

Preliminary Design Report

I-91 / I-691 / Route 15 Interchange Southbound Improvements Project

Cities of Meriden and Middletown, Connecticut

State Project No. 0079-0240

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Prepared For:

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1.0 General

1.1 LOCATION

This proposed project is located on a segment of Interstate 91 (I-91) that provides access to Route 15 (Wilbur Cross Parkway), Interstate 691 (I-691), and East Main Street in the City of Meriden. All three highways in the project area consist of a complex system of mainline lanes, weave sections and ramp connections that form the I-91/I-691/Route 15 Interchange. The improvements proposed as part of this project encompass highway elements in the southbound direction within the limits as described below.

- The proposed project limits on I-91 SB begin approximately 0.5 miles north of Interchange No. 19 (MP 21.60) extending southerly to the Meriden/Wallingford town line (MP 17.31) for approximately 4.26 miles.
- The proposed project limits on Route 15 SB begin at the I-691 EB overpass (MP 65.23) extending southerly to the Miller Avenue overpass (MP 63.18) for approximately 2 miles.
- The proposed project also includes improvements to I-691 EB from the Route 5 overpass (MP 1.32, Interchange 8) to approximately 130 feet prior to the Bee Street overpass (MP 0.00) for approximately 1.1 miles.
- I-691 WB from the Interchange No. 11 (off-ramp to I-91 NB) to just beyond the Interchange 18 on-ramp from I-91 SB for approximately 0.50 mile.

The project location map is depicted in **Figure 1-1**.

1.2 PROJECT DESCRIPTION

The I-91/I-691/Route 15 Interchange Improvement project in the cities of Meriden and Middletown was initiated by the Connecticut Department of Transportation (CTDOT, Department) to address operational and safety concerns associated with capacity, congestion and weaving at the I-691 and Route 15 connections with I-91.

The I-91/I-691/Route 15 Interchange improvements in the City of Meriden and Middletown have been broken out into three projects. The subject project is 0079-0240 focuses on southbound improvements. The remaining two projects are:

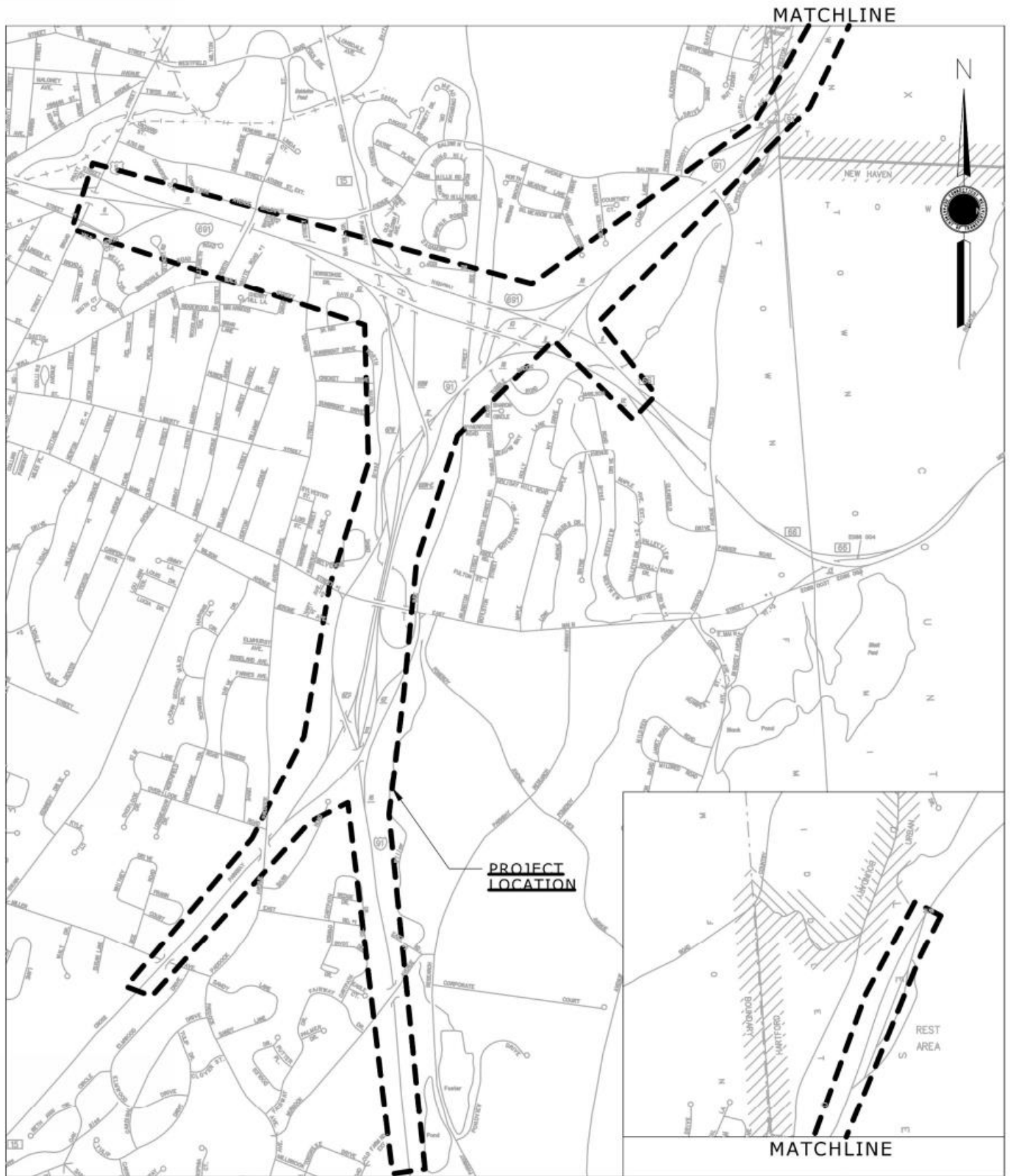
- State Project No. 0079-0245 (proposed to be procured as design/build)
 - I-691 EB to I-91 NB Improvements
- State Project No. 0079-0246
 - I-91 NB, Route 15 NB, and I-691 WB Improvements

1.3 PURPOSE AND NEED

The purpose of this project is to reduce congestion and improve safety for the southbound movements on Route 15 and I-91 within the I-91, I-691, and Route 15 Interchange in Meriden and Middletown, CT. This project intends to complete the following:

- Reduce traffic congestion to achieve a Level of Service (LOS) of D or better by design year 2051
- Improve safety associated with crashes caused by congestion and weaving

It is proposed to widen I-91 SB to provide an additional operational lane between Interchanges 18 and 19, widen the existing off-ramp from I-91 SB to I-691 WB (Interchange 18) to two lanes, and relocate the existing off-ramp from I-91 SB to Route 15 SB (Interchange 17). The improvements on Route 15 SB consist of widening I-691 EB to the Route 15 SB (Interchange 10) on-ramp to two lanes.



SCALE IN FEET



STATE PROJECT NO.:

0079-0240

CITY/TOWN:

MERIDEN & MIDDLETOWN



STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION



FIGURE 1-1
SOUTHBOUND IMPROVEMENTS

DATE:

04/02/2020

1.4 LIST OF STRUCTURES

The list of structures included in Project No. 0079-0240 is provided in **Table 1-1** below.

Table 1-1 – List of Structures

Structure No.	Location	Structure No.	Location
00797	Route 15 Over Miller Ave	01829	I-91 SB & TR 813 Over Bee Street
01824	Near I-91 SB to East Main Street Exit Ramp Over Route 15 SB	01819	Near I-91 SB Entrance Ramp Over Route 15 SB
03052	I-91 SB Over Baldwin Ave	01826	I-691 EB Over Route 15
01831	I-691 WB Over I-91	01833	I-691 EB Over I-691 TR 802
01834	I-691 WB Over Bee Street	03046	I-691 EB Over Gravel Street
01822	I-91 & Route 15 Over Willow Brook	01823	Ramps 9SEM and 5SEM Over Willow Brook
02159	Route 15 and ramp 6E5S Over Willow Brook	01841	I-691 WB and Ramp 148 Over Spoon Shop Brook
Unnumbered (EM5S)	Proposed East Main Street Entrance Ramp on to Route 15 SB (west of Bridge No. 01819)	Unnumbered (EM9S)	Proposed East Main Street Entrance Ramp on to I-91 SB (north of Bridge No. 01819)
03049	I-691 EB Over Willow Brook	New Culvert (5S9S)	Proposed Culvert Under Route 15 SB to I-91 SB Ramp
01839	I-91 NB and SB over Spoon Shop Brook	01840	I-691 EB over Spoon Shop Brook
79015	Tumblebrook Road over Spoon Shop Brook		

1.5 PROPOSED RAMP NAMING CONVENTION

The naming convention for the project ramps are as follows: The roadway the traffic originates from make-up the first two letters of the ramp abbreviation and the destination makes up the last two letters. Freeways and local roads have been abbreviated as listed below:

- 9S = I-91 SB
- 5S = Route 15 SB
- 6E = I-691 EB
- 6W = I-691/ Route 66 WB
- BA = Baldwin Avenue
- EM = East Main Street
- PA = Preston Avenue
- RA = Rest Area

2.0 Environmental Design

2.1 ENVIRONMENTAL IMPACTS

There are multiple wetland systems throughout the project corridor. Many of these systems, or “reaches” are associated with the watercourses that run through the limits, specifically Willow Brook and the Unnamed Tributary to Willow Brook. The Willow Brook has a FEMA Zone AE Floodplain associated with it throughout the project limits. In addition to wetland impacts along the corridor, there will also be work within the floodplains. The only FEMA designated floodway within the project limits is associated with the Spoon Shop Brook. Work within this floodway will be limited to repairs and improvements to the numbered structures that carry Spoon Shop Brook.

WETLAND IMPACTS

Contract 0079-0240 interacts with both of these watercourses and their associated wetlands primarily through the widening of Route 15 SB and I-91 SB and the reconfiguration of several southbound ramps. South of East Main Street, Willow Brook proper is located on the east side of I-91 NB and does not interact with the southbound highways. However,

the Unnamed Tributary to Willow Brook (UTWB) runs alongside Route 15 SB and then the southbound on-ramps from East Main Street before being conveyed under East Main Street for approximately 700 feet via an 84" RCP culvert before it combines with Willow Brook proper at Structure No. 01823, approximately 1,000 feet north of East Main Street. Willow Brook then runs along the west side of Route 15 SB until it crosses eastward underneath Route 15 at Bridge No. 02159 and then northerly under I-691 EB and I-691 WB at structures 03049 and 03050, respectively. Willow Brook then flows northerly, out of the project limits, where it eventually converges with Harbor Brook.

Proposed impacts to these two watercourses and their associated wetland systems vary from temporary impacts for drainage end-wall repairs to the filling and relocation of sections UTWB. The largest overall impact will be the partial relocation of the northern section of the Unnamed Tributary to Willow Brook. Ramp 5S9S will cross over the watercourse at a skew. This will require a new box culvert to carry the stream from its current location along the western edge of Route 15 SB under Ramp 5S9S where it will reconvene with the original stream alignment before entering the 84" RCP that carries it under East Main Street. The new ramp has been designed to minimize impacts to Wetland WB-3A, a well-established PFO wetland, however the overall impacts to Wetland WB-3A and UTWB will be more than one and a half acres.

Impacts to Willow Brook Proper and the wetlands that surround it will be limited to temporary impacts, mostly for the reconstruction of existing drainage outlets or the installation of new outlet protection. Several of the large and numbered bridge structures will be repaired under Contract 0079-0240 and require work within the Willow Brook for water handling or access roads within the surrounding wetlands.

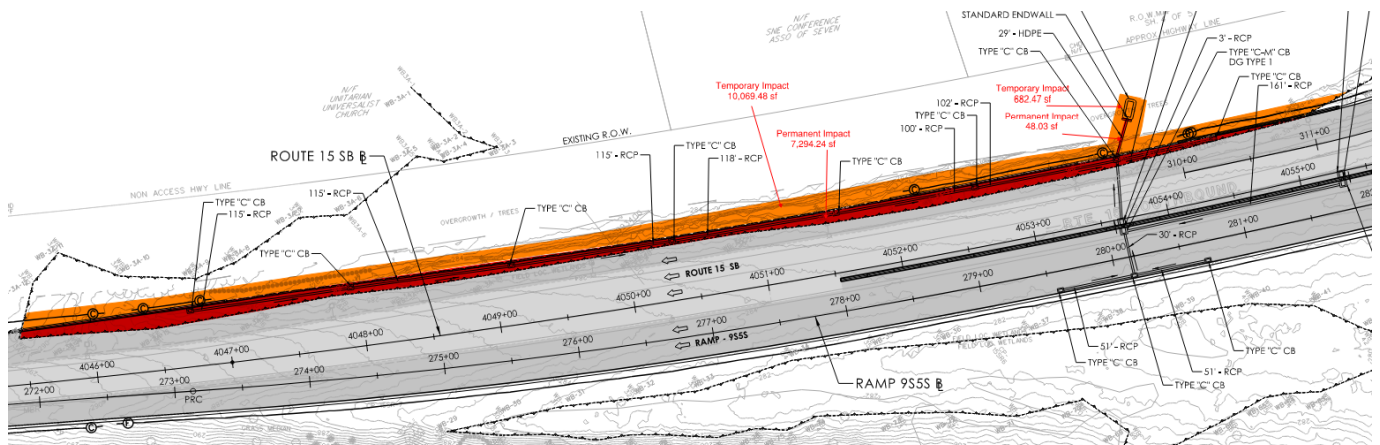


Figure 2-1 - Wetland impacts for highway widening

Other large numbered and unnumbered structures that carry Spoon Shop Brook and North Branch Spoon Shop Brook will also be repaired under this contract and will require temporary impacts to both the watercourses and surrounding wetlands, mostly for access roads. **Table 2-1** lists the extents of the impacts, locations, and descriptions/needs. The sheet number corresponds to the Environmental Permit Plans included with the Environmental Resource Impact memo report under separate cover.

