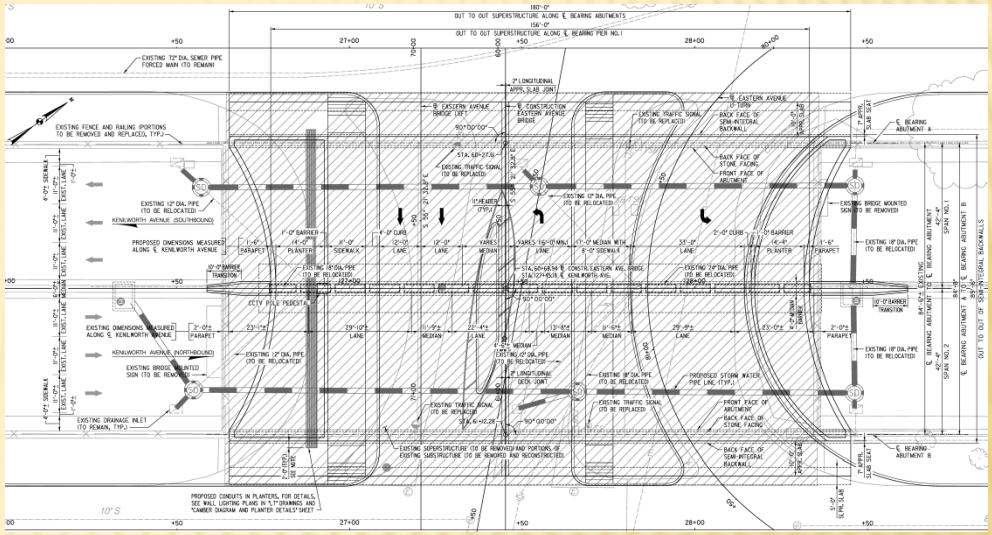
d.

Reconstruction of Eastern Avenue Bridge over Kenilworth Avenue, N.E.

