



Kittery, Overpass Bridge Replacement

Date: October 30, 2014

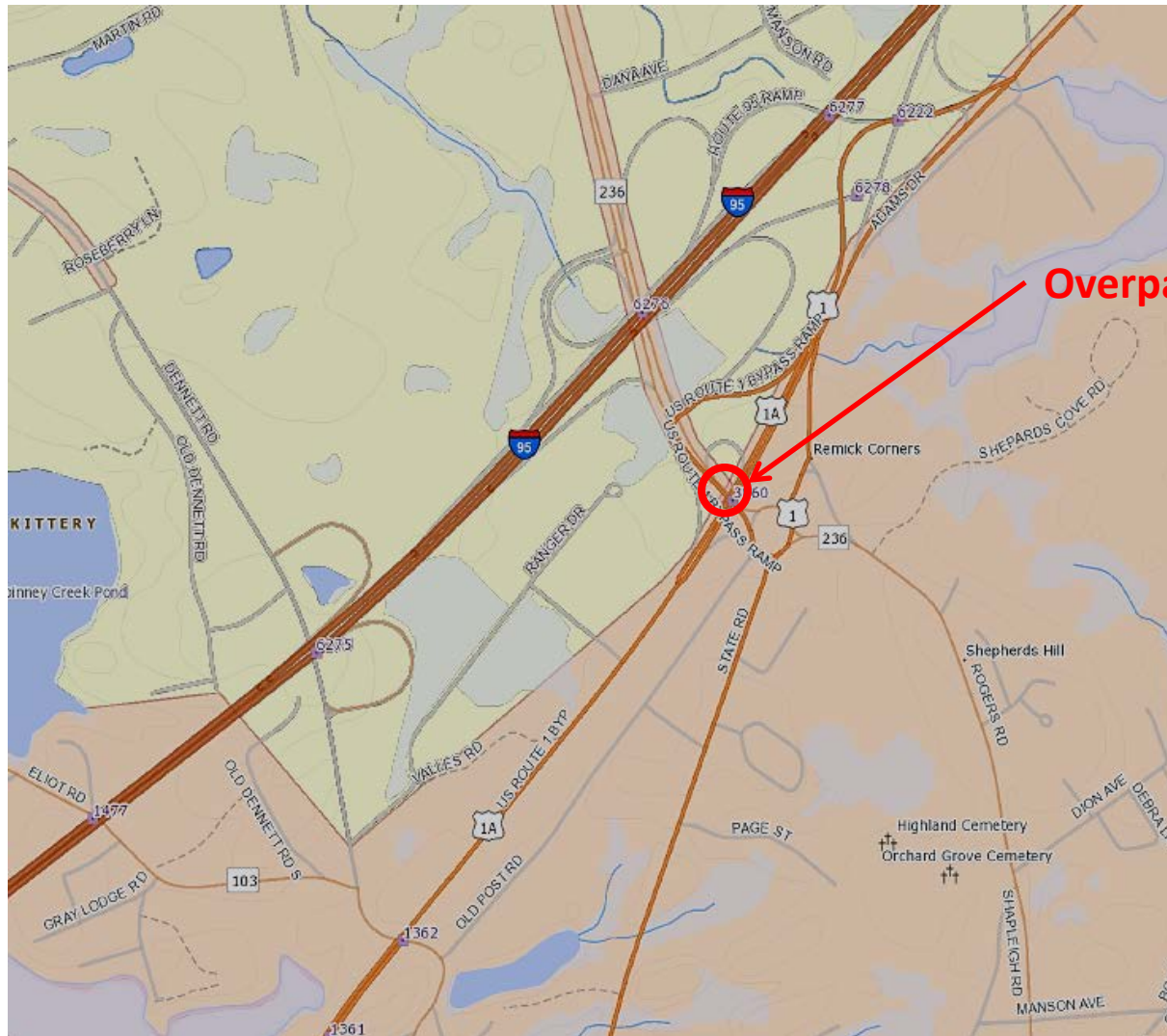


U.S. Department of Transportation
Federal Highway Administration



TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

Overpass Bridge Location



Overpass Bridge

Overpass Bridge



Kittery, Overpass Bridge

Design, Construction, and Fabrication Team

- McFarland Johnson, Concord, NH – Consultant Designer
- Wyman & Simpson, Richmond, ME – General Contractor
- Shaw Brothers, Gorham, ME – Subcontractor
- High Concrete, Denver, PA – NEXT-D Beam Fabricator
- Precast of Maine, Topsham, ME – Precast Abutments & Approach Slabs Fabricator
- Oldcastle Precast, Auburn, ME – Precast T-Walls Fabricator
- Tokyo Rope Mfg., Tokyo, Japan – Carbon Fiber Composite Cable (CFCC) Prestressing Strands Fabricator