Table 2-1 - List of Wetland Impacts

Sheet	Watercourse	Wetland	STA	Temporary Impact (SF)	Permanent Impact (SF)	Description of Impacts
1		WL-100	2006+30	200		Drainage Outlet Repairs
2		WL-200	2018+00	215		Drainage Outlet Repairs
3		WL-300	2027+50	205	30	Drainage Outlet Repairs
8		WBB	2076+50	216	38	Drainage Outlet Repairs
8		WB1	2082+00	259	24	Drainage Outlet Repairs
11		SGB-A	4030+75	2,475	439	Drainage Outlet Repairs
13	Unnamed Tributary	WB-3A	4045+45 to 4055+15	10,070	7,295	Widening of RT 15 SB, Retaining Wall

Sheet	Watercourse	Wetland	STA	Temporary Impact (SF)	Permanent Impact (SF)	Description of Impacts
13		WB-3A	4053+80	584	48	New Drainage outlet
14	Unnamed Stream		225+55		155	Installation of new Ramp 5S9S & Culvert Extension
14	Unnamed Stream		2085+00 to 2086+50	832		Installation of new Ramp 5S9S
14		WBB	2085+00 to 2086+50	594	584	Installation of new Ramp 5S9S
14		WBB	2086+50 to 2086+55		40	Extension of Existing Culvert
14		WB	233+00	233	8	Drainage Outlet Repairs
15		WB-3A	313+60	291	14	Drainage Outlet Repairs
15		WB	285+50		360	Widening of Ramp 9S5S
15		WB	285+55	197	9	Drainage Outlet Repairs
15	UTWB		238+05 to 238+65	744	250	Extension of Existing Culvert
15		WB-3A	239+75 to 242+00	1,730		West side of new Ramp 5S9S
15		WB-3A	4064+00 to 4067+50	3,718		East side of new Ramp 5S9S
15		WB-3A	238+05 to 242+00		14,181	Installation of new Ramp 5S9S
16		WB-3A	4069+50	233	5	Drainage Outlet Repairs
16	UTWB				5,257	Relocation of stream
16		WB-3A	242+00 to 247+50	5,215		West side of new Ramp 5S9S
16		WB-3A	242+00 to 247+50	3,215		East side of new Ramp 5S9S
16		WB-3A	242+00 to 247+50		26,680	Installation of new Ramp 5S9S
17	UTWB		247+50 to 249+25		2,048	Installation of new Ramp 5S9S
17		WB-3A	247+50 to 251+45	463	8,929	Installation of new Ramp 5S9S
19		WB-3	378+45	235		Drainage Outlet Repairs
19		WB-3	381+20	151		Drainage Outlet Repairs
19	Willow Brook		4086+00 to 4088+00	1,566		Access Repairs to 01822 and 01823
19		NB-3A	4085+80 to 4086+40	383		Access Repairs to 01822 and 01823
19		WB-3	379+75 to 380+25	276		Access Repairs to 01822 and 01823
19		WB-3	384+80	111		Drainage Outlet Repairs
20		WB-3	4100+15		167	Existing Culvert Replacement, Outlet Protection
20		WB-3	387+50		125	Existing Culvert Replacement, Outlet Protection
20		WB-3	4104+50	1,598	374	Extension of Existing Culvert
21	Spoon Shop Brook		2152+00	245		Access Repairs to 01839
21		SSB-D	2152+00	292		Access Repairs to 01839
22		SSB-D	421+60	665		Drainage Outlet Repairs & Access to 01840
22	Spoon Shop Brook		421+65	578		Access Repairs to 01840

Sheet	Watercourse	Wetland	STA	Temporary Impact (SF)	Permanent Impact (SF)	Description of Impacts
22		SSB-D	421+30	197		Drainage Outlet Repairs
22		SSB-G	105+40	418	79	Drainage Outlet Repairs
22		SSB-G	107+85	279	80	Drainage Outlet Repairs
33	Willow Brook		533+50	1,000*	TBD	Access Repairs to 03050
33		WB-4	533+50	1,000*	TBD	Access Repairs to 03050
34	Willow Brook		5055+20	1,000*	TBD	Access Repairs to 03049
34		WB-4	5055+20	1,000*	TBD	Access Repairs to 03049
34	Willow Brook		4119+00	1,000*	TBD	Access Repairs to 02159
34		WB-3	4119+00	1,000*	TBD	Access Repairs to 02159
37	Spoon Shop Brook		6132+00	1,000*	TBD	Access repairs to 01841
37		SSB-G	6132+00	1,000*	TBD	Access repairs to 01841
37		SSB-F	6132+00	1,000*	TBD	Access repairs to 01841
38	NB Spoon Shop Brook		6153+00	1,000*	TBD	Access repairs to 96" CMP under I-691WB
38		SSB-A	6153+00	1,000*	TBD	Access repairs to 96" CMP under I-691WB
38		SSB2	6152+50	1,000*	TBD	Access repairs to 96" CMP under I-691WB
38	NB Spoon Shop Brook		6149+00	1,000*	TBD	Access repairs to 96" CMP under I-691EB
38		SSB2	6149+00	1,000*	TBD	Access repairs to 96" CMP under I-691EB

*Estimated pending development of final reports on structure repairs

FLOODPLAIN IMPACTS

In addition to impacts to wetlands and watercourses, there will be work within the 100-year calculated floodplains for Willow Brook and Spoon Shop Brook at several locations. Most of these impacts will be temporary in nature for access to culvert/structure repairs or the installation of drainage outlets. However, some impacts within the floodplain will be permanent fill for the widening of the highway or ramps. While the volumes of these fills will be relatively small by comparison to the overall floodplain, they will be mitigated with compensatory storage within the interior area of horseshoe on-ramp just south of East Main Street, which is also one of the proposed wetland mitigation areas. **Table 2-2** below identifies the proposed temporary and permanent impacts to the floodplain under Contract 0079-0240:

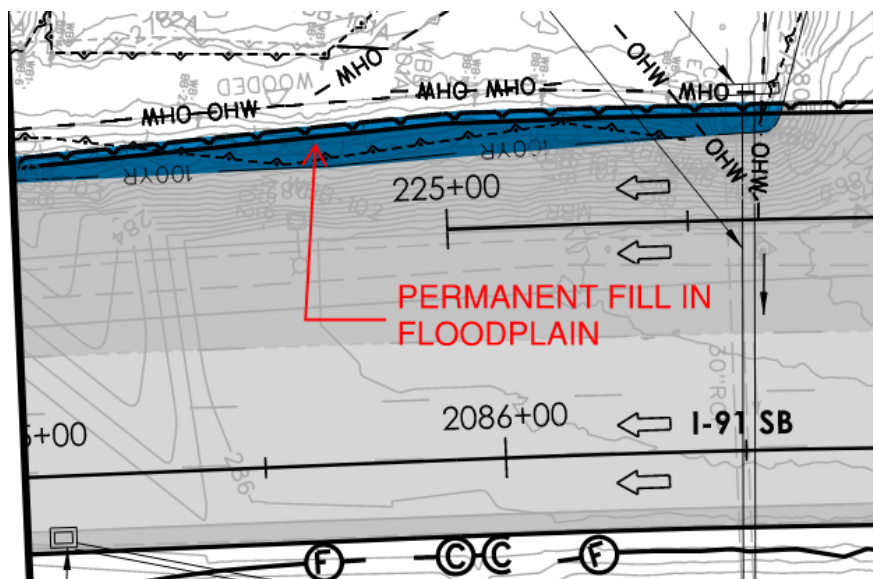


Figure 2-2 - Floodplain Fill for Highway Widening

Table 2-2 - List of Floodplain Impacts

Sheet	Floodplain Impact (SF)	Impact	STA	Description of Impacts
8	199	Temporary	2076+50	Drainage Outlet Repairs
8	105	Temporary	2082+00	Drainage Outlet Repairs
8,14	2,160	Temporary	2083+30 to 2086+55	Installation of Ramp 5S9S
8,14	1,306	Permanent	2084+25 to 2086+60	Fill For Ramp 5S9S
19	2,295	Temporary	4086+00	Access Repairs to 01822 and 01823
19	786	Temporary	4087+50	Access Repairs to 01822 and 01823
19	102	Temporary	381+40	Drainage Outlet Repairs
19	215	Temporary	384+80	Drainage Outlet Repairs
20	153	Temporary	387+50	Drainage Outlet Repairs
20	1,489	Temporary	4104+50	Drainage Outlet Repairs
21	1,400	Temporary	418+35	Access Repairs to 01839
22	965	Temporary	421+60	Access Repairs to 01840
33	1,400	Temporary	533+50	Access Repairs to 03050
34	1,000	Temporary	5054+95	Access Repairs to 03049
34	1,835	Temporary	4119+00	Access Repairs to 02159
37	1,000*	Temporary	6131+90	Access Repairs to 01841
37	3,450	Temporary	6132+10	Access Repairs to 01841
38	45	Temporary	6148+55	Drainage Outlet Repairs
38	196	Temporary	6151+60	Drainage Outlet Repairs
38	1,500*	Temporary	6152+50	Access repairs to 96" CMP under I-691WB
38	1,500*	Temporary	6153+40	Access repairs to 96" CMP under I-691WB

*Estimated pending development of final reports on structure repairs

2.2 ENVIRONMENTAL RELATED PERMIT REQUIREMENTS

The proposed construction activities in regulated areas will be coordinated with the agencies (USACE, CTDEEP Fisheries, EPA, CTDEEP NDDB, SHPO and City of Meriden). The anticipated environmental permits are listed below:

- CTDOT Flood Management Certification (FMC)
- CTDEEP Request for Authorization Form for the General Permit for Water Resource Construction Activities (Activities 1, 5 & 8)
- USACE Section 404 Pre-Construction Notification for NWP Activity (Potentially Individual depending on impacts)
- CTDEEP General Permit for Stormwater and Dewatering Wastewaters Associated with Construction Activity

3.0 Highway Design

3.1 PROPOSED IMPROVEMENTS

I-91 Southbound

The proposed improvements on I-91 SB include the following:

- Construct operational lane – Provide an operational lane from approximately 0.5 miles north of Interchange 19 (Baldwin/Preston Avenue) to the relocated exit ramp to Route 15 SB for about 2 miles. The operational lane is expected to reduce congestion and rear-end crashes that may be attributed to the existing conditions. These improvements will require widening of Bridge No. 03052 (I-91 SB over Baldwin/Preston Avenue) and Bridge No. 01829 (I-91 SB over Bee Street) to accommodate the operational lane.
- Relocate the access to Route 15 SB and realign the exit ramp to East Main Street – The existing access to Route 15 SB is shared with the East Main Street exit (Interchange 17). It is proposed to relocate the access to Route 15 SB by providing a diverge consisting of two I-91 SB through lanes and a two-lane ramp to Route 15 SB. The two-

lane ramp to Route 15 SB will merge with two lanes of Route 15 SB. By removing the traffic bound for Route 15 SB at the existing exit ramp (Interchange 17), a single-lane ramp to East Main Street will be adequate. This exit ramp to East Main Street will be relocated further south to increase the weave distance between this exit and the I-691 WB on-ramp. The existing Bridge No. 01824, carrying exit ramp from I-91 SB will be replaced to accommodate the proposed ramp alignment and the proposed widening on Route 15. The new two-lane entrance ramp from Route 15 SB is proposed to merge with two I-91 SB mainline lanes under Bridge No. 01818 carrying Route 15 NB over I-91. The outermost lane of the four-lane section of I-91 SB will get dropped off in the vicinity of Bridge No. 03134 carrying Murdock Avenue over I-91. Beyond this merge, I-91 SB will match with existing three lane configuration.

- Mill and Repave – The portion of I-91 SB between Wallingford town line and Bridge No. 1818, carrying Route 15 NB over I-91 will be milled and repaved.

Route 15 Southbound

The proposed improvements on Route 15 SB include the following:

- Provide a two-lane exit ramp from I-691 EB to Route 15 SB – Widen the existing single-lane exit ramp from I-691 EB to Route 15 SB to two lanes. This improvement will address capacity constraints and is anticipated to reduce the potential for crashes.
- Relocate the exit ramp to East Main Street – The exit ramp to East Main Street will be relocated south of its present location to increase the weave distance from the I-691 EB on-ramp.
- Relocate the exit ramp to I-91 SB – Construct a new two-lane ‘fly-over’ ramp from Route 15 SB to I-91 SB to replace the current undesirable one-lane left-hand configuration, improve driver expectancy and reduce confusion. Bridge No. 01819 (East Main Street ramp over Route 15 SB) will be replaced to accommodate the new lane configuration.
- Widen Route 15 SB – Widen Route 15 SB to accommodate the new two-lane ramp from I-91 SB. It is also proposed to realign the on-ramp from East Main Street. Bridge No. 05382 (Paddock Avenue over Route 15) will be replaced as a part of the 0079-0246 project to accommodate the Route 15 widening.

I-691 Westbound

The portion of I-691 WB on Bridge No. 1831 (I-691 WB over I-91) will be restriped to accommodate two travel lanes. The inside lane will be an exit only lane and it will carry the traffic from I-691 WB to I-91 SB and the outside lane will be a I-691 WB through lane. The one lane section of I-691 WB continues westerly for about 700 feet until it meets with a two-lane entrance ramp from I-91 SB thereby matching with existing three-lane section of I-691 WB.

I-691 Eastbound

The portion of I-691 EB between South Broad Street overpass and Route 15 overpass will be milled and repaved.

Additional improvements associated with this project include:

- a. I-91 SB, I-691 WB, I-691 EB, Route 66 WB, Route 15 SB pavement rehabilitation
- b. I-91 SB, I-691 WB, I-691 EB, Route 66 WB, Route 15 SB roadside safety improvements
- c. Repair/ rehabilitation of five bridges, including deck patching and parapet upgrades
- d. Repair/ rehabilitation and widening of two bridges including deck patching and parapet upgrades
- e. Upgrades to existing drainage systems
- f. Upgrade highway illumination

3.2 DESIGN EXCEPTIONS AND JUSTIFICATIONS

This is a 4R (resurfacing, restoration, rehabilitation, and reconstruction) project and it was initiated to make specific improvements to the existing roadways including freeways, ramps, and local roads. As such the approach to identifying design exceptions is to apply the Department’s new construction criteria specifically to the geometric design element that is being improved, unless the existing substandard condition is made worse, or a new deficiency is caused by the proposed improvements. The deficiencies and justifications include the following:

- Substandard shoulder widths are proposed for segments of I-91 SB. Justifications include providing consistent corridors at tie-ins, avoiding impacts to the alignment of the parallel running I-91 NB, and to minimize staging impacts to the traveling public.
- Substandard shoulder widths are proposed for segments of Route 15 SB. Justifications include avoiding reconstructions of Bridge No. 01821 due to widening, impacting the traveling public, and requiring embankment reconstruction.
- Substandard cross slopes of 2% for left shoulder are proposed on I-91 SB at bridges over Baldwin Ave (Bridge No. 3051) and Bee Street (Bridge No. 1829). Justifications include avoiding increased costs, lane closures on bridges, and challenges to underground utilities and drainage.
- It is proposed to maintain existing substandard minimum vertical clearance for Bridge Nos. 01829 (I-91 SB over Bee Street) and 03051 (I-91 SB over Baldwin Avenue) that are to be widened. Justifications include avoiding reconstruction of ramp intersections and avoiding impacts to utilities, drainage, private properties, and the traveling public.

The Project design exceptions and justifications are provided in greater detail within the Southbound Improvements Design Exceptions Report.

3.3 PROPOSED GEOMETRIC DESIGN DATA

The proposed design data for each facility is provided in **Table 3-1** through **Table 3-15**. Refer to Interstate Access Modification Justification Report for detailed traffic volumes.

Table 3-1 - I-91 SB

Functional Design Classification		Urban Freeway	
Type of Area		Suburban	
Type of Improvement		New Construction/Major Reconstruction Urban Freeway	
2051 Build ADT		55,700 at East Main Street	
Design Element	Existing	CTDOT Highway Design Manual (CTHDM 2003 - Rev. Feb 2013)	Proposed
Design Speed	65 MPH	65 - 70 MPH	65 MPH
85 th Percentile Speed	SB: 69 MPH	N/A	N/A
Lane Width	12'	12'	12'
Shoulder Width - Outside	10' ^{1,2}	12' ^{1,2}	Var 4' to 12' *
Shoulder Width - Inside	4' ^{1,2}	12' ^{1,2}	Var 10' to 12' *
Bridge Width	Meet Approach Roadway Width	Meet Approach Roadway Width	Meet Approach Roadway Width
Min. Radius	2610'	1665'	2610'
K Crest	295	193	295
K Sag	115	157	115 ⁴
Max. Grade	3.0%	4.0%	3.0%
Min. Grade	0.5%	0.5%	0.5%
Stopping Sight Distance	480'	645'	480' ⁴
Cross-Slope - Travel Lane	1.5-2.0% adjacent to crown 1.8% away from crown	1.5-2.0% adjacent to crown 2.0% away from crown	1.5% adjacent to crown 2.0% away from crown
Cross-Slope - Shoulder	4%	4% - 6%	Var 2% to 4%*
Maximum Superelevation	7.05%	6%	5.2%
Min. Vert Clearance for Freeway Under...	New Hwy Bridge	N/A	16'-3"
	Exist. Hwy Bridge	15'-7"	16'-0"
	Overhead Signs	N/A	18'-0"
Min. Vertical Clearance: Local/ Collector Under Existing Highway Bridge	14'-1"	14'-3"	14'-1" ³
Roadside Clear Zone	12'	26 - 30'	26'

* Design Exception will be requested

1. 6+ lane highway (3 lanes in each direction)
2. Where the truck volumes exceed 250 DDHV, both the left and right shoulders should be 12 feet
3. Existing vertical clearance will be maintained
4. Existing condition