PROJECT CONSTRUCTION: PREFAB PIER



PROJECT CONSTRUCTION: SUPERSTRUCTURE

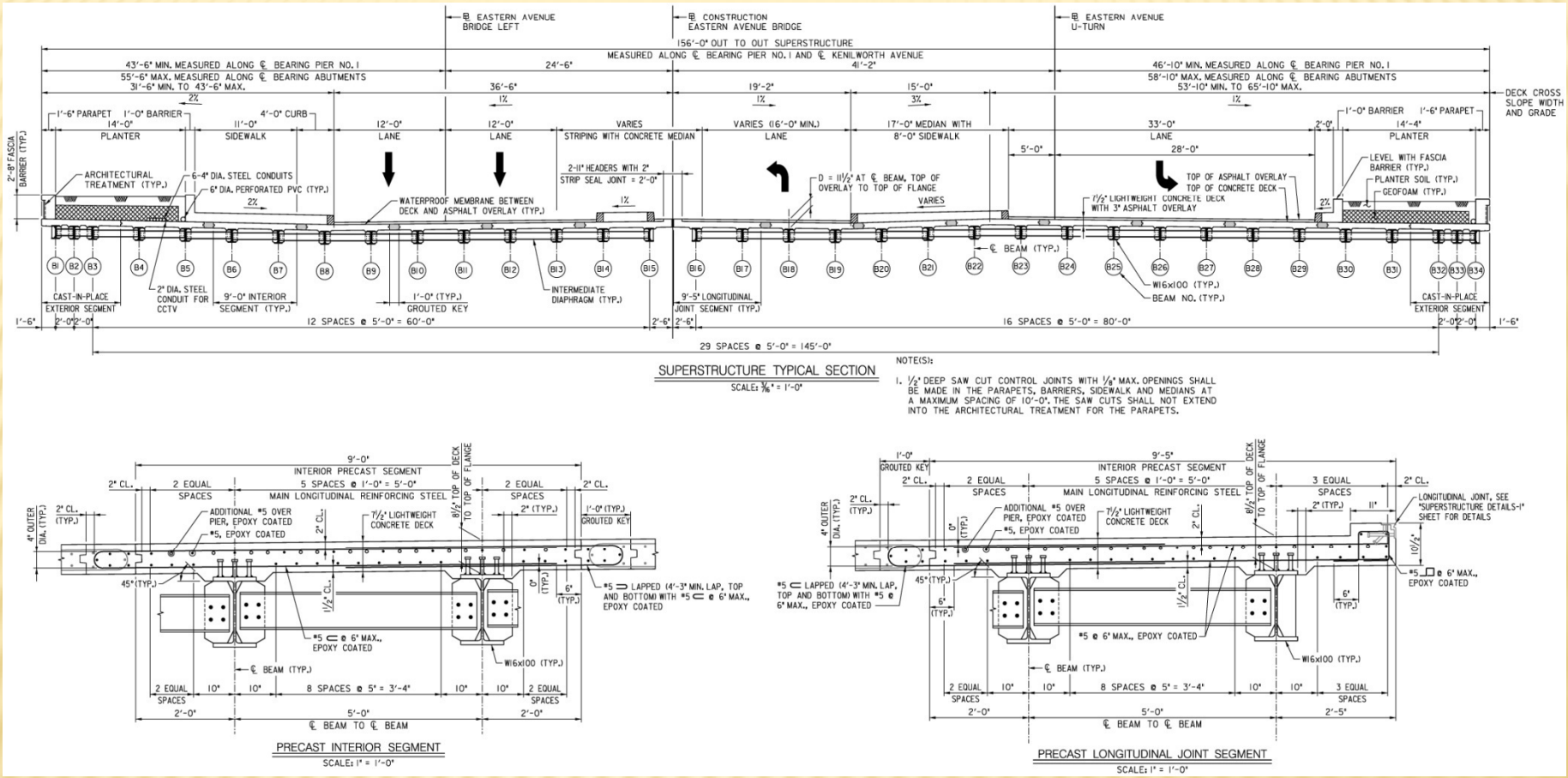


- THE EXISTING BRIDGE WAS REPLACED BY TWO-SPAN BRIDGE TO MINIMIZE THE SUPERSTRUCTURE DEPTH AND INCREASE THE VERTICAL CLEARANCE
- BRIDGE LENGTH IS 84’-8” WITH TWO 42’-4” SPANS
- SUPERSTRUCTURE WIDTH VARIES FROM 180’ AT ABUTMENTS TO 156’ AT PIER DUE TO CURVED FASCIA
- 14 PREFABRICATED SUPERSTRUCTURE SEGMENTS – PREFABRICATED SECTIONS MANUFACTURED CONCURRENT TO FIELD CONSTRUCTION SAVING TIME FROM TRADITIONAL WOOD OR METAL FORMWORK AND CIP
- 3” ASPHALT OVERLAY WITH WATERPROOF MEMBRANE

d.

Reconstruction of Eastern Avenue Bridge over Kenilworth Avenue, N.E.

PROJECT CONSTRUCTION: SUPERSTRUCTURE



SUPERSTRUCTURE TYPICAL SECTION

SCALE: 3/16" = 1'-0"

NOTE(S):

1. ½" DEEP SAW CUT CONTROL JOINTS WITH ⅛" MAX. OPENINGS SHALL BE MADE IN THE PARAPETS, BARRIERS, SIDEWALK AND MEDIANS AT A MAXIMUM SPACING OF 10'-0". THE SAW CUTS SHALL NOT EXTEND INTO THE ARCHITECTURAL TREATMENT FOR THE PARAPETS.

PRECAST INTERIOR SEGMENT

SCALE: 1" = 1'-0"

PRECAST LONGITUDINAL JOINT SEGMENT

SCALE: 1" = 1'-0"

d.

Reconstruction of Eastern Avenue Bridge over Kenilworth Avenue, N.E.

PROJECT CONSTRUCTION: SUPERSTRUCTURE

PROJECT CONSTRUCTION: SCHEDULE

- 11/25/09 Mobilization to begin
- 11/25/09 Prepare maintenance of traffic
- 01/11/10 Begin utility work in Kenilworth Ave (night shift work)
- 02/01/10 Close Bridge Deck and begin demolition
- 03/31/10 Bridge Pier Construction
- 09/27/10 Bridge Deck Construction
- 10/13/10 Roadway Approaches to Bridge deck
- 10/19/10 Service Road reconstruction
- 10/27/10 All Bridge / Road work complete, Bridge opened to public for use.

DIFFICULTIES ENCOUNTERED / LESSONS LEARNED

- Existing space limitations found for use of SPMT to effectively move sections of deck to adjacent site usage locations. Due to the urban environment location, the potential impact to traffic, and concern for applicability of this application to this specific project the SPMT method was not used by the Contractor for this project effort.
- Reconfiguration of existing storm sewer collection system to accommodate new bridge pier requiring new CIP manholes, changes from design to accommodate new manhole structures. This included timely field changes to properly fit existing catch basins with new manholes and distribution piping to the existing collection system.