Old Overpass Bridge



Kittery, Overpass Bridge

Existing Bridge and Project Overview

- Carries US Route 1 Bypass over Route 236
 - 4 traffic lanes with wide median and guardrail barrier
 - 2 thru lanes NB
 - 1 thru lane and 1 onramp SB
- Built 1942
- Rehabilitation 1993
- 47'-4" span concrete rigid frame founded on bedrock
- 71'-4" to 74'-4" fascia-to-fascia width
- 13'-10" vertical clearance over Route 236 (posted)
- Adjacent to Memorial Circle – a rotary with 6 legs

Project Issues

Bridge Condition

- 72 years old with poor concrete condition overall
- Narrow lanes and shoulders
- Substandard vertical clearance

Bridge Design Considerations

- Incorporate experimental Carbon Fiber Composite Cable (CFCC) prestressing strands
- Design durable, long-lasting structure
- Improve vertical clearance

Project Issues (cont.)

Town of Kittery Preferences

- Minimize traffic impacts
- Nice looking structure – considered bridge to be gateway to Town of Kittery
- Black bridge rail color
- Anti-graffiti coating on concrete walls
- Room for bicyclists on new bridge
- Sidewalks along Route 236

Project Issues (cont.)

Traffic

- 7,740 AADT - US Route 1 Bypass (used to be higher)
- 20,000 AADT - Route 236
- Tourist destination
- Portsmouth Naval Shipyard commuter traffic

Construction Timing

- Need to wait until US Route 1 was reopened to traffic in 2013 due to recent Memorial Bridge construction
- Cannot coincide with construction of SML Bridge on US Route 1 Bypass, which starts in Fall 2014
- SML Bridge is considered the backup to the I-95 Bridge when there are lane closures
- Ordering, Fabrication, and Delivery of CFCC prestressing strands

Kittery-Portsmouth Bridges



**Memorial Bridge
On US Route 1**

**SML Bridge
On US Route 1
Bypass**

**Piscataqua Bridge
On I-95**

Kittery, ME

Portsmouth, NH

Project Solutions

New Bridge

- Utilize precast concrete elements – abutments, wings, approach slabs, NEXT-D precast prestressed concrete beams
- Pre-buy CFCC prestressing strands due to long lead time
- Improve vertical clearance by raising finish grade about 2'
- Allow space for future sidewalks on Route 236

Project Solutions (cont.)