Table 3-2 - I-691 EB

Functional Design Classification		Urban Freeway	
Type of Area		Suburban	
Type of Improvement		New Construction/Major Reconstruction Urban Freeway	
2051 Build ADT		51,000	
Design Element	Existing	CTDOT Highway Design Manual (CTHDM 2003 - Rev. Feb 2013)	Proposed
Design Speed	65 MPH	65 - 70 MPH	65 MPH
85 th Percentile Speed	EB: 63 MPH	N/A	N/A
Lane Width	12'	12'	12'
Shoulder Width - Outside	3' ^{1,2}	10' ^{1,2}	10'
Shoulder Width - Inside	4' ^{1,2}	10' ^{1,2}	4' [*]
Bridge Width	Meet Approach Roadway Width	Meet Approach Roadway Width	Meet Approach Roadway Width
Min. Radius	1910'	1665'	2000'
K Crest	215	193	215
K Sag	157	157	157
Min. Grade	1.5%	0.5%	1.5%
Max. Grade	3.0%	4.0%	3.0%
Stopping Sight Distance	525'	645'	525' ⁴
Cross-Slope - Travel Lane	0.1-1.1% adjacent to crown 1.1% away from crown	1.5-2.0% adjacent to crown 2.0% away from crown	1.5% adjacent to crown 2.0% away from crown
Cross-Slope - Shoulder	4% - 6%	4% - 6%	4%
Maximum Superelevation	5.21%	6%	5.9%
Min. Vert Clearance for Freeway Under...	New Hwy Bridge	N/A	N/A
	Exist. Hwy Bridge	13'-10"	13'-10" ^{* 3}
	Overhead Signs	N/A	18'-0"
Min. Vertical Clearance: Local/ Collector Under Existing Highway Bridge	14'-3"	14'-3"	14'-3"
Roadside Clear Zone	26'	26 - 30'	26'

* Design Exception will be requested

1. 6+ lane highway (3 lanes in each direction)
2. Where the truck volumes exceed 250 DDHV, both the left and right shoulders should be 12 feet
3. Existing vertical clearance will be maintained
4. Existing condition

Table 3-3 - I-691 WB (Sta 6141+16 to 6117+50)

Functional Design Classification		Urban Freeway	
Type of Area		Suburban	
Type of Improvement		New Construction/Major Reconstruction Urban Freeway	
2051 Build ADT		29,600	
Design Element	Existing	CTDOT Highway Design Manual (CTHDM 2003 - Rev. Feb 2013)	Proposed
Design Speed	65 MPH	65 - 70 MPH	65 MPH
85 th Percentile Speed	WB: 63 MPH	N/A	N/A
Lane Width	12'	12'	12'
Shoulder Width - Outside	3' ¹	10' ¹	10'
Shoulder Width - Inside	4' ¹	10' ¹	4'
Bridge Width	Meet Approach Roadway Width	Meet Approach Roadway Width	Meet Approach Roadway Width
Min. Radius	N/A	1665'	N/A
K Crest	N/A	193	N/A
K Sag	N/A	157	N/A
Min. Grade	1.0%	0.5%	1.0%
Max. Grade	1.0%	4.0%	1.0%
Stopping Sight Distance	645'	645'	645'
Cross-Slope - Travel Lane	0.1-1.1% adjacent to crown 1.1% away from crown	1.5-2.0% adjacent to crown 2.0% away from crown	1.5% adjacent to crown 2.0% away from crown
Cross-Slope - Shoulder	4%	4% - 6%	4%
Maximum Superelevation	N/A	6%	N/A
Min. Vert Clearance for Freeway Under...	New Hwy Bridge	N/A	N/A
	Exist. Hwy Bridge	15'-9"	15'-9"
	Overhead Signs	N/A	N/A
Min. Vertical Clearance: Local/ Collector Under Existing Highway Bridge	N/A	14'-3"	N/A
Roadside Clear Zone	26'	26 - 30'	26'

* Design Exception will be requested

1. 6+ lane highway (3 lanes in each direction)
2. Where the truck volumes exceed 250 DDHV, both the left and right shoulders should be 12 feet
3. Existing vertical clearance will be maintained
4. Existing condition

Table 3-4 - Route 66 WB

Functional Design Classification		Urban Freeway	
Type of Area		Suburban	
Type of Improvement		New Construction/Major Reconstruction Urban Freeway	
2051 Build ADT		19,200	
Design Element	Existing	CTDOT Highway Design Manual (CTHDM 2003 - Rev. Feb 2013)	Proposed
Design Speed	65 MPH	65 - 70 MPH	65 MPH
85 th Percentile Speed	WB: 63 MPH	N/A	N/A
Lane Width	12'	12'	12'
Shoulder Width - Outside	10' ¹	10' ¹	10'
Shoulder Width - Inside	4' ¹	10' ¹	4'
Bridge Width	Meet Approach Roadway Width	Meet Approach Roadway Width	Meet Approach Roadway Width
Min. Radius	2257'	1665'	2257'
K Crest	N/A	193	N/A
K Sag	85	157	85 ⁴
Min. Grade	1.0%	0.5%	1.0%
Max. Grade	4.0%	4.0%	4.0%
Stopping Sight Distance	424'	645'	424' ⁴
Cross-Slope - Travel Lane	0.1-1.1% adjacent to crown 1.1% away from crown	1.5-2.0% adjacent to crown 2.0% away from crown	1.5% adjacent to crown 2.0% away from crown
Cross-Slope - Shoulder	4% - 6%	4% - 6%	4%
Maximum Superelevation	5.6%	6%	5.6%
Min. Vert Clearance for Freeway Under...	New Hwy Bridge	N/A	16'-3"
	Exist. Hwy Bridge	15'-9"	16'-0"
	Overhead Signs	N/A	18'-0"
Min. Vertical Clearance: Local/ Collector Under Existing Highway Bridge	N/A	14'-3"	N/A
Roadside Clear Zone	26	26 - 30'	26'

* Design Exception will be requested

1. 6+ lane highway (3 lanes in each direction)
2. Where the truck volumes exceed 250 DDHV, both the left and right shoulders should be 12 feet
3. Existing vertical clearance will be maintained
4. Existing condition

Table 3-5 - Route 15 SB

Functional Design Classification		Urban Freeway	
Type of Area		Suburban	
Type of Improvement		New Construction/Major Reconstruction Urban Freeway	
2051 Build ADT		27,600 at East Main Street	
Design Element	Existing	CTDOT Highway Design Manual (CTHDM 2003 - Rev. Feb 2013)	Proposed
Design Speed	65 MPH	65 - 70 MPH	65 MPH
85 th Percentile Speed	SB: 66 MPH	N/A	N/A
Lane Width	12'	12'	12'
Shoulder Width - Outside	10'	10'	10'
Shoulder Width - Inside	2'	8'	Var 2'-4' ^{1,4}
Bridge Width	Meet Approach Roadway Width	Meet Approach Roadway Width	Meet Approach Roadway Width
Min. Radius	5760'	1665'	5760'
K Crest	195	193	195
K Sag	180	157	180
Min. Grade	0.43%	0.5%	0.43% ⁴
Max. Grade	2.9%	4.0%	2.90%
Stopping Sight Distance	857'	645'	857'
Cross-Slope - Travel Lane	0.5-4.9% adjacent to crown 2.0% away from crown	1.5-2.0% adjacent to crown 2.0% away from crown	1.5% adjacent to crown 2.0% away from crown
Cross-Slope - Shoulder	4% - 6%	4% - 6%	4.0%
Maximum Superelevation	3.0%	6%	3.0%
Min. Vert Clearance for Freeway Under...	New Hwy Bridge	16'-3"	16'-3"
	Exist. Hwy Bridge	13'-10"	13'-10" * 3
	Overhead Signs	N/A	18'-0"
Min. Vertical Clearance: Local/ Collector Under Existing Highway Bridge	N/A	14'-3"	N/A
Roadside Clear Zone	26'	26 - 30'	26'

* Design Exception will be requested

1. 6+ lane highway (3 lanes in each direction)
2. Where the truck volumes exceed 250 DDHV, both the left and right shoulders should be 12 feet
3. Existing vertical clearance will be maintained
4. Existing condition

Table 3-6 – 91SB - 691WB Interstate Ramp (Existing Ramp Widened)

Functional Design Classification		Interstate Ramp (Urban)	
Type of Improvement		Urban Freeway – New Construction	
2051 Build ADT		17,600	
Design Element	Existing	CTDOT Highway Design Manual (CTHDM 2003 – Rev. Feb 2013)	Proposed
Design Speed (Ramp Proper)	40 MPH	35-60 MPH	40 MPH
Lane Width	14'	12'	12'
Shoulder Width – Outside	8'	10'	10'
Shoulder Width – Inside	2'	4'	4'
Bridge Width	N/A	Meet Approach Roadway Width	N/A
Min. Radius	1412'	510' (CTHDM Fig 8-2A)	1412'
	N/A	145' (CTHDM Fig. 11-4D -Loop Ramp)	N/A
K Crest	86	44 (CTHDM Fig. 9-3C)	86
K Sag	68	64 (CTHDM Fig. 9-3D)	68
Min. Grade	0.74%	0.5%	0.74%
Max. Grade	2.58%	4% - 6% (CTHDM Fig. 12-4C)	2.58%
Stopping Sight Distance	425'	305' (CTHDM Fig. 7-1A)	425'
Cross-Slope – Travel Lane	1.5%	1.5% (CTHDM Fig. 12-4B)	1.5%
Cross-Slope – Shoulder	1.5% to 4%	1.5% - 4% (CTHDM Fig. 12-4B)	4%
Maximum Superelevation	6.2%	6% (CTHDM Fig. 8-2A)	4.1%
Min Vertical Clearance	N/A	16'-3"	N/A
Roadside Clear Zone	13'	10 - 14' (CTHDM Fig. 13-2A)	13'
Dist. Between Ramps	1120'	See AASHTO (2011) Exhibit 10-68	1120'
Deceleration Length	205'	390' (CTHDM Fig. 12-3A)	500'
Acceleration Length	770'	770' (CTHDM Fig. 12-3D)	770'

* Design Exception will be requested

1. Where the truck volumes exceed 250 DDHV, both the left and right shoulders should be 12 feet
2. Existing vertical clearance will be maintained
3. Existing condition

Table 3-7 – 91SB – 15SB Interstate Ramp (Relocated Ramp)

Functional Design Classification	Interstate Ramp (Urban)		
Type of Improvement	Urban Freeway – New Construction		
2051 Build ADT	20,400		
Design Element	Existing	CTDOT Highway Design Manual (CTHDM 2003 – Rev. Feb 2013)	Proposed
Design Speed (Ramp Proper)	35 MPH	35 – 60 MPH	40 MPH
Lane Width	14'	12'	12'
Shoulder Width – Outside	4'	10'	10'
Shoulder Width – Inside	2'	4'	4'
Bridge Width	Meet Approach Roadway Width	Meet Approach Roadway Width	Meet Approach Roadway Width
Min. Radius	777'	510' (CTHDM Fig 8-2A)	1500'
	N/A	145' (CTHDM Fig. 11-4D -Loop Ramp)	N/A
K Crest	31	44 (CTHDM Fig. 9-3C)	150
K Sag	50	64 (CTHDM Fig. 9-3D)	356
Min. Grade	1.0%	0.5%	0.5%
Max. Grade	5.0%	4% - 6% (CTHDM Fig. 12-4C)	1.78%
Stopping Sight Distance	398'	305' (CTHDM Fig. 7-1A)	438'
Cross-Slope – Travel Lane	1.5%	1.5% (CTHDM Fig. 12-4B)	1.5%
Cross-Slope – Shoulder	1.5% - 4%	1.5% – 4% (CTHDM Fig. 12-4B)	4%
Maximum Superelevation	4.8%	6% (CTHDM Fig. 8-2A)	4%
Min Vertical Clearance	15'-11"	14'-6"	16'-3"
Roadside Clear Zone	10'	10 - 14' (CTHDM Fig. 13-2A)	14'
Dist. Between Ramps	960'	See AASHTO (2011) Exhibit 10-68	See AASHTO (2011) Exhibit 10-68
Deceleration Length	N/A	390' (CTHDM Fig. 12-3A)	N/A ²
Acceleration Length	N/A	770' (CTHDM Fig. 12-3D)	N/A ²

* Design Exception will be requested

1. Two-lane exit with shared lane
2. Ramp continues as auxiliary lane
3. Existing vertical clearance will be maintained
4. Existing condition

Table 3-8 - 691WB - 91SB Interstate Ramp (Existing Ramp)

Functional Design Classification		Interstate Ramp (Urban)	
Type of Improvement		Urban Freeway – New Construction	
2051 Build ADT		6,200	
Design Element	Existing	CTDOT Highway Design Manual (CTHDM 2003 – Rev. Feb 2013)	Proposed
Design Speed (Ramp Proper)	40 MPH	35-60 MPH	40 MPH
Lane Width	14'	12'	12'
Shoulder Width – Outside	8'	10'	10'
Shoulder Width – Inside	4'	4'	4'
Bridge Width	Meet Approach Roadway Width	Meet Approach Roadway Width	Meet Approach Roadway Width
Min. Radius	402'	510' (CTHDM Fig 8-2A)	402' ⁴
	N/A	145' (CTHDM Fig. 11-4D -Loop Ramp)	N/A
K Crest	60	44 (CTHDM Fig. 9-3C)	60
K Sag	45	64 (CTHDM Fig. 9-3D)	45 ⁴
Min. Grade	1.2%	0.5%	1.2%
Max. Grade	6.3%	4% - 6% (CTHDM Fig. 12-4C)	6.3% ⁴
Stopping Sight Distance	181'	305' (CTHDM Fig. 7-1A)	181' ⁴
Cross-Slope – Travel Lane	1.5%	1.5% (CTHDM Fig. 12-4B)	1.5%
Cross-Slope – Shoulder	1.5% to 4%	1.5% – 4% (CTHDM Fig. 12-4B)	4%
Maximum Superelevation	6.0%	6% (CTHDM Fig. 8-2A)	6.0%
Min Vertical Clearance	16'-2"	16'-0"	16'-2"
Roadside Clear Zone	13'	10 - 14' (CTHDM Fig. 13-2A)	14'
Dist. Between Ramps	N/A	See AASHTO (2011) Exhibit 10-68	N/A
Deceleration Length	N/A	390' (CTHDM Fig. 12-3A)	N/A
Acceleration Length	960'	770' (CTHDM Fig. 12-3D)	1150'

* Design Exception will be requested

1. Two-lane exit with shared lane
2. Ramp continues as auxiliary lane
3. Existing vertical clearance will be maintained
4. Existing condition

Table 3-9 – 15SB – 91SB Off-Ramp (New Ramp)

Functional Design Classification		Interstate Ramp (Urban)	
Type of Improvement		Urban Freeway – New Construction	
2051 Build ADT		14,600	
Design Element	Existing	CTDOT Highway Design Manual (CTHDM 2003 – Rev. Feb 2013)	Proposed
Design Speed (Ramp Proper)	35 MPH	35 – 60 MPH	40 MPH
Lane Width	14'	12'	12'
Shoulder Width – Outside	4'	10'	10'
Shoulder Width – Inside	3'	4'	4'
Bridge Width	N/A	N/A	N/A
Min. Radius	764'	510' (CTHDM Fig. 8-2A)	600'
	N/A	145' (CTHDM Fig. 11-4D – Loop Ramp)	N/A
K Crest	41.23	44 (CTHDM Fig. 9-3C)	44
K Sag	50.78	64 (CTHDM Fig. 9-3D)	64
Min. Grade	0.26%	0.5%	0.57%
Max. Grade	5.6%	4% - 6% (CTHDM Fig. 12-4C)	6.75% ³
Stopping Sight Distance	256.8'	305' (CTHDM Fig. 7-1A)	308'
Cross-Slope – Travel Lane	1.5%	1.5% (CTHDM Fig. 12-4B)	1.5%
Cross-Slope – Shoulder	1.5% - 4%	1.5% – 4% (CTHDM Fig. 12-4B)	4%
Maximum Superelevation	4.8%	6% (CTHDM Fig. 8-2A)	5.9%
Min Vertical Clearance	N/A	14'-6"	>16'-3"
Roadside Clear Zone	10'	10 - 14' (CTHDM Fig. 13-2A)	14'
Dist. Between Ramps	1540'	See AASHTO (2011) Exhibit 10-68	420'
Deceleration Length	N/A ¹	390' (CTHDM Fig. 12-3A)	N/A ¹
Acceleration Length	N/A ²	770' (CTHDM Fig. 12-3D)	N/A ²

* Design Exception will be requested

1. Existing lane drop. Proposed two-lane exit with shared lane (500 ft. of parallel section)
2. The ramp continues as third lane of I-91 SB
3. Occurs on a down grade