DIFFICULTIES ENCOUNTERED / LESSONS LEARNED

- Demolition and removal of post tension concrete beams from existing bridge with specific concern for damaged spans. Cutting of the bridge post tensioning and concrete demolition at the abutment walls and between concrete girder beams was much more time consuming and costly to the contractor than they had anticipate or planned. Further concern was warranted for girder beams damaged by previous impact to the bottom flange of the beam creating a weak point for failure under the increase tension forces imposed by rigging/lifting operations.

DIFFICULTIES ENCOUNTERED / LESSONS LEARNED

- Conditions of existing soils and unanticipated dewatering of ground water under Kenilworth Ave at bridge pier spread footing location were found to be unsuitable for use under the proposed new pier spread footing. Further engineering input and DDOT acceptance of recommendations for construction requirements delayed the start of the footing formwork and rebar installation. Remediative measures included the undercutting of the existing soils and replacement with compacted stone and geo-textile materials providing suitable sub-grade foundation for the new pier structure.

DIFFICULTIES ENCOUNTERED / LESSONS LEARNED

- Inclusion of an unforeseen MOT phase 2C to allow for demolition of bridge abutment walls not previously included in project plans.
- Use of mechanical splices in lieu full length rebar in precast pier base closure pour sections to allow for fitting of #11 bars. Mechanical splices allowed for some deviation in prefabricated bar around the tightness of the CIP bar extended from the spread footing. However this method was time consuming and difficult in connecting bar in a tight location as well as timely procedures for tightening of shear-bolt connections.

DIFFICULTIES ENCOUNTERED / LESSONS LEARNED

- Unforeseen conflicts between portions of the existing bridge components (not demolished) and the new bridge requirements. This particular project experienced some conflicts between the existing approach slab sleeper slab, left in place under the adjacent roadway, and the new sleeper slab that extended out into the same space.
- Full depth replacement of existing Kenilworth Ave PCC base in lieu of planned asphalt overlay. This was due to the condition of the PCC base found during construction activities.
- Field installation by contractor personnel of fabricated rebar sections of bridge median barrier with varying roadway elevations and typical clearance requirements.

DIFFICULTIES ENCOUNTERED / LESSONS LEARNED

- Grades on Approach Slab and Roadway modified to accommodate new roadway grades from the bridge deck elevation. This required rebar installation at approach slabs to be modified for slope consideration.
- Grades and rebar changes for approach slabs sections from bridge deck elevation to existing roadway elevation on the south side of the bridge at the existing North Bound Service Road.

CONCLUSIONS AND RECOMMENDATIONS

- Fort Miller off site fabrication of pre-cast pier sections significantly reduced bridge foundation construction duration by having pre-cast and field cast in place work completed simultaneously.
- Fort Miller off site fabrication of pre-cast deck sections significantly reduced bridge superstructure construction by having pre-cast deck spans completed simultaneously with bridge abutment reconstruction.
- Elimination of the curved sections of the bridge from the project scope would have further shortened construction duration by not having a significant amount of time used to place and assemble structural steel, place deck formwork and CIP PCC deck after the placement of adjacent pre-cast deck sections.
- Reuse of the existing abutment walls by making modifications from an existing construction joint and building back to the new bridge beam seat elevations provided savings in time and cost to the project by not having to do a complete demolition and reconstruction of the existing abutment wall sections and spread footings.

CONCLUSIONS AND RECOMMENDATIONS

- Possible use of BIM Modeling or 3D Imaging could improve both the prefabrication and field installation of major rebar for critical structural components. In particular at locations where these sections must meet in closure pours lessening the need for use of mechanical splicing.
- Prefabricated bridge components expedited construction of the overall project from that of more conventional wood or metal deck formwork with cast in place concrete. This positively reflects on the construction impact duration to the surrounding community, overall costs to the project, exposure to potential safety concerns during construction, exposure to the traveling public using Kenilworth Ave.
- Prefabricated units (both deck and pier) can be installed during non-peak hours to minimize traffic impacts. This would include overnight and weekend periods when the full closure of the roadway is necessary for rigging/lifting operations.
- Projects completed in less urban environments may be considered to include additional innovations in bridge demolition such as demolition of major sections of bridge structure components with Self Propelled Modular Transporters (SPMT) and/or adjacent construction wherein the proposed new superstructure could be built on a temporary foundation and moved as a single unit onto the pier and abutment wall beam seats.

QUESTIONS???

d.

Reconstruction of Eastern Avenue Bridge over Kenilworth Avenue, N.E.