Maintenance of Traffic and Construction Timing

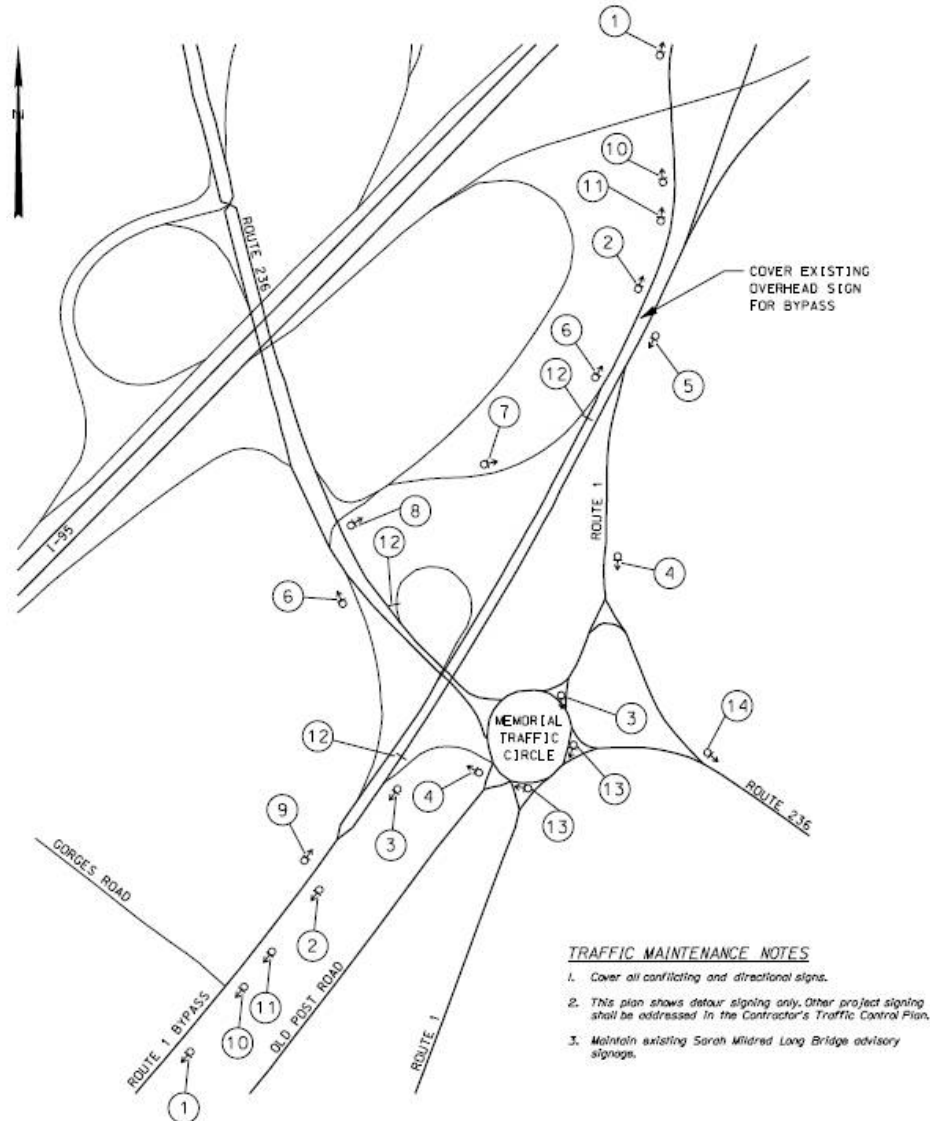
- Allow up to 35 days closure of US Route 1 Bypass and detour onto adjacent ramp system
- Allow up to 24 hours closure of Route 236 for demolition (within 35 day closure window)
- Be complete prior to start of construction of SML Bridge on US Route 1 Bypass
- Include incentives/disincentives for road closure durations
 - \$10,000/day for 35 day closure
 - \$5,000/hour for 24 hour closure
 - Maximum total incentive = \$125,000

Kittery, Overpass Bridge

New Bridge

- 60' span NEXT-D precast prestressed beams with CFCC prestressing strands
- 75'-4" fascia-to-fascia width
- 4 traffic lanes with mountable median and no barrier and 6' shoulders to accommodate bicyclists
- Dual coated corrosion resistant rebar
- Precast concrete abutments on CIP footings founded on bedrock
- Precast T-walls for return wings
- Ashlar masonry form liner on abutments and wing walls
- 16' vertical clearance over Route 236
- Bridge length allows for future sidewalks along Route 236, but no sidewalks included

US Route 1 Bypass Detour



NOT TO SCALE

Project Timeline

Advertised Bridge Project	1/8/14	
Bridge Contract Awarded	2/20/14	
Executed CFCC Pre-Buy Contract	2/24/14	
CFCC Strands Delivered	5/9/14	
US Route 1 Bypass Closed	7/23/14	6:00 AM
Route 236 Closed	7/23/14	8:00 AM
Route 236 Opened	7/23/14	9:00 PM
Route 1 Bypass Opened	8/21/14	
Construction Completed	10/6/14	

Project Results

New Bridge

- CFCC strands delivered a little later than expected from Japan, but in time for NEXT-D beam fabrication
- Precast concrete elements all fabricated and delivered on time
- Improved vertical clearance and improved sight distance through the bridge opening towards Memorial Circle
- Town of Kittery happy with results

Maintenance of Traffic and Construction Timing

- Closure of US Route 1 Bypass lasted 29 days – Contractor earned \$10,000/day incentive for a total of \$60,000
- Closure of Route 236 lasted 11 hours – Contractor earned \$5,000/hr incentive for a total of \$65,000
- Project completed on time and on budget

Project Results (cont.)