Table 3-10 – 691EB - 15SB Off-Ramp (Existing Ramp Widened)

Functional Design Classification		Interstate Ramp (Urban)	
Type of Improvement		Urban Freeway – New Construction	
2051 Build ADT		22,400	
Design Element	Existing	CTDOT Highway Design Manual (CTHDM 2003 – Rev. Feb 2013)	Proposed
Design Speed (Ramp Proper)	35 MPH	35 – 60 MPH	40 MPH
Lane Width	14'	12'	12'
Shoulder Width – Outside	4'	10'	10'
Shoulder Width – Inside	3'	4'	4'
Bridge Width	N/A	N/A	N/A
Min. Radius	1180'	510' (CTHDM Fig. 8-2A)	1180'
	N/A	145' (CTHDM Fig. 11-4D – Loop Ramp)	N/A
K Crest	109	44 (CTHDM Fig. 9-3C)	109
K Sag	50	64 (CTHDM Fig. 9-3D)	50 ¹
Min. Grade	0.5%	0.5%	0.5%
Max. Grade	5.0%	4% - 6% (CTHDM Fig. 12-4C)	5.0%
Stopping Sight Distance	388'	305' (CTHDM Fig. 7-1A)	388'
Cross-Slope – Travel Lane	1.5%	1.5% (CTHDM Fig. 12-4B)	1.5%
Cross-Slope – Shoulder	1.5% - 4%	1.5% – 4% (CTHDM Fig. 12-4B)	4%
Maximum Superelevation	4.5%	6% (CTHDM Fig. 8-2A)	4.5%
Min Vertical Clearance	N/A	N/A	N/A
Roadside Clear Zone	10'	10 - 14' (CTHDM Fig. 13-2A)	14'
Dist. Between Ramps	2450'	See AASHTO (2011) Exhibit 10-68	2450'
Deceleration Length	N/A ²	390' (CTHDM Fig. 12-3A)	N/A ²
Acceleration Length	N/A ³	770' (CTHDM Fig. 12-3D)	N/A ³

* Design Exception will be requested

1. Existing condition
2. Lane drop
3. Continues as auxiliary lane of Route 15 SB

Table 3-11 – 91SB - Preston Ave Off-Ramp (Existing Ramp)

Functional Design Classification		Interstate Ramp (Urban)	
Type of Improvement		Urban Freeway – New Construction	
2051 Build ADT		2,200	
Design Element	Existing	CTDOT Highway Design Manual (CTHDM 2003 – Rev. Feb 2013)	Proposed
Design Speed (Ramp Proper)	35 MPH	35 – 60 MPH	35 MPH
Lane Width	14'	12'	12'
Shoulder Width – Outside	4'	10'	10'
Shoulder Width – Inside	3'	4'	4'
Bridge Width	N/A	N/A	N/A
Min. Radius	421'	385' (CTHDM Fig. 8-2A)	421'
	N/A	145' (CTHDM Fig. 11-4D – Loop Ramp)	N/A
K Crest	55	29 (CTHDM Fig. 9-3C)	55
K Sag	N/A	49 (CTHDM Fig. 9-3D)	N/A
Min. Grade	2.3%	0.5%	2.3%
Max. Grade	5.5%	4% - 6% (CTHDM Fig. 12-4C)	5.5%
Stopping Sight Distance	254'	250' (CTHDM Fig. 7-1A)	254'
Cross-Slope – Travel Lane	1.5%	1.5% (CTHDM Fig. 12-4B)	1.5%
Cross-Slope – Shoulder	1.5% - 4%	1.5% – 4% (CTHDM Fig. 12-4B)	4%
Maximum Superelevation	6%	6% (CTHDM Fig. 8-2A)	6%
Min Vertical Clearance	N/A	N/A	N/A
Roadside Clear Zone	10'	10 - 14' (CTHDM Fig. 13-2A)	14'
Dist. Between Ramps	3700'	See AASHTO (2011) Exhibit 10-68	3700'
Deceleration Length	300'	440' (CTHDM Fig. 12-3A)	448'
Acceleration Length	N/A	1000' (CTHDM Fig. 12-3D)	N/A

* Design Exception will be requested

Table 3-12 – 91SB - East Main Street Off-Ramp (Relocated Ramp)

Functional Design Classification		Interstate Ramp (Urban)	
Type of Improvement		Urban Freeway – New Construction	
2051 Build ADT		3,300	
Design Element	Existing	CTDOT Highway Design Manual (CTHDM 2003 – Rev. Feb 2013)	Proposed
Design Speed (Ramp Proper)	35 MPH	35 – 60 MPH	35 MPH
Lane Width	14'	12'	12'
Shoulder Width – Outside	4'	10'	10'
Shoulder Width – Inside	2'	4'	4'
Bridge Width	Meet Approach Roadway Width	Meet Approach Roadway Width	30'
Min. Radius	777'	385' (CTHDM Fig. 8-2A)	400'
	N/A	145' (CTHDM Fig. 11-4D – Loop Ramp)	N/A
K Crest	31	29 (CTHDM Fig. 9-3C)	29
K Sag	50	49 (CTHDM Fig. 9-3D)	50
Min. Grade	1.0%	0.5%	1.0%
Max. Grade	5.0%	4% - 6% (CTHDM Fig. 12-4C)	5.0%
Stopping Sight Distance	398'	250' (CTHDM Fig. 7-1A)	251'
Cross-Slope – Travel Lane	1.5%	1.5% (CTHDM Fig. 12-4B)	1.5%
Cross-Slope – Shoulder	1.5% - 4%	1.5% – 4% (CTHDM Fig. 12-4B)	4%
Maximum Superelevation	4.8%	6% (CTHDM Fig. 8-2A)	6%
Min Vertical Clearance	15'-11"	16'-3"	16'-3"
Roadside Clear Zone	10'	10 - 14' (CTHDM Fig. 13-2A)	14'
Dist. Between Ramps	960'	See AASHTO (2011) Exhibit 10-68	1150'
Deceleration Length	N/A	440' (CTHDM Fig. 12-3A)	N/A ¹
Acceleration Length	N/A	1000' (CTHDM Fig. 12-3D)	N/A

* Design Exception will be requested

1. Existing lane drop

Table 3-13 – 15SB - East Main Street Off-Ramp (New Ramp)

Functional Design Classification		Interstate Ramp (Urban)	
Type of Improvement		Urban Freeway – New Construction	
2051 Build ADT		6,400	
Design Element	Existing	CTDOT Highway Design Manual (CTHDM 2003 – Rev. Feb 2013)	Proposed
Design Speed (Ramp Proper)	35 MPH	35 – 60 MPH	35 MPH
Lane Width	14'	12'	12'
Shoulder Width – Outside	4'	10'	10'
Shoulder Width – Inside	3'	4'	4'
Bridge Width	N/A	N/A	N/A
Min. Radius	1020'	385' (CTHDM Fig. 8-2A)	2000'
	N/A	145' (CTHDM Fig. 11-4D – Loop Ramp)	N/A
K Crest	41	29 (CTHDM Fig. 9-3C)	94
K Sag	51	49 (CTHDM Fig. 9-3D)	60
Min. Grade	0.5%	0.5%	0.5%
Max. Grade	2.0%	4% - 6% (CTHDM Fig. 12-4C)	2.0%
Stopping Sight Distance	254'	250' (CTHDM Fig. 7-1A)	254
Cross-Slope – Travel Lane	1.5%	1.5% (CTHDM Fig. 12-4B)	1.5%
Cross-Slope – Shoulder	1.5% - 4%	1.5% – 4% (CTHDM Fig. 12-4B)	3.6%
Maximum Superelevation	4.3%	6% (CTHDM Fig. 8-2A)	2.8%
Min Vertical Clearance	N/A	N/A	N/A
Roadside Clear Zone	10'	10 - 14' (CTHDM Fig. 13-2A)	14'
Dist. Between Ramps	1400'	See AASHTO (2011) Exhibit 10-68	2300'
Deceleration Length	N/A ¹	440' (CTHDM Fig. 12-3A)	N/A ¹
Acceleration Length	N/A	1000' (CTHDM Fig. 12-3D)	N/A

* Design Exception will be requested

1. Lane drop

Table 3-14 - East Main Street - 15SB On-Ramp

Functional Design Classification		Interstate Ramp (Urban)	
Type of Improvement		Urban Freeway - New Construction	
2051 Build ADT		3,700	
Design Element	Existing	CTDOT Highway Design Manual (CTHDM 2003 - Rev. Feb 2013)	Proposed
Design Speed (Ramp Proper)	35 MPH	35 - 60 MPH	35 MPH
Lane Width	14'	12'	12'
Shoulder Width - Outside	4'	10'	4' ¹
Shoulder Width - Inside	3'	4'	4'
Bridge Width	Meet Approach Roadway Width	Meet Approach Roadway Width	Meet Approach Roadway Width
Min. Radius	764'	385' (CTHDM Fig. 8-2A)	670'
	N/A	145' (CTHDM Fig. 11-4D - Loop Ramp)	N/A
K Crest	41	29 (CTHDM Fig. 9-3C)	41
K Sag	51	49 (CTHDM Fig. 9-3D)	51
Min. Grade	0.5%	0.5%	0.5%
Max. Grade	5.6%	4% - 6% (CTHDM Fig. 12-4C)	5.6%
Stopping Sight Distance	256.8'	250' (CTHDM Fig. 7-1A)	256.8'
Cross-Slope - Travel Lane	1.5%	1.5% (CTHDM Fig. 12-4B)	1.5%
Cross-Slope - Shoulder	1.5% - 4%	1.5% - 4% (CTHDM Fig. 12-4B)	4.0%
Maximum Superelevation	5.0%	6% (CTHDM Fig. 8-2A)	5.0%
Min Vertical Clearance	N/A	N/A	N/A
Roadside Clear Zone	10'	10 - 14' (CTHDM Fig. 13-2A)	14'
Dist. Between Ramps	1000'	See AASHTO (2011) Exhibit 10-68	1000'
Deceleration Length	N/A	440' (CTHDM Fig. 12-3A)	N/A
Acceleration Length	800'	1000' (CTHDM Fig. 12-3D)	1000'

* Design Exception will be requested
¹ Existing condition

Table 3-15 - East Main Street - 91SB On-Ramp (New Ramp)

Functional Design Classification		Interstate Ramp (Urban)	
Type of Improvement		Urban Freeway - New Construction	
2051 Build ADT		3,400	
Design Element	Existing	CTDOT Highway Design Manual (CTHDM 2003 - Rev. Feb 2013)	Proposed
Design Speed (Ramp Proper)	35 MPH	35 - 60 MPH	35 MPH
Lane Width	14'	12'	12'
Shoulder Width - Outside	4'	10'	10'
Shoulder Width - Inside	3'	4'	4'
Min. Radius	1400'	385' (CTHDM Fig. 8-2A)	2200'
	N/A	145' (CTHDM Fig. 11-4D - Loop Ramp)	N/A
K Crest	43	29 (CTHDM Fig. 9-3C)	43
K Sag	60	49 (CTHDM Fig. 9-3D)	57
Min. Grade	0.5%	0.5%	0.75%
Max. Grade	3.6%	4% - 6% (CTHDM Fig. 12-4C)	3.6%
Stopping Sight Distance	256.8'	250' (CTHDM Fig. 7-1A)	377'
Cross-Slope - Travel Lane	1.5%	1.5% (CTHDM Fig. 12-4B)	1.5%
Cross-Slope - Shoulder	1.5% - 4%	1.5% - 4% (CTHDM Fig. 12-4B)	4%
Maximum Superelevation	3.6%	6% (CTHDM Fig. 8-2A)	4%
Min Vertical Clearance	14'-6"	14'-6"	N/A ¹
Roadside Clear Zone	10'	10 - 14' (CTHDM Fig. 13-2A)	14'
Dist. Between Ramps	600'	See AASHTO (2011) Exhibit 10-68	N/A
Deceleration Length	N/A	440' (CTHDM Fig. 12-3A)	N/A
Acceleration Length	200	1000' (CTHDM Fig. 12-3D)	300' ¹

* Design Exception will be requested

1. This ramp merges with Route 15 SB to I-91 SB ramp

3.4 TYPICAL SECTIONS

This project proposes to incorporate the following improvements:

- The cross slopes of the roadways that will be milled and repaved will be corrected with the help of wedge courses to meet the standard values.
- The roadside existing guiderail will be replaced with a MASH compliant guiderail.
- To protect existing bridge piers at the locations where shoulder widths are very narrow, 54" vertical barriers are proposed to comply with the zone of intrusion requirements.
- Maximum 2:1 side slopes are proposed with exception of a few localized areas where 1.5:1 slopes are proposed to minimize impacts to private property and/or regulated areas.

The proposed typical sections are provided under a separate cover within the Project Plans.

3.5 INTERCHANGE CONFIGURATIONS

The proposed interchange configuration for each mainline within the Project area are as follows:

- I-91 SB connects to Preston Avenue/Baldwin Avenue via Exit 19. Southbound traffic continues to and connects to I-691 WB via Exit 18 and is accessed by I-691 WB. Exit 17 connects I-91 SB right-hand traffic to East Main Street. Further south, I-91 connects to Route 15 SB via proposed right-hand exit and is accessed by Route 15 SB via proposed right-hand entrance ramp 9S5S.
- Route 15 SB is accessed by I-691 EB from the right-hand side. The right-hand lane later connects to East Main Street via proposed exit ramp 5SEM south of Bridge No. 01824. Route 15 SB connects to I-91 SB via a proposed right-hand exit ramp 5S9S. East Main Street traffic merges on the right south of Bridge No. 01819 and then I-91 SB traffic merges in on the left via proposed left-hand entrance ramp EM9S.
- I-691 EB connects to Route 15 SB via Interchange 10E, then connects to I-91 NB via Exit 11, is then accessed by I-91 NB/Route 15 NB, and then connects to Preston Avenue via Exit 12.
- I-691 WB is accessed by Preston Avenue, then connects to I-91 NB via Exit 11, connects with I-91 SB at Exit 10, then is accessed by I-91 NB/I-691 WB two-lane on-ramp, and connects to Route 15 NB via Exit 9.

3.6 SEDIMENTATION AND EROSION CONTROL

The purpose of erosion and sediment control is to reduce runoff velocities during construction in order to protect the ecosystem including wetland areas surrounding the proposed project. The Sediment and Erosion Control design consists of utilizing silt fences placed at a 10-foot offset from the toe of slope on any new fill slopes placed. The fill slope will be stabilized with erosion control matting by placing the matting between the new edge of road and the cut or fill lines throughout the project limits. In areas with milling and resurfacing, silt fences will be placed at a 10-foot offset of the toe of slope within the project. All proposed slopes on the project are a maximum of 2:1 (with a few exceptions where 1.5:1 slopes are proposed), so that the silt fencing will have sufficient capacity to contain the sediment during construction activity. The existing catch basins will be protected using hay bale barriers to block sediment from infiltrating the existing drainage system.

3.7 CONCRETE PAVEMENT REPAIR

Repair locations within the project limits generally fall into two categories: Joint Repairs and Slab Distress Repairs. Joint Repairs are intended to address failing joints with poor joint load transfer. Slab Distress Repairs are intended to address any areas defects near the joint (corner breaks, spalls, etc.), mid-slab distresses, and any areas identified as high potential areas of distress within pavement layers from GPR data. All full depth new construction for widenings and revised alignments have been designed using 30-year design lives. Further pavement report details for will be provided under a separate cover.

The overall pavement design being recommended for mainline I-91 and I-691 will incorporate milling down to concrete pavement, performing joint repairs, slab repairs, crack repairs and overlaying with AC pavement for a 20-year design life. While a 30-year design life is the preferred duration stated by CTDOT, the required overlay on heavily traveled I-91 and I-691 was found to result in excessive overlay thicknesses and corresponding impacts. Given this, along with the age and anticipated future decay of the underlying PCC pavement, it was felt that a 20-year design for these roadways was most appropriate and feasible. For Route 15 and all ramps, the same design approach will be applied, only using a 30-year overlay thickness, which for these lower volume roadways was found to be close to current overlay thickness values.

4.0 Structural Design

4.1 GEOTECHNICAL CONDITIONS

Geotechnical conditions for the proposed structures and major rehabilitation structural improvements are as listed below. Note that all provided elevations are measured from the current vertical datum.

BRIDGE NO. 03052 (MAJOR REHABILITATION): Subsurface information for the bridge includes four borings performed as part of the design of the original bridge in 1964. In addition, the design team also reviewed information from two of the borings performed in May 2021 by New England Boring Contractors under the direction of GZA GeoEnvironmental, Inc. (GZA), the project geotechnical consultant, for the proposed widening of the adjacent bridge (Bridge No. 03051). These recent borings are located approximately 60 feet south of the proposed widening of Bridge No. 03052.

There are two additional borings planned as part of preliminary design for CTDOT Project No. 0079-0240 that will be performed for the proposed bridge widening to confirm conditions encountered in the historical borings and to provide additional subsurface data. The borings were not complete at the time of preparation of this report.

Based on the historical borings, as well as historical design plans that show existing and proposed site conditions at the time of design and construction of the original bridge, the subsurface conditions, in order of decreasing depth, generally consist of relatively shallow overburden soils consisting of natural sand & gravel overlying bedrock. In some borings, basalt bedrock overlies sandstone bedrock, while in other borings, the basalt bedrock was not present. The top of bedrock was encountered in the recent borings closest to the north abutment between approximately EL. 297 and EL. 312 and closest to the south abutment between approximately EL. 292 and EL. 310. Generally, the top of bedrock appears to slope from northwest to southeast.

BRIDGE NO. 01824 (PROPOSED STRUCTURE): Subsurface information for the bridge includes five borings performed as part of the design of the original bridge in 1961. There are four additional borings planned as part of preliminary design for CTDOT Project No. 0079-0240 that will be performed for the proposed replacement bridge to confirm conditions encountered in the historical borings and provide additional subsurface data. The borings were not complete at the time of preparation of this report.

Based on the historical borings, as well as historical design plans that show existing and proposed site conditions at the time of design and construction of the original bridge, the subsurface conditions, in order of decreasing depth, are anticipated to generally consist of fill placed during construction of the existing bridge overlying natural granular soils consisting predominately of sand with up to 50% silt and up to 50% gravel, which in turn overlies weathered bedrock and bedrock. The top of sandstone bedrock was encountered in the historical explorations at approximately EL. 254 at the west abutment between EL. 260 and EL. 263 at the east abutment.

BRIDGE NO. 01819 (PROPOSED STRUCTURE): Subsurface information for the bridge includes eight borings and two test pits performed as part of the design of the original bridge in the 1960s. There are four additional borings planned within the footprint of the proposed replacement bridge as part of preliminary design for CTDOT Project No. 0079-0240 to confirm conditions encountered in the historical borings and to provide additional subsurface data. The additional borings were not complete at the time of preparation of this report.

Subsurface conditions at the site are anticipated to vary widely from north to south. Based on the information in the historical boring logs and bridge design plans, it appears that the existing Route 15 roadway, the existing bridge piers, and northern side of the bridge were constructed over a former swamp area. It appears that the peat/organics associated with the swamp area were removed to construct the existing Route 15 roadway and then later, when the bridge was constructed, additional removal of peat/organics was required to construct the north abutment. Based on the borings, it does not appear that the swamp extended up to the south abutment.

The natural soils underlying the peat and swamp fill generally consist of silt or clayey silt with a varying amount of fine sand and gravel, which in turn overlies glacial till with boulders, weathered bedrock and bedrock. The top of glacial till is generally encountered between approximately EL. 259 and EL. 265. Bedrock was classified as red-brown sandstone or red-brown sandstone shale. The top of bedrock was encountered between approximately EL. 256 and EL. 263.

BRIDGE NO. 01829 (MAJOR REHABILITATION): Subsurface information for the bridge includes four borings performed as part of the design of the original bridge in 1961. There are two additional borings planned as part of preliminary design for CTDOT Project No. 0079-0240 that will be performed for the proposed bridge widening to confirm conditions encountered in the historical borings and provide additional subsurface data. The borings were not completed at the time of preparation of this report.

Based on the historical borings, as well as historical design plans that show existing and proposed site conditions at the time of design and construction of the original bridge, the subsurface conditions, in order of decreasing depth, are anticipated to generally consist of fill placed during construction of the existing bridge overlying natural soils and sandstone bedrock. There appears to be two layers within the overburden soils with the upper layer consisting of a mix of sand, silt, and clayey silt and the lower layer consisting of a mix of sand, silt, and gravel. The lower layer is denser, predominantly granular, and is reported to contain boulders and cobbles. The top of sandstone bedrock ranged from approximately EL. 229 to EL. 231.

BRIDGE NO. 01833 (MAJOR REHABILITATION): Subsurface information for the bridge includes four borings performed as part of the design of the original bridge in 1961. The design team notes that there are a series of additional borings planned for a new retaining wall located along the west side of the roadway ramp that starts just before the bridge and then extends beyond the bridge that is proposed as part of preliminary design for CTDOT Project No. 0079-0240. The borings were not complete at the time of preparation of this report.

Based on the historical borings, as well as historical design plans that show existing and proposed site conditions at the time of design and construction of the original bridge, the subsurface conditions, in order of decreasing depth, are anticipated to generally consist of fill that was placed following excavation for foundations of the proposed bridge and construction of the approach roadways for the bridge. This fill overlies natural granular soils consisting predominately of very dense sand and gravel that is noted to include boulders and cobbles overlying a relatively thin layer of very hard clayey silt that grades into boulders and cobbles with silt, sand, and gravel (possibly weathered bedrock). Bedrock cores were obtained in the weathered bedrock layer, but it appears that competent bedrock was not encountered within the depth of the borings.

BRIDGE NOS. 00797, 01826, 01831, 01834, AND 03046: The scope of work for these bridges does not include any major substructure rehabilitation work, just concrete repairs and application of a penetrating sealer. Therefore, geotechnical investigations are not required for these bridges.

CULVERT NOS. 01822 AND 01823: Based on the Indepth Inspection Report for Structure No. 01822 for I-91 & Route 15 over Willow Brook, dated July 16, 2021, inspected by Haks, the channel bottom at the culvert consists of sand, silt, and boulders. Additional subsurface information for these culverts includes three borings performed for a culvert that was replaced by Culvert Nos. 01822 and 01823 and two borings performed for Culvert Nos. 01822 and 01823. Subsurface conditions based on these historical borings, in order of decreasing depth, generally consist of silt or organic silt, overlying natural sand, silt, and gravel, which in turn overlies sandstone bedrock. The top of bedrock was encountered in the historical borings between approximately EL. 262 and EL. 267.

CULVERT NO. 01841: Subsurface information for the culvert includes four borings performed as part of the culvert design in 1961. Based on the historical borings, as well as historical design plans that show existing and proposed site conditions at the time of design and construction of the culvert, the subsurface conditions, in order of decreasing depth, generally consist of up to about 30 feet of fill placed over the culvert to construct the I-691 roadway (formerly U.S. Route 6A) above, overlying natural sand, silt, and gravel. The top of bedrock was not encountered in the borings; however, refusal was encountered at approximately EL. 220 in the borings.

CULVERT NO. 03049: Subsurface information for the culvert includes one boring performed as part of the design of the culvert in 1961. Based on the historical borings, as well as historical design plans that show existing and proposed site conditions at the time of design and construction of the culvert, the subsurface conditions, in order of decreasing depth, generally consist of overburden soils comprised of sand, silt, and gravel overlying weathered sandstone bedrock. Depth to the weathered bedrock is anticipated to be approximately two to five feet below the bottom of Culvert No. 03049.

PROPOSED CULVERT UNDER RAMP 5S9S: There is one boring planned for the proposed culvert and two nearby borings for proposed retaining walls that will be performed as part of preliminary design for CTDOT Project No. 0079-0240 to provide subsurface information for design of the culvert and retaining walls. The borings were not complete at the time of preparation of this report. However, based on historical borings performed for the design of the west abutment of nearby Bridge No. 01821 in 1962, the subsurface conditions, in order of decreasing depth, are anticipated to generally consist of topsoil, overlying natural granular soils consisting of sand, silt, and gravel overlying sandstone bedrock. The top of bedrock was encountered between approximately EL. 243 and EL. 259.

CULVERT NO. 02159: There is no subsurface information available at this culvert location. However, based on borings performed in 1961 for design of nearby Culvert No. 03049 located approximately 200 feet northeast, the subsurface conditions may be similar. Subsurface conditions at Culvert No. 03049 generally consist of overburden soils comprised of sand, silt, and gravel overlying weathered sandstone bedrock. Depth to the weathered bedrock is anticipated to be approximately five to ten feet below the bottom of Culvert No. 03049.

UNNAMED CULVERTS: There are two unnamed culverts, one carrying the East Main Street exit ramp to I-91 SB and one carrying the East Main Street exit ramp to Route 15 SB, whose field inspections have not yet been taken at the time of preparation of this report. Therefore, the scope of work has not been determined yet for these two culverts.

4.2 HYDRUALICS AND DRAINAGE INVOLVEMENT

During the Preliminary Engineering phase, peak flows were determined for the culvert structures. For the numbered culverts, design flows were established using USGS regression equations adjusted for urbanization. These culverts are all classified as intermediate structures with hydraulic design criteria of 100-year design storm, 500-year check storm, \leq one-foot backwater, and one-foot freeboard. Design flows for the unnumbered culverts were established using TR-55; these culverts are all classified as small structures with hydraulic design criteria of a 50-year design storm, 100-year check storm, and 1-foot minimum freeboard.

With the exception of Culvert No. 02159, no significant improvements/changes are proposed to the numbered and unnumbered culverts. Culvert No. 02159, which carries Willow Brook under Route 15 SB in the northwest quadrant of the project area, will be modified as part of the proposed widening of Route 15. The modification to Culvert No. 02159 results in minor increases and decreases in water surface elevations and velocities upstream of the structure. Topography contains the minor increases within the channel and embankment along the residential properties to the west. A wider floodplain contains increases in the State Right-of-Way (ROW) to the east. The modifications to Culvert No. 02159 will not alter the hydraulic capacity of the structure, will not adversely impact the floodplain, and will not increase the potential for flooding of the residential properties to the west.

One new structure, Culvert 5S9S (Route 15 SB to I-91 SB over Willow Brook), is required to accommodate the relocated ramp 5S9S. The proposed culvert will carry Ramp 5S9S traffic with a 38-foot roadway width. The structure will provide an open area of ± 57 SF. This structure provides adequate hydraulic capacity to pass the 50-year design storm (190 CFS) and provide $>$ one-foot freeboard (4.2' freeboard for the design storm).

The hydraulic analyses for all structures, numbered and unnumbered, demonstrate the existing structures to remain and new Culvert 5S9S are hydraulically adequate. Rehabilitated structures will maintain hydraulic conditions and will not adversely impact the floodplain or channels.

4.3 HYDROLOGY RELATED PERMIT REQUIREMENTS

Refer to **Section 2.2** of this report for a list of permit requirements.

4.4 SUMMARY OF STRUCTURE TYPES AND REHABILITATION STUDY REPORTS

There are a total of 21 structures in the Southbound Project 0079-0240 (eleven culverts and ten bridges).

Of the ten bridges in the scope, two are replacements of existing structures (01819 and 01824), two are structure widenings (01829 and 03052), and the remaining six bridges are proposed rehabilitations.

Of the eleven culverts in the scope, one is a new structure (Culvert 5S9S), one is a structure widening (02159), eight structures are proposed for rehabilitation, and one is a town owned structure (79015) with no rehabilitation proposed.

PROPOSED STRUCTURES

The list of structures that are replacement/new structures in Project No. 0079-0240 is provided in **Table 4-1** below. For a detailed discussion of the replacement structures please refer to the individual structure type studies.

Table 4-1 - List of Proposed Structures

Structure	Skew (degrees)	Length (ft)	No. Spans	Curb-Curb (ft)	Out-Out (ft)
Bridge No. 01819	45	170' ±	1	50'-0"	53'-2 ½"
Bridge No. 01824	45	107'±	1	30'-0"	33'-2 ½"
Culvert 5S9S	61.91 with ramp	160'	2	38'-0" (Roadway)	41'-2 ½" (Roadway)

BRIDGE NO. 01819

Bridge No. 01819 (East Main Street to Route 15 SB over I-91 SB) will be replaced with a new structure to accommodate the highway improvements. The proposed replacement to Bridge No. 01819 will carry three 12-foot travel lanes, a 10-foot right and 4-foot left shoulder (50'-0" travel way). The bridge will carry East Main Street to I-91 SB (one travel lane) and Route 15 SB to I-91 SB traffic (two travel lanes). The bridge was aligned to limit the maximum allowable skew to 45 degrees and provide adequate minimum vertical clearance (16'-3") to the travel way below (Route 15 SB and I-91 SB to Route 15). The proposed structure will span approximately 170 feet and be simply supported. The proposed configuration eliminates the need for a central pier, which reduces substructure costs and improves the driver safety. Due to the large span (170') and moderately high skew (45 degrees), a steel plate, multi-girder system with a reinforced concrete slab is the preferred superstructure configuration. The substructure will be supported by traditional cast-in-place reinforced concrete abutments. The cast-in-place reinforced concrete abutments will be supported by shallow foundations.

BRIDGE NO. 01824

Bridge No. 01824 (I-91 SB to East Main Street over Route 15 SB) will be replaced with a new structure to accommodate the highway improvements. The proposed replacement to Bridge No. 01824 will carry one 12-foot travel lane, a 14-foot right shoulder, and 4-foot left shoulder (30'-0" travel way). The bridge will carry I-91 SB to East Main Street. The bridge was aligned to limit the maximum allowable skew to 45 degrees and provide adequate minimum vertical clearance (16'-3") to the travel way below (Route 15 SB). The proposed structure will span approximately 107 feet and be simply supported. The proposed configuration is the shortest crossing over Route 15 SB while maintaining the requirements of the highway design criteria. Due to the moderately high skew (45 degrees), span length, and flexibility of steel, a steel plate, multi-girder system with a reinforced concrete slab is the preferred superstructure configuration. The substructure will be supported by

traditional cast-in-place reinforced concrete abutments. The cast-in-place reinforced concrete abutments will be supported by shallow foundations.

Culvert 5S9S

Culvert 5S9S (Route 15 SB to I-91 SB over unnamed tributary to Willow Brook) will be a new structure for the relocated ramp 5S9S to accommodate the highway improvements. The proposed culvert will carry Ramp 5S9S traffic with two 12-foot travel lanes, a 10-foot right shoulder, and 4-foot left shoulder (38'-0" travel way). The ramp roadway embankment will be supported by Mechanically Stabilized Earth (MSE) retaining walls (RW 91S-103 and RW 91S-104) on both sides. The culvert will also carry a portion of the MSE wall. The culvert carries approximately two feet of fill (including roadway section). The proposed culvert will be a 10-foot-wide by 8-foot-deep single cell precast four-sided reinforced concrete box culvert. The culvert will have two-feet minimum of native streambed material for the channel and will carry a two-foot-wide critter shelf on one side. The proposed channel is 6-foot wide at the bottom and eight-foot wide at the top with a side slope of 2:1. Skewed wingwalls and a concrete apron with cutoff and return walls are being proposed at both upstream and downstream of the culvert.

PROPOSED WIDENINGS

The list of structures that are proposed widenings in Project No. 0079-0240 is provided in **Table 4-2** and **Table 4-3** below. For a detailed discussion of the modifications required for the structure widenings please refer to the individual Rehabilitation Study Reports provided under a separate cover.

Table 4-2 - List of Proposed Bridge Widenings

Bridge	Exist. Curb-Curb (ft)	Prop. Curb-Curb (ft)	Exist. Out-Out (ft)	Prop. Out-Out (ft)
01829	61'-10"	70'-0" ±	65'-6"	73'-5" ±
03052	51'-10"	72'-0"	55'-6"	75'-5" ±

Table 4-3 - List of Proposed Culvert Widenings

Culvert	Exist. Culvert Length (ft)	Prop. Culvert Length (ft)
02159	160'-5"	165'-5" ±

BRIDGE NO. 01829

Bridge No. 01829 (I-91 SB over Bee Street) will be widened to accommodate the highway improvements of I-91 SB. The structure will be widened to the south (towards I-91 NB). The proposed widening will allow the structure to carry four 12-foot travel lanes, a 10-foot ± right and 12-foot left shoulder (70'-0" ± travel way).