Other Factors Contributing to Success of Project

- Schedule required long work hours, a skilled work force, and proper equipment to complete the work
- Survey layout was critical
- Precast concrete quality control was critical
- Contractor used multiple shims in the erection of precast abutment pieces
- Traffic control during the Route 236 detour was a major issue; however, the Kittery Police Department was a major player in making this work
- No delays due to bad weather
- Teamwork between all the players was critical
- Good General Contractor management of all subs was critical in meeting project schedule milestones

ABC vs. Conventional Construction Cost Comparison

Conventional

Construction

Construction = \$2.43

million

Incentive Allowance = \$0

Total = \$2.43 million

ABC

Construction = \$2.79
million

Incentive Allowance =
\$125,000

Subtotal = \$2.92

million = +20%

CFCC Strand = \$180,000

Total = \$3.10

11/6/2014

Bridge Demolition



Bridge Demolition



Bridge Demolition



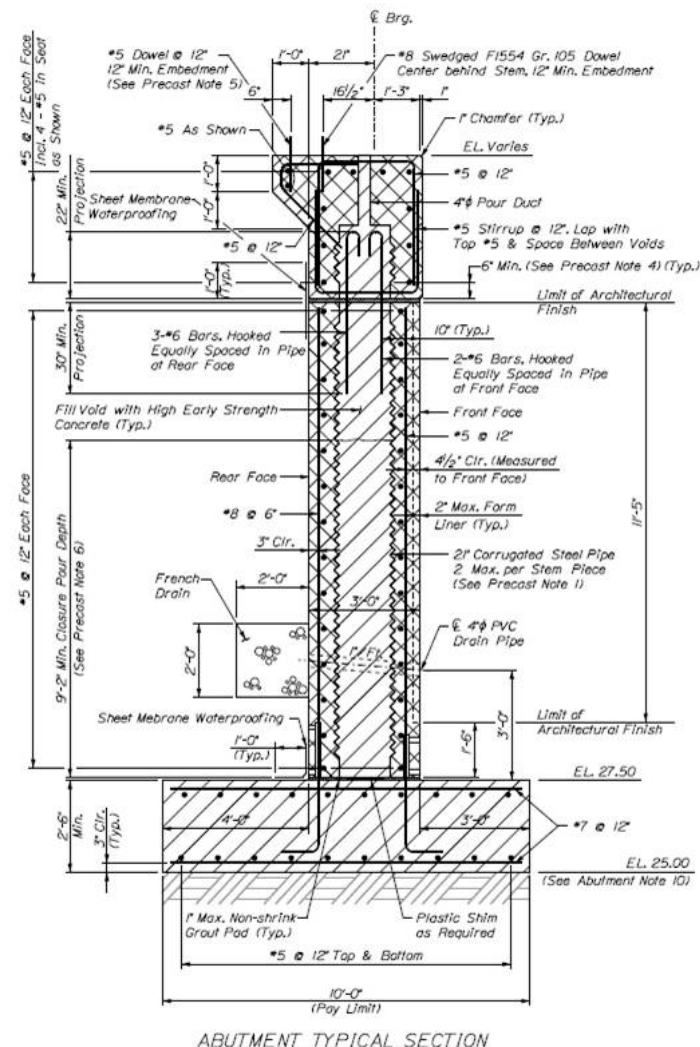
Bridge Demolition



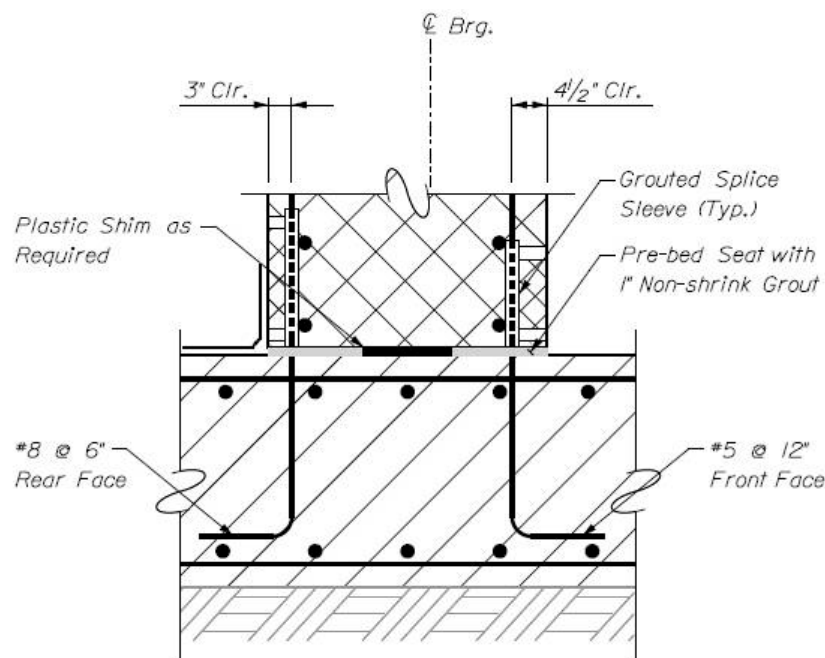
Abutment Construction

Each Abutment:

- 8 precast stem wall sections with 21" vertical voids
- 2 precast corner stem wall sections
- 6 precast stem cap sections
- Precast approach slabs
- Precast T-walls for return wings
- Heaviest abutment elements weighed about 47,000 lbs; most were in 30,000-40,000 lbs range