The widened portion of the structure was investigated for minimum vertical clearance to ensure the new portion of the structure would not further limit vertical clearance of the structure. The proposed widening will match the existing structure in kind.

Due to aesthetics, constructability, and ease of maintenance, the proposed superstructure will match the existing structure in kind. The substructure will be extended to support the structure widening. The existing cast-in-place reinforced concrete abutments are supported by a shallow foundation, as such the proposed substructure will also be supported by a shallow foundation.

BRIDGE NO. 03052

Bridge No. 03052 (I-91 SB over Baldwin Avenue) will be widened to accommodate the highway improvements of I-91 SB. The structure will be widened to the south (towards I-91 NB). The proposed widening will allow the structure to carry four 12-foot travel lanes, a 12-foot right shoulder, and a 12-foot left shoulder (72'-0" travel way).

The widened portion of the structure was investigated for minimum vertical clearance to ensure the new portion of the structure would not further limit vertical clearance of the structure. The proposed widening will match the existing structure in kind.

Due to aesthetics, constructability, and ease of maintenance, the proposed superstructure will match the existing structure in kind. The substructure will be extended to support the structure widening. The existing cast-in-place reinforced concrete abutments are supported by a shallow foundation, as such the proposed substructure will also be supported by a shallow foundation.

CULVERT NO. 02159

Culvert No. 02159 (Route 15 and Ramp 6E5S over Willow Brook) is a two-cell reinforced concrete box culvert with reinforced concrete channel walls and a bottom slab at the upstream end and inline wingwalls with concrete apron, cutoff and return walls on the downstream end. Culvert No. 02159 will be widened approximately seven feet to the west (upstream), in order to accommodate the highway improvements of Ramp 6E5S.

The proposed widening will allow the culvert to carry the additional lane that is being added for Ramp 6E5S along with a MASH compliant parapet on the widened portion. For widening of the culvert, the top portion of the existing upstream channel walls will be modified to accommodate a top slab and the existing culvert center wall will be extended to support the new top slab. The culvert will also undergo concrete rehabilitation including rehabilitation of leaking joints between culvert segments utilizing expanded polystyrene fill and the removal of debris and vegetation that adversely impacts the flow of water through the culvert.

Water handling will be required to facilitate rehabilitation of the culvert. Water will be diverted into one cell of the culvert using water diversion barriers (e.g., sandbags), while the other cell is rehabilitated. Subsequently, the flow of water will be switched, and the other cell rehabilitated. Since the culvert widening is being performed utilizing the existing upstream channel walls foundation modifications are not anticipated. For a full list of rehabilitation tasks, refer to the Rehabilitation Study Report provided under a separate cover.

STRUCTURE REHABILITATION

The list of structures which will undergo minor rehabilitation in Project No. 0079-0240 is provided in **Table 4-4** and **Table 4-5** below. For a detailed discussion of the condition based and safety improvements required for the structures please refer to the individual Rehabilitation Study Reports provided under a separate cover.

Table 4-4 - Bridge Condition Factors

Bridge	Deck Condition (58)	Superstructure Condition (59)	Paint	Substructure Condition (60)
00797	6	6	N/A	7
01831	6	5	5	6
01834	7	6	3	6
01826	6	5	5	6
01833	6	6	3	6
03046	7	6	3	6

NBI condition factors are per the latest inspection report on file

Table 4-5 - Culvert Condition Factors

Culvert	Channel Protection (61)	Culvert (62)
01822	6	6
01823	5	6
01839	6	6
01840	6	6
01841	6	6
02159	5	6
03049	6	7
Ramp EM5S	Unknown	Unknown

Ramp EM9S	Unknown	Unknown
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NBI condition factors are per the latest inspection report on file

BRIDGE NO. 00797

Bridge No. 00797 is a reinforced concrete frame which carries Route 15 over Miller Avenue. Route 15 SB will be widened into the existing grassy median which is carried by this bridge. No structural modifications are necessary to accommodate the revised highway layout. In order to accommodate the highway widening, the top layer of fill on the arch will need to be removed and replaced. While the fill is removed, this structure will undergo concrete full and partial depth patching of the top barrel of the arch, new waterproofing and surface repairs of the frame of the arch. The existing ornamental parapets are to remain in place.

BRIDGE NOS. 01831, 01834, 01826, 01833, AND 03046

The remaining five bridges will undergo removal of the existing wearing surface, patching of the concrete deck, new waterproofing membrane, and wearing surface. The joints of this structures will be replaced during the re-surfacing. The existing safety-walk parapets will be modified to F-Shape parapets, in order to meet MASH compliance. The superstructure will undergo full abrasive blast cleaning and field painting of the entire steel superstructure. Additional miscellaneous tasks will include replacement of the expansion bearings, cleaning and painting the fixed bearings, patching spalls and cracks in the substructure, and steel repair of the superstructure. A full list of rehabilitation tasks will be provided within the Rehabilitation Study Report under a separate cover.

Additionally, the west abutment of Bridge No. 01833 will require extensive underpinning to accommodate the widening of Ramp I-691 TR802 (Route 15 NB to I-691 WB). Please refer to the Rehabilitation Study Report under a separate cover for further details.

CULVERT NOS. 01822, 01823, 01839, 01840, 01841, 02159, AND 03049

The culvert structures noted here are cast-in-place twin cell reinforced concrete four-sided box culverts with wingwalls at both upstream and downstream ends. The culverts will undergo concrete rehabilitation including rehabilitation of leaking joints between culvert segments utilizing expanded polystyrene fill and the removal of debris and vegetation that adversely impacts the flow of water through the culvert. Water handling will be required to facilitate rehabilitation of the culvert. Water will be diverted into one cell of the culvert using water diversion barriers (e.g., sandbags), while the other cell is rehabilitated. Subsequently the flow of water will be switched, and the other cell rehabilitated. A full list of rehabilitation tasks will be provided within the Rehabilitation Study Report under a separate cover.

UNNUMBERED CULVERTS (EM5S AND EM9S)

The culvert structures noted here are single cell reinforced concrete elliptical pipes with headwalls and wingwalls. The conditions of these structures are unknown since no bridge safety inspection reports exist. Video inspections for these culverts are underway to determine the condition of the culverts. The rehabilitation scope for these two culverts will be determined once the inspections and rehabilitation studies have been completed. Access roads to perform any repairs to these culverts are not anticipated at this time, but the design team will re-evaluate once the Rehabilitation scope is finalized.

ACCESS ROADS

Rehabilitation of the culverts, with the exception of the unnumbered culverts listed above, will require installation of temporary access roads. Temporary wetland impacts are anticipated to accommodate the access roads. The access roads are assumed to consist of 18-inch processed aggregate in non-wetland areas and timber crane matting placed on the existing ground in wetland areas. This will need to be evaluated further during final design phase. It is also assumed that these access roads are temporary. The need for permanent access roads will need to be evaluated during final design based on feedback from the Bridge Safety and Maintenance Units.

4.5 SUMMARY OF RETAINING WALL STUDY REPORTS

Southbound walls identified in the Preliminary Southbound Retaining Wall Report were located, where needed, to avoid impacts to adjacent structures, wetlands, environmentally or culturally sensitive areas, and ROW due to the shift in roadway alignment or roadway widening. Start and end of wall locations were determined using the existing grades at the interface of the critical features identified above and located such that a 2:1 slope from the edge of the proposed roadway would no longer impact them.

At a fill location, walls were placed where a 2:1 slope from the edge of the new roadway would impact the features identified above. Walls at a fill location will generally consist of MSE (Mechanically Stabilized Earth) walls with a concrete moment slab where a concrete barrier or parapet is proposed on top of the wall.

At a cut location, a concrete barrier or parapet will be used to retain soils up to the height of the barrier (3'-6") above the roadway surface, where possible. Where retained soil height exceeds the height of the concrete barrier, a concrete cantilever wall is proposed. At some locations, where there are extreme constraints between the proposed face of the wall and a structure or ROW line, pile and lagging walls are proposed at cut locations.

The following **Table 4-6** is a summary of the southbound retaining walls, please refer to the Preliminary Southbound Retaining Wall Report under a separate cover for expanded information and detail on each wall.

Table 4-6 - Southbound Retaining Wall Summary

Wall Nuber	Wall Location	Begin Wall Station	End Wall Station	Wall Length	Wall Type	Cut or Fill	Wall Area (SF)
RW 15S-101	Route 15 SB	4103+30 LT	4108+50 LT	520'	MSE	Fill	2,123
RW 15S-102	Route 15 SB Under East Main Street	4077+52 LT	4078+85 LT	133'	Concrete Cantilever	Cut	765
RW 91S-103	Route 15 SB Ramp to I-91 SB	238+25 LT	251+50 LT	1,322'	MSE	Fill	16,085
RW 91S-104	Route 15 SB Ramp to I-91 SB	236+80 RT	246+79 RT	999'	MSE	Fill	19,370
RW 91S-105	I-91 SB to East Main Street	387+23 LT	391+49 LT	426'	MSE	Fill	6,994
RW 91S-106	I-91 SB	2139+75 LT	2140+76 LT	101'	Concrete Parapet	Cut	N/A
RW 91S-107	Route 15 SB to I-91 SB	230+19 LT	231+73 LT	154'	MSE	Fill	809
RW 91S-108	Route 15 SB to I-91 SB	232+70 LT	234+21 LT	129'	MSE	Fill	548
RW 91S-109	Route 15 SB to I-91 SB	232+70 RT	235+99 RT	329'	MSE	Fill	3,674
RW 91S-110	I-91 SB	2080+25 LT	2085+50 LT	525'	MSE	Fill	2,625
RW 15S-111	Route 15 SB	4027+00 LT	4027+50 LT	50'	MSE	Fill	208
RW 15S-112	Route 15 SB	4028+50 LT	4031+11 LT	261'	MSE	Fill	783
RW 15S-113	Route 15 SB	4037+05 LT	4041+50 LT	445'	MSE	Cut	3,968
RW 15S-114	Route 15 SB	4047+01 LT	4052+00 LT	499'	Concrete	Cut/Fill	665
RW 15S-115	Route 15 SB	4053+81 LT	4054+18 LT	37'	Concrete	Fill	26
RW 15S-116	Route 15 SB	4084+25 LT	4087+34 LT	309'	MSE	Fill	875

RW 91S-117	I-91 SB	2072+81 LT	2073+50 LT	69'	MSE	Fill	155
RW 91S-118	East Main to I-91 SB Ramp	336+64 RT	338+96 RT	232'	MSE	Fill	967
RW 91S-119	East Main to I-91 SB Ramp	2085+91 LT	2087+87 LT	184'	MSE	Fill	1,288
RW 15S-120	Route 15 SB	4098+78 RT	4099+50 RT	72'	Concrete Cantilever	Cut	1,236
RW 15S-121	Route 15 SB	4100+75 LT	4101+26 LT	51'	MSE	Fill	587

4.6 STAGING AND SEQUENCE OF CONSTRUCTION

PROPOSED STRUCTURES

- Bridge No. 01819:** The proposed alignment for the replacement of Bridge No. 01819 is partially on the existing footprint of Bridge No. 01819, as a result the bridge will need to be constructed in stages. Two 11-foot lanes with two-foot shoulders will be constructed on the portion of the structure which will support the proposed Route 15 SB to I-91 SB alignment. Existing traffic from East Main Street to I-91 SB will be temporarily shifted on to the Route 15 SB to I-91 SB alignment and be carried by one 11-foot lane. With traffic on the newly constructed portion of the bridge, the existing structure can be demolished, and the rest of the proposed structure can be built.
- Bridge No. 01824:** The proposed alignment for replacement Bridge No. 01824 is mostly outside of the existing footprint of Bridge No. 01824. The structure will be constructed in stages nonetheless to not interfere with the existing structure. One 11-foot lane with two-foot shoulders will be constructed on the north side of the structure. Existing traffic from I-91 SB to East Main Street will be shifted onto the new structure. Once traffic has been shifted, the existing bridge can be demolished, and the remaining portion of the new structure can be built. See the Structure Type Study Report under a separate cover for information regarding the construction activities and necessary maintenance and protection of traffic.
- Culvert 5S9S:** The proposed alignment for construction of the proposed ramp 5S9S is completely offline and will not impact traffic. Handling water will need to be performed to build the culvert and realign the brook. Stage construction of the culvert is not anticipated.

BRIDGE WIDENINGS

Bridge Nos. 01829 and 03052 proposed bridge widenings will utilize temporary precast concrete barriers anchored to the concrete slab to protect the work zone during the bridge widening activities. Traffic lane widths will be reduced to 11-feet and shoulders to two-feet. See the Rehabilitation Study Report under a separate cover for information regarding the construction activities and necessary maintenance and protection of traffic.

STRUCTURE REHABILITATION

All structure rehabilitation (except for culverts) will utilize temporary precast concrete barriers anchored to the concrete slab to protect the work zone during rehabilitation activities, including but not limited to deck patching and parapet modification. Traffic lane widths will be reduced to 11-feet and shoulders to two-feet. See the Rehabilitation Study Report under a separate cover for information regarding the construction activities and necessary maintenance and protection of traffic.

CULVERT REHABILITATION

All culvert rehabilitation can be performed without any major impacts to the traffic the culverts are carrying. Traffic impacts will be restricted to accessing the culverts from the proposed access roads. Since the culverts are subject to only minor rehabilitation, staging and sequence of construction is not expected to be critical. Handling of water flow through the culverts will need to be addressed before performing repairs to the culverts. Since these culverts are twin-box culverts, performing repairs to one cell at a time and handling the flows through the other cell is anticipated. Refer to the culvert

specific Rehabilitation Study Report under a separate cover for information regarding the construction activities and necessary maintenance and protection of traffic.

4.7 LIST OF SPECIAL PROVISIONS REQUIRED AND NOTICES TO CONTRACTOR

Special provisions and notices to Contractor will be provided under a separate cover.

5.0 Traffic Design

5.1 EXISTING CONDITIONS AND CRASH DATA

EXISTING I-91 SB

North of Interchange 17, I-91 SB provides three travel lanes. A lane drop at Interchange 17 reduces I-91 SB to two travel lanes until Interchange 67 S (Route 15 SB to I-91 SB), where the on-ramp from Route 15 SB results in three travel lanes.

Vehicles travelling on I-91 SB experience back-ups during the afternoon peak hours due to the limited capacity of the single-lane off-ramp to Route 15 SB/East Main Street at Interchange 17 (I-91 SB to Route 15 SB). The resulting queue on the right lane of I-91 SB varies but has been observed to extend approximately one mile. The condition is worsened by the tendency of motorists to cut into the right-lane queue from the center lane, slowing down the center lane traffic as a result.

The configuration of the ramps in this area, combined with the complex connections to East Main Street contribute to operational and safety issues. There are significant geometric deficiencies on the ramps in the vicinity of the East Main Street interchange, including the weaving length on I-91 SB between the on-ramp from I-691 WB and Interchange 17 that is deficient. Vehicles exiting at Interchange 17 must quickly decide between merging to Route 15 SB on the left side or exiting to East Main Street on the right side, since the right lane drops at Interchange 17. Too many decision points within such a short distance may cause driver confusion and increase the potential for crashes. In addition, shoulder widths along I-91 SB within the project limits are observed to be deficient.

EXISTING ROUTE 15 SB

Route 15 SB consists mainly of two travel lanes. There are two segments with an additional third lane. The first segment is an auxiliary lane between the I-691 EB on-ramp and the off-ramp to East Main Street (Interchange 67 W). The second segment is south of Interchange 67 W where an additional lane from the I-91 SB on-ramp (Interchange 17) results in three lanes and ends at the off-ramp to I-91 SB (Interchange 67 S).

A section of Route 15, between the on-ramp from I-91 SB (Interchange 17) and the off-ramp to I-91 SB (Interchange 67 S), experiences congestion and weaving concerns due to the traffic merge from I-691 WB, I-91 SB and Route 15 SB destined for either I-91 SB or Route 15 SB. The left-hand exit ramp from Route 15 SB to I-91 SB also contributes adversely to driver expectancy as well as safety and operations. In addition, the weaving section between the I-691 EB on-ramp to Route 15 SB and the off-ramp to East Main Street is deficient in weave length and contributes to a considerable number of crashes.

EXISTING I-691 EB AND WB

Within the project limits, I-691/Route 66 consists of two mainline lanes of travel in each direction. The I-691/Route 66 access to I-91 NB (Interchange 11) consists of a single one-lane left-hand off-ramp from I-691 EB which merges with the one-lane Route 66 WB off-ramp prior to merging with I-91 NB.

Traffic on I-691 and Route 66 has a predominant flow in the eastbound direction in the morning and in the westbound direction in the afternoon peak hour.

CRASH DATA HISTORY

The southbound crash data between May 1, 2014 and April 30, 2017 indicated there were a total of 549 crashes with 161 injuries and two fatalities (I-91 SB recorded 493 crashes with 150 injuries and two fatalities, Route 15 SB recorded

56 crashes with eleven injuries). The two fatal crashes on I-91 SB included one attributed to an overturned vehicle between Interchange 18 (I-691 WB) and the entrance ramp from I-691 WB (MP 19.9 to 19.7) and a second crash that was the result of a sideswipe between Interchange 17 (Route 15 SB/East Main Street) and the entrance ramp from Route 15 SB (MP 19.3 to 18.6). The predominant types of crashes are listed in **Table 5-1** below:

Table 5-1 - Crash Types

Facility	I-91 SB	Route 15 SB
Rear End	75%	27%
Sideswipe	12%	23%
Fixed Object	11%	50%

The crash data shows that there are high crash rates in this area that can be attributed to congestion due to limited ramp capacity as well as to deficient weaving lengths between I-91 Interchanges 17 and 18.

5.2 PROPOSED MP/T CONCEPTS AND SELECTION

The concepts proposed in the PE phase were reviewed for constructability and were implemented in the Preliminary Design phase. The proposed maintenance and protection of traffic was developed to minimize impacts to traveling public and at the same time offer maximum possible workspace to the Contractor. The staging sequence for the proposed improvements generally follows standard traffic control patterns in accordance with the limitations of operations chart.

The alignments of two bridges, 01819 (Route 15 SB to I-91 SB over Route 15 SB) and 01824 (I-91 SB to East Main Street ramp over Route 15 SB), were revised to address the severe skew angle. The following alternate staging schemes were considered in the development of the horizontal alignment of ramps carrying these bridges:

- Closed road detour
- Temporary bridge
- Offset alignment so that the new bridge can be constructed in a staged construction manner

The closed road detour alternative was not advanced primarily because of heavy traffic volumes and that routing the traffic on city streets for an extended duration would negatively impact abutters along the route which was not considered desirable. The temporary bridge alternative was not advanced primarily because of the cost associated with it. Ultimately the staged construction alternative was selected since it is relatively cost effective and offers relatively minimal disturbance to the traveling public. The staging scheme for these two bridges is included in **Section 4.2** of this report.

5.3 MP/T AND SEQUENCE OF CONSTRUCTION

The proposed sequence of construction is divided into three major stages. Stage 1 is I-91 SB works, Stage 2 is Route 15 SB works, and Stage 3 is I-691 works. These stages are not sequential but are coincidental. There are some works that can occur in each stage at the same time. There is some work that starts in one stage location and goes into another stage location. This work is only shown in one stage. The staging breakdown is listed below.

STAGE 1A

1. Close left shoulder (travel direction) along I-91 SB, reduce lane widths, and shift traffic to the right (outside) from Sta. 2060+00 to Sta. 2232+00.
2. Construct new full depth pavement widening along I-91 SB from Sta. 2060+00 to Sta. 2231+00. Construct full depth crossover connection near Sta. 2221+00.
3. Close left shoulder (travel direction) East Main Street to I-91 SB from I-91 SB to East Main Street.
4. Construct widening portion of East Main Street to I-91 SB on-ramp outside of existing roadway from I-91 SB to East Main Street.

5. Construct new Route 15 SB to I-91 SB bridge over Route 15 SB and I-91 SB to Route 15 SB ramp.
6. Close right shoulder (travel direction) along Route 15 SB, reduce lane widths and shift traffic to the left (inside) from Sta. 4073+00 to Sta. 4083+00.
7. Construct widening portion of Route 15 SB to I-91 SB ramp, outside of existing roadway from Sta. 4074+00 to Sta. 4078+00 for ramp Route 15 SB to I-91 SB exit taper.
8. Construct I-91 SB to East Main Street off-ramp outside of existing roadway, including new I-91 SB to East Main Street bridge over Route 15 SB.
9. Close left shoulder (travel direction) along I-91 SB to I-691 WB ramp.
10. Construct full depth pavement widening on left side of I-91 SB to I-691 WB ramp from Sta. 102+00 to Sta. 111+50.
11. Widen bridge over Preston Ave.

STAGE 1B

12. Continue work on ramps (Route 15 SB to I-91 SB, East Main Street to I-91 SB) and bridges (Route 15 SB to I-91 SB, I-91 SB to East Main Street) started in Stage 1A that are not yet completed.
13. Close right shoulder (travel direction) along I-91 SB, reduce lane widths and shift traffic to the left (inside) from Sta. 2060+00 to Sta. 2095+00, Sta. 2125+00 to Sta. 2151+00, Sta. 2165+00 to Sta. 2185+00, and Sta. 2206+00 to Sta. 2218+00.
14. Construct full depth widening along the right side of I-91 SB from Sta. 2060+00 to Sta. 2093+00, Sta. 2125+00 to Sta. 2150+00, Sta. 2170+00 to Sta. 2183+00, and Sta. 2206+00 to Sta. 2218+00.
15. Construct retaining wall along the right side of I-91 SB from Sta. 2166+50 to Sta. 2177+00.
16. Close right shoulder (travel direction), reduce lane widths, and shift traffic to the left (inside) along 15 SB from Sta. 4073+00 to Sta. 4083+00.
17. Construct full depth widening along the right side of Route 15 SB from Sta. 4073+00 to Sta. 4078+00 for Ramp 5S9S (Route 15 SB to I-91 SB).
18. Close right shoulder (travel direction) along I-91 SB to East Main Street ramp from Sta. 393+00 to Sta. 398+00.
19. Construct full depth widening along right side of I-91 SB to East Main Street ramp and temporary widening along left side of I-91-SB to East Main Street ramp from Sta. 393+00 to Sta. 395+00.
20. Complete construction of new I-91 SB to East Main Street bridge over Route 15 SB.
21. Close right shoulder (travel direction), reduce lane widths, and shift traffic to the left (inside) along I-91 SB to I-691 WB Ramp from Sta. 102+00 to Sta. 112+00.
22. Construct new full depth widening along right side of I-91 SB to I-691 WB ramp from Sta. 102+00 to Sta. 112+00.

STAGE 1C

23. Shift East Main Street to I-91 SB traffic to new ramp.
24. Close existing East Main Street to I-91 SB ramp.
25. Mill and Overlay I-91 SB, East Main Street to I-91 SB ramp, I-91 SB to East Main Street ramp, I-691 EB to I-91 SB ramp, I-91 SB to I-691 WB ramp, I-691 WB to I-91 SB ramp, and I-91 SB to Preston Ave ramp.

STAGE 2A

26. Close right shoulder (travel direction), reduce lane widths, and shift traffic to the left (inside) along Route 15 SB from Sta. 4017+00 to Sta. 4055+00, Sta. 4057+00 to Sta. 4068+00, and Sta. 4074+00 to Sta. 4118+50.
27. Provide breaks in temporary concrete barrier for existing ramp access until the new ramps are in place.

28. Construct full depth pavement widening along right side of Route 15 SB from Sta. 4017+00 to Sta. 4055+00, Sta. 4057+00 to Sta. 4068+00, Sta. 4074+00 to Sta. 4086+00, and Sta. 4092+00 to Sta. 4118+50.
29. Construct full depth pavement widening along right side of Route 15 SB from Sta. 4074+00 to Sta. 4086+00 for the Route 15 SB to I-91 SB Ramp tie-in to the new Route 15 SB to I-91 SB Ramp constructed in Stage 1.
30. Close right shoulder (travel direction) of I-691 EB to Route 15 SB ramp from Sta. 415+00 to Sta. 436+00.
31. Construct full depth pavement widening along I-691 EB to Route 15 SB ramp from Sta. 415+00 to Sta. 436+00.

STAGE 2B

32. Open new Route 15 SB to I-91 SB connection.
33. Close and demolish existing Route 15 SB to I-91 SB.
34. Close left shoulder (travel direction), reduce lane widths, and shift traffic to the right along Route 15 SB from Sta. 4003+37 to Sta. 4082+00.
35. Close right shoulder (travel direction), reduce lane widths, and shift traffic to the left along I-91 SB from Sta. 2098+00 to Sta. 2116+00.
36. Construct new I-91 SB to Route 15 SB connection. Full depth widening along left side of Route 15 SB from Sta. 4003+37 to Sta. 4064+00 and full depth widening along right side of I-91 SB from Sta. 2099+00 to Sta. 2116+00. Provide breaks in temporary concrete barrier for existing ramp access until new ramps in place.
37. Close both shoulders along existing Route 15 SB to East Main Street ramp.
38. Construct Ramp 9SEM (I-91 SB to East Main Street) outside Ramp 5SEM (15 SB to East Main Street) roadway.

STAGE 2C

39. Open new I-91 SB to Route 15 SB connection.
40. Close right shoulder (travel direction) along Route 15 SB from Sta. 4085+00 to Sta. 4103+00.
41. Close left shoulder (travel direction) along Route 15 SB to East Main Street from Sta 355+00 to Sta 359+70.
42. Construct full depth widening Route 15 SB to East Main Street along left side.
43. Close both shoulders at entrance I-91 SB to East Main Street ramp.
44. Continue construction of proposed I-91 SB to East Main Street ramp and bridge.
45. Maintain lane shift entrance to I-91 SB to East Main Street ramp from Stage 1B.

STAGE 2D

46. Close right shoulder (travel direction) along new Route 15 SB to East Main Street from Sta. 355+00 to Sta. 360+00.
47. Close left shoulder (travel direction) along I-91 SB to East Main Street from Sta. 375+50 to Sta. 381+00.
48. Construct full depth Route 15 SB to East Main Street ramp.
49. Demolish existing I-91 SB to East Main Street ramp.
50. Close right shoulder (travel direction) along Route 15 SB from Sta. 4098+70 to Sta. 4109+80.
51. Construct full depth widening on right side along Route 15 SB from Sta. 4099+00 to Sta. 4100+00.

STAGE 2E

52. Mill/Overlay along Route 15 SB from Sta. 4003+00 to Sta. 4121+66.
53. Mill/Overlay East Main Street to Route 15 SB ramp and I-91 SB to East Main Street.

54. Demolish portion of Route 15 SB to East Main Street ramp and I-91 SB to East Main Street ramp outside of proposed roadway.

STAGE 3A

55. Mill/Overlay along I-691 EB from Sta. 5007+84 to Sta. 5061+00.

STAGE 3B

56. Close right shoulder (travel direction) along I-691 WB from Sta. 6120+00 to Sta. 6132+60.

57. Construct full depth widening on right side I-691 WB.

STAGE 3C

58. Mill/Overlay along I-691 WB from Sta. 6117+50 to Sta. 6167+00.

5.4 DRAFT TRAFFIC MANAGEMENT PLAN

The Transportation Management Plan (TMP) is developed pursuant to THE CTDOT'S "Policy on Systematic Consideration and Management of Work Zone Impacts" (Policy Number E&H.O.-57) and the associated Implementation Plan, dated August 6, 2007. Project 0079-0240 may require intermittent, but not continuous, lane closures on mainline I-91 SB, Route 15 SB, and I-691 EB WB, along with temporary ramp closures. The TMP evaluates mitigation strategies to reduce impacts on access, mobility, and safety and makes recommendations for proposed work zone impacts within the project limits. The draft TMP is developed during the preliminary design stage and will be updated regularly over time to reflect the decisions and changes made during the design process. A detailed explanation of the TMP will be provided under a separate cover.

6.0 Hydrology and Hydraulics

6.1 HYDROLOGIC INVOLVEMENT AND WATER RESOURCE IMPACTS

During the Preliminary Engineering phase, hydrology was focused on large and numbered structures that carry Willow Brook, an unnamed tributary to Willow Brook and Spoon Shop Brook through the limits of the three separate projects. Peak flow rates at key design points were computed and approved by CTDOT H&D. These culverts are all classified as intermediate structures per the CTDOT Drainage Manual Table 8-4 based on a drainage area ≥ 1 and < 10 mi². Hydraulic design criteria include a 100-year design storm, 500-year check storm, ≤ 1 -foot backwater, and 1-foot freeboard. Design flows were established using USGS regression equations adjusted for urbanization.

Six additional unnumbered culverts which carry North Branch Spoon Shop Brook, an unnamed tributary to Willow Brook, and drainage towards Harbor Brook were identified as potentially affected by the proposed highway work. Peak flow rates were computed at each structure and approved by CTDOT H&D. The cross culverts are all classified as small structures per CTDOT Drainage Manual Table 8-2 based on drainage areas < 1 mi². Hydraulic design criteria include a 50-year design storm, 100-year check storm, and 1-foot minimum freeboard. Design flows were established using Technical Release 55 (TR-55) Urban Hydrology for Small Watersheds and the NRCS WinTR55 program ver. 1.00.10.

A summary of the structures, compiled by watercourse, is provided in **Table 6-1** below.

Table 6-1 - List of Culvert Structures

Culvert	Structure	Highway	Watercourse
01839	Twin 12' x 8' Conc. Box	I-91	Spoon Shop Brook
01840	Twin 12' x 8' Conc. Box	I-691 EB	Spoon Shop Brook
01841	Twin 12' x 8' Conc. Box	I-691 WB	Spoon Shop Brook
CC-01	96" CMP	I-691 WB Sta. 6153+00	N. Branch Spoon Shop Brook
CC-02	96" CMP	I-691 EB Sta. 5084+00	N. Branch Spoon Shop Brook
01820	Twin 10' x 8' Conc. Box	Route 15 ramps 144 & 147	Willow Brook
79017	Twin 8' x 6' Conc. Box	East Main Street	Willow Brook
79018	10' x 8' Conc. Box	East Main Street	Willow Brook
01822	Twin 10' x 8' Conc. Box	I-91 and Route 15	Willow Brook
01823	Twin 14' x 8' Conc. Box	Ramp 148	Willow Brook
02159	Twin 8' x 6' Conc. Box.	Route 15	Willow Brook
03049	Twin 10' x 7' Conc. Box	I-691 EB	Willow Brook
03050	Twin 10' x 7' Conc. Box	I-691 WB Ramp	Willow Brook
CC-03	76" x 48" RCP	Route 15 SB on-ramp from E. Main	Unnamed tributary Willow Brook
CC-04	83" x 58" RCP	I-91 SB on-ramp from E. Main	Unnamed tributary Willow Brook
CC-05	84" RCP	E. Main near I-91 SB Sta 4078+00	Unnamed tributary Willow Brook
CC-06	Twin 60" CMP	I-691 WB Sta. 6083+60	Drainage towards Harbor Brook

Design flows are utilized to evaluate the structures; see the Hydraulic Analysis Design Report provided under separate cover for details.

With the exception of Culvert No. 02159, no significant improvements/changes are proposed to the major numbered and unnumbered culverts as part of any of the three contracts. Culvert No. 02159, which carries Willow Brook under Route 15 SB in the northwest quadrant of the project area, will be modified as part of the proposed widening of Route 15. However, the modifications will not have a significant impact on the hydraulic adequacy of the structure.

The hydraulic analyses for all structures, numbered and unnumbered, demonstrate the existing structures to remain are hydraulically adequate and modifications and/or new structures will maintain hydraulic conditions and not adversely impact the floodplain or channels.