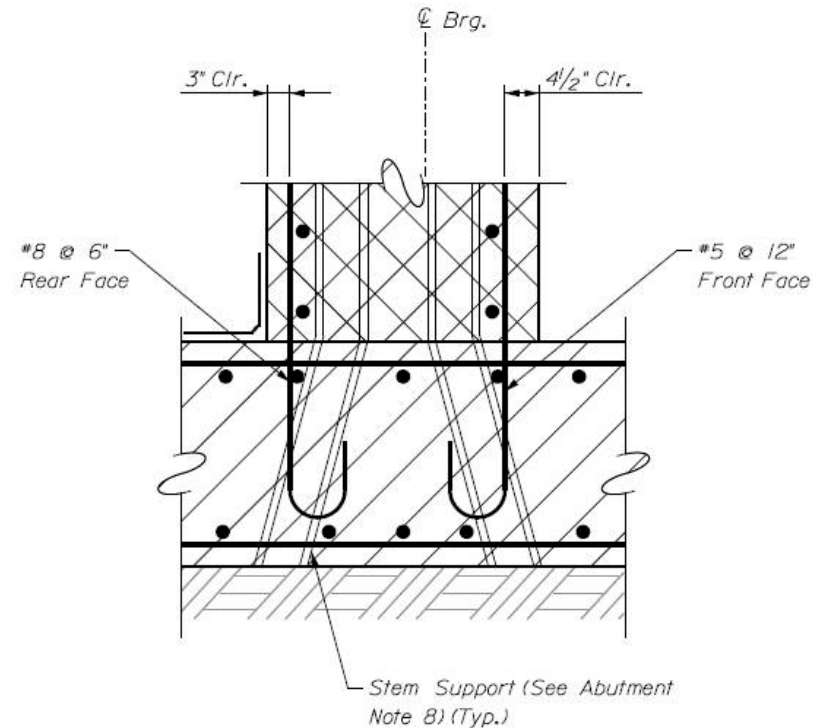


Abutment Construction



FOOTING CONNECTION DETAIL

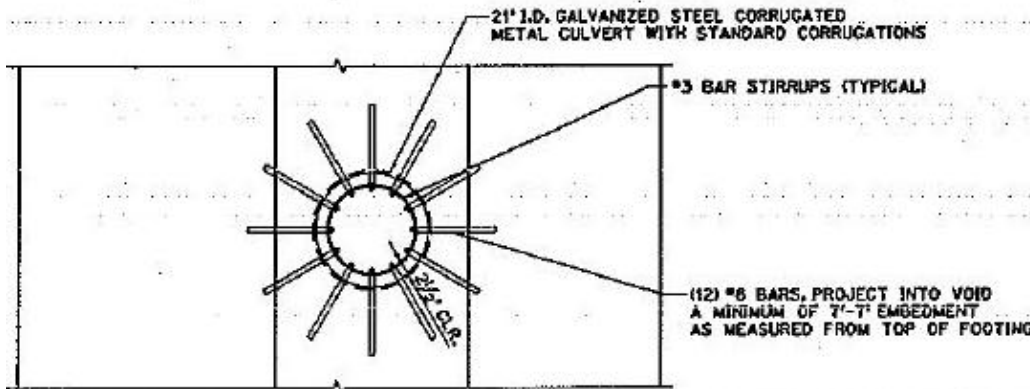
From SHRP2 ABC Toolkit
Not Used



ALTERNATE FOOTING CONNECTION DETAIL

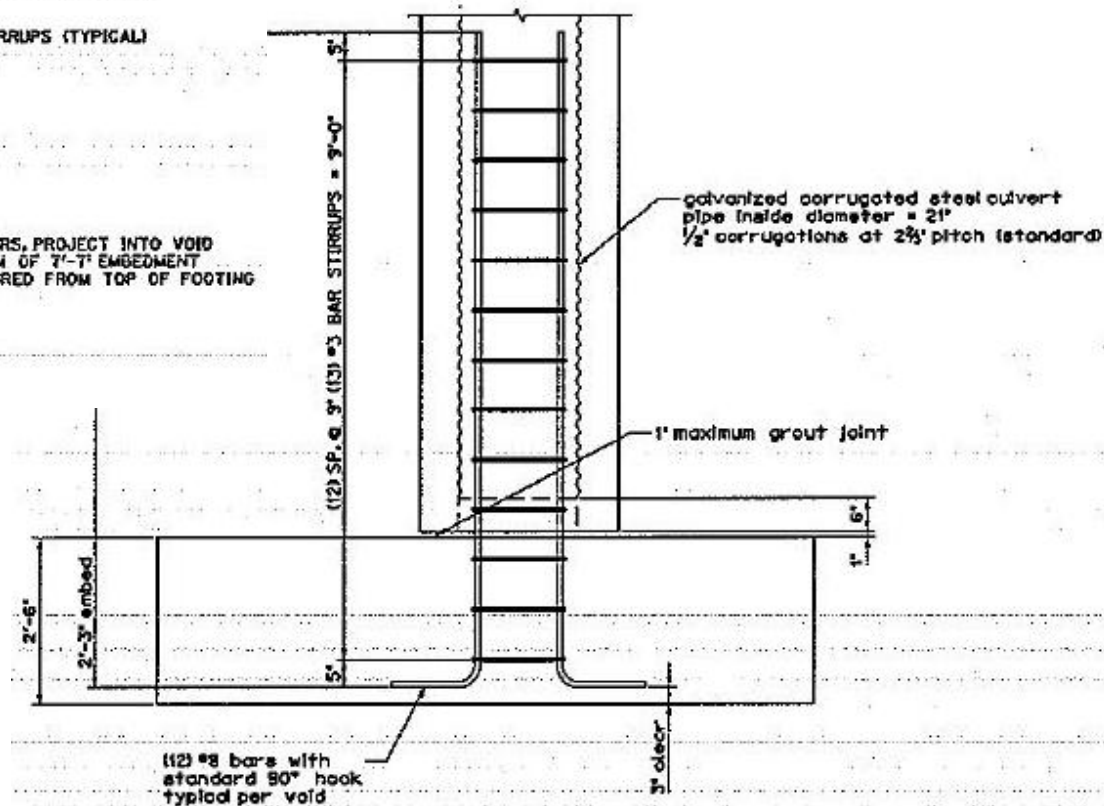
From EDC Workshop sponsored by MassDOT
Not Used

Abutment Construction



ALTERNATE FOOTING CONNECTION PLAN VIEW

**Footing Connection Detail
Proposed by Contractor and
Accepted by MaineDOT**



ALTERNATE FOOTING CONNECTION ELEVATION

OTHER REINFORCING STEEL NOT SHOWN SHALL BE THE SAME AS THAT SHOWN IN THE CONTRACT DRAWINGS WITH THE EXCEPTION THAT HMB COUPLERS MAY BE OMITTED AND DOWELS FROM THE FOOTING INTO THE HMB COUPLERS MAY ALSO BE OMITTED

Abutment Construction Leveling Slab



Abutment Construction

CIP Footing



Abutment Construction Stem Walls



Abutment Construction Stem Wall



Abutment Construction Filling Stem Wall Voids



Abutment Construction T-Wall Return Wings



Abutment Construction Stem Wall Cap



Abutment Construction Approach Slab



Abutment Construction



Superstructure Construction



Superstructure Construction



Superstructure Construction



Superstructure Construction



Superstructure Construction

CIP Concrete Median



Superstructure Construction High Performance Membrane



Superstructure Construction Bridge Rail and Paving



New Overpass Bridge



Time Lapse Video