6.2 PROPOSED IMPROVEMENTS

EXISTING CONDITIONS

The combined project area of 0079-0240 and 0079-0246 is ±190 acres within the highway right-of-way. The existing drainage within the project limits consists of 119 systems, ranging in size from single catch basins with a directly discharged outlet to long, linear systems with dozens of catch basins. Roadside ditches that collect and convey surface runoff to various discharge points, including wetlands or watercourses, snake throughout the project, carried by cross culverts back and forth under the highways. Highway construction dates back to the 1940s for Route 15 and the 1960s to 1980s for I-91, when I-691 was constructed to replace Route 66 as a better way to connect I-91 with I-84. Just like the roadway geometry of the highway mainlines, the drainage for each was constructed during different time periods and utilized different methods to collect and convey stormwater. See **Figure 6-1** below for existing watershed regions.

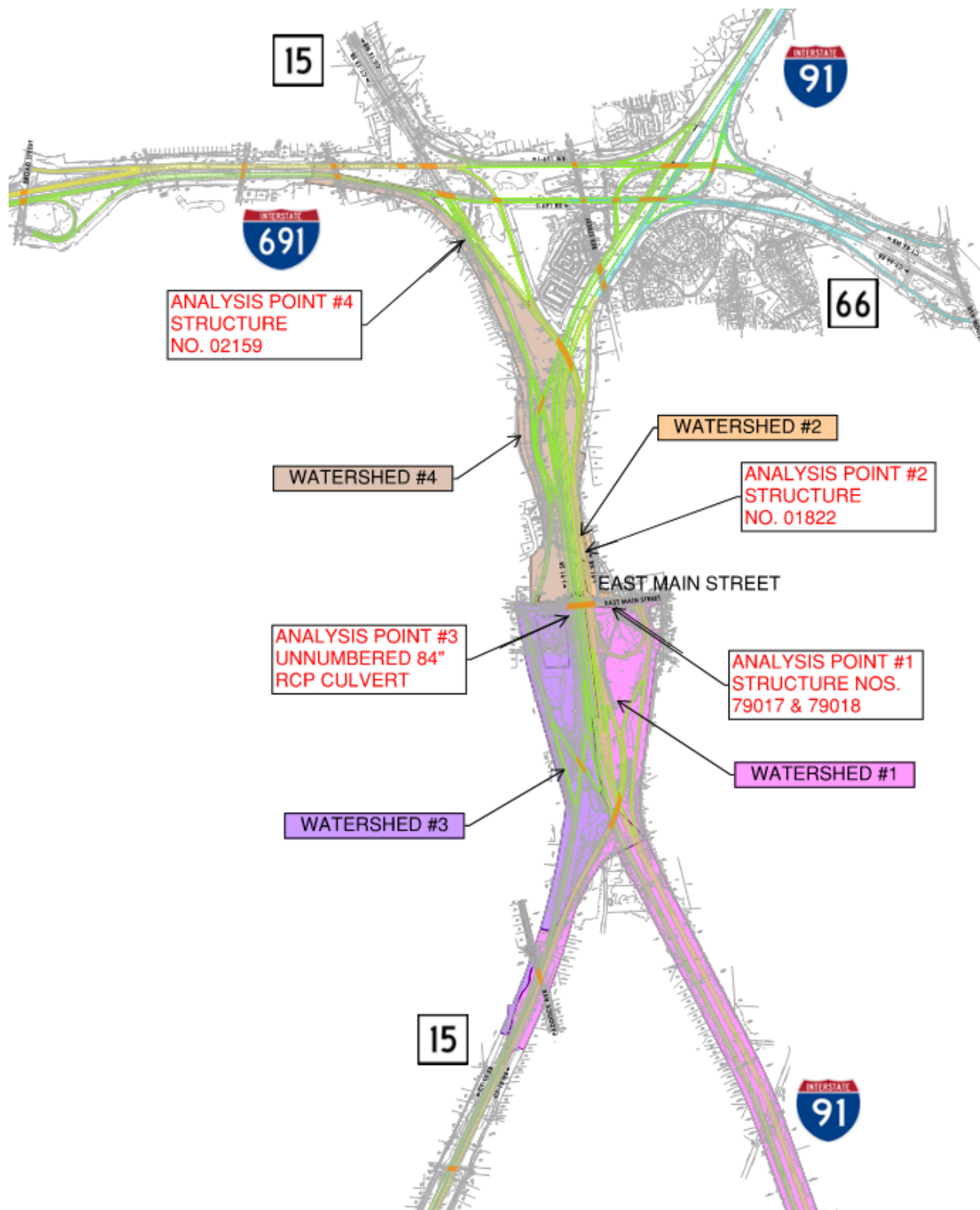


Figure 6-1 – Existing Watershed Map

PROPOSED DRAINAGE

The proposed drainage approach for the standalone design-build contract, 0079-0245, involved utilizing as much existing infrastructure throughout that corridor as possible. This is achievable for two main reasons: first, because the horizontal and vertical alignments of the existing are generally maintained from existing to proposed and second, because the increase in impervious surface through that corridor is only increased by about 8%. However, under both 0079-0240 and 0079-0246, neither condition will be achievable.

The amount of increased impervious area is ± 6 acres throughout the project limits of 0079-0240 and 0079-0246. The increase in impervious surface is throughout the project limits, and primarily around I-91 in both directions, where the existing grassed median will be taken for lane widening. In addition, both contracts include significant changes to ramp alignments. Due to this increase, it is unlikely it is feasible to maintain existing runoff rates.

The quantity of stormwater being discharged to the receiving waterbodies will likely increase. There may be some opportunity to minimize this through infiltration, but field tests to determine infiltration rates are pending and given the soil survey data for the corridor (urban fill), infiltration opportunities may be limited. Understanding that limiting the total volume of runoff increase may not be possible, the approach to proposed drainage design is to minimize impacts to the stream channels and hydraulic structures by controlling the increased runoff and therefore the peak flows at critical analysis points. This is a balancing act that will be an iterative process once full modeling of the proposed drainage systems is completed and capacity analysis can be run.

Focusing on maintaining peak flows at four critical analysis points within the 0079-0240 and 0079-0246 contracts allows for more flexibility in reusing existing infrastructure from some of the 119 drainage systems. It is not feasible to reuse many of these systems because of realignments of the highways and ramps that they currently service. However, the general locations of their outlets will often be reusable, and every effort is made to maintain those locations to minimize impacts to environmental resources.

The four critical analysis points for 0079-0240 and 0079-0246, previously detailed in **Figure 6-1**, represent a culvert or bridge that will remain in place with minor improvements. Each has a fixed capacity that must be essentially maintained or there will be negligible increase between the existing and proposed conditions. The preliminary hydrology and hydraulics analyses provide critical data at these analysis points in order to provide a “baseline” of the existing conditions and determine the existing flows. The baseline flows will then be utilized to size stormwater management BMPs adjacent to each critical analysis point in order to control the peak flows to each structure.

The drainage checklist will be included in the 0079-0246 NB Improvement project submission.

6.3 JUSTIFICATIONS FOR NONSTANDARD DRAINAGE DESIGN ELEMENTS

Drainage design is still in development. Justifications for nonstandard designs, if any, will be provided under a separate cover.

6.4 LIST OF PERMIT REQUIREMENTS

Refer to **Section 2.2** of this report for a list of permit requirements.

6.5 DETENTION DESIGNS

Under the preliminary drainage design phase, the increases in impervious areas to each analysis point have been calculated and potential BMP areas have been identified. A large detention basin is proposed in the southeast quadrant that is earmarked to manage the largest increases in impervious surface from I-91 and Route 15 northbound and southbound widening, which will remove the median drainage ditch. During the subsequent Semi-Final design phase, the BMPs will be further developed and sized based on calculated flows. See **Figure 6-2** below for the proposed detention basin design.

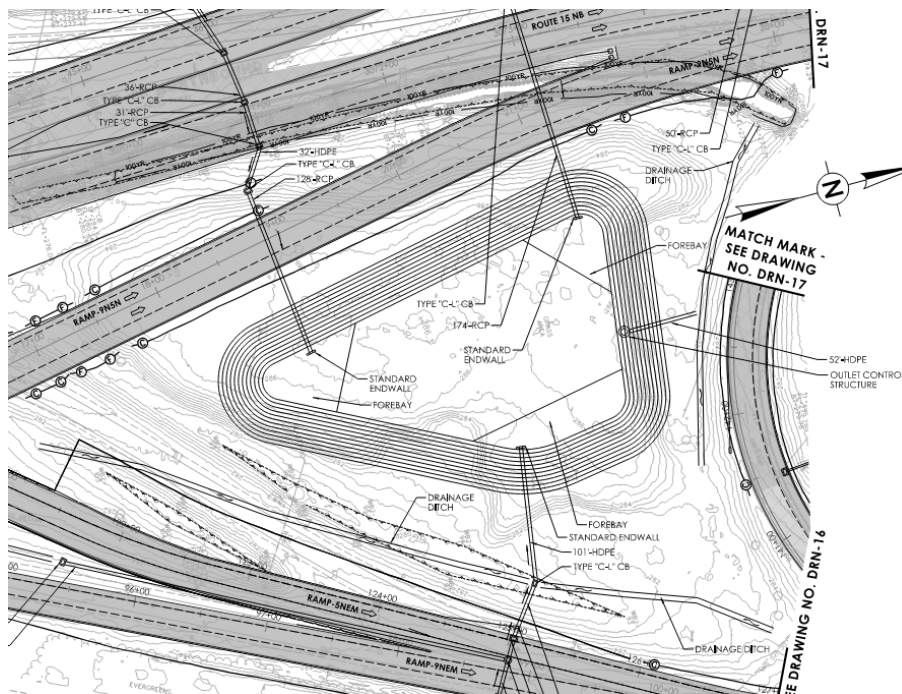


Figure 6-2 - Proposed Detention/Infiltration Basin South of East Main Street

7.0 Noise Mitigation

The need for noise mitigation due to the proposed project is currently under investigation. The project meets the Federal Highway Administration’s (FHWA) definition of a Type I federal-aid highway project. As such, a noise study in accordance with the FHWA Noise Standard at 23 Code of Federal Regulations (CFR) Part 772 (23 CFR 772) and the CTDOT *Highway Traffic Noise Abatement Policy for Projects Funded by the Federal Highway Administration* (Noise Policy), effective May 2017, is required. Modeling of the noise environment in the vicinity of the proposed project is performed utilizing FHWA’s Traffic Noise Model Version 2.5 (TNM 2.5). Multiple noise models are generated in TNM 2.5 to represent Existing, Validation, Future No Build, and Future Build conditions in the study area.

Per the CTDOT Noise Policy, evaluation of traffic noise abatement is warranted and must be considered when traffic noise impacts are identified based on either of the following conditions:

- The predicted worst hour equivalent steady-state sound level (Leq[h]) traffic noise levels for the design year Build conditions approach (within 1 dBA) or exceed the FHWA Noise Abatement Criteria (NAC) contained in 23 CFR 772 and in Table 1 of the Noise Policy; or
- The predicted traffic noise levels for the design year Build conditions substantially exceed existing noise levels by 15 dBA or more.

Noise mitigation for identified traffic noise impacts as defined above are then considered and evaluated for feasibility and reasonableness. The CTDOT Noise Policy defines specific feasibility and reasonableness criteria to be used in the noise mitigation evaluation. All criteria must be met for noise abatement to be justified and incorporated into the project. Evaluation of potential noise wall locations for noise abatement purposes, as applicable, is performed using the noise barrier analysis feature in TNM 2.5. The CTDOT Noise Policy does not specify a particular noise wall construction material or method to be used in the analysis. As such, a Noise Reduction Coefficient (NRC) value of zero (100% reflective; 0% absorptive) is used in the TNM 2.5 analysis for the noise wall material. Standard noise wall analyses assume the wall is rigid, sufficiently dense (at least 20 kilograms/square meter) and contains no holes or cracks along its surface.

Noise walls will be considered where necessary along the project corridor based on the TNM 2.5 results. Any walls that can be designed to meet all feasibility and reasonableness criteria will be proposed for inclusion in the project design.

8.0 Schedule of Property Owners

The schedule of property owners that will experience Right-of-Way impacts are listed in **Table 8-1** below.

Table 8-1 - Schedule of Property Owner Right-Of-Way Impacts

NO.	Owner	Location	Taking Area	Excess Area	Bldg. Part.	Type of Search	Type of Take	Taking Class	Remarks
1	Community Economic Development	Sta. 143+50 LT to 246+50 LT, Route 15 SB to I-91 SB Exit Ramp Meriden, CT	6,300 SF ±	N/A	No	Full	Ease-ment	D	Realignment of Route 15 SB exit ramp to I-91 SB
2	Andres F Quintero	Sta 2079+50 LT to 2086+00 LT, I-91 SB	91,000 SF ±	N/A	No	Full	Ease-ment	D	Potential area for wetlands mitigation
3	City of Meriden	Sta 2079+50 LT to 2086+50 LT, I-91 SB	170,000 SF ±	N/A	No	Full	Ease-ment	D	Potential area for wetlands mitigation

Taking Class D= Partial Land / Easement

9.0 Historic Impacts

The site investigations indicate that there are two known historic properties that had proximity to the Project. Those are the Wilbur Cross Parkway (Route 15) itself, with the two rigid frame concrete bridges that contribute to the Parkway as a group resource, and the Gethsemane Cemetery, which qualifies as an Ancient Burial Ground under State law. However, it has been determined that the Project will not impact Gethsemane Cemetery or either of the rigid frame concrete bridges on Route 15.

10.0 Utilities

Overhead utilities, overhead electrical, and IMS infrastructure will be impacted within the project area. Coordination with associated companies will be required to minimize impact and disruption to the public. Utility companies of the cities within the project area are listed in **Table 10-1** below.

Table 10-1 - List of Utility Companies

City	Type of Utility	Company
Meriden	Cable TV	<ul style="list-style-type: none"> CoxCom, LLC
	Communication	<ul style="list-style-type: none"> Crown Castle Fiber, LLC The Southern New England Telephone Company WiITel Communication, LLC
	Electric	<ul style="list-style-type: none"> The Connecticut Light and Power Company
	Gas	<ul style="list-style-type: none"> Algonquin Gas Transmission Company Yankee Gas Services Company
	Railroad	<ul style="list-style-type: none"> Amtrak – National Railroad Passenger Corp. The York Hill Trap Rock Quarry Company
	Water	<ul style="list-style-type: none"> City of Meriden, Department of Public Works- Water Bureau

City	Type of Utility	Company
Middletown	Cable TV	<ul style="list-style-type: none"> Comcast of Connecticut, Inc
	Communication	<ul style="list-style-type: none"> Cellco Partnership Crown Castle Fiber, LLC The Southern New England Telephone Company
	Electric	<ul style="list-style-type: none"> The Connecticut Light and Power Company
	Gas	<ul style="list-style-type: none"> Algonquin Gas Transmission Company Yankee Gas Services Company
	Petroleum Pipeline	<ul style="list-style-type: none"> Buckeye Pipe Line Company, L.P.
	Railroad	<ul style="list-style-type: none"> Providence and Worcester Railroad Company The York Hill Trap Rock Quarry Company
	Water	<ul style="list-style-type: none"> City of Middletown Water and Sewer Department

A utility coordination meeting was conducted on 06/24/2021. The report of meeting is attached in Appendix A.

11.0 List of Special Provisions and Contractor Notices

Special provisions and notices to Contractor will be provided under a separate cover.

12.0 Construction Cost Estimate

The estimated construction cost of this project is \$163 million. The summary of cost estimate is attached in Appendix B.

The estimated construction cost in the PE phase was \$145 million. The increase in the cost can be primarily attributed to the following factors:

1. Increased allowance for the noise barrier wall
2. Based on the pavement core analysis, the underlying concrete pavement appears to be in poorer condition than what was assumed previously
3. In some areas of Route 15 SB and I-91 SB where there will be a change in the alignment, full depth pavement is proposed instead of the milling and repaving that was assumed previously
4. The cost of structural items has been increased mainly due to the significant increase in the cost of structural steel

13.0 Project Schedule

- FDP Jun 05, 2023
- Design completion..... Aug 14, 2023
- Advertisement..... Aug 14, 2023
- Notice to proceed..... Nov 15, 2023
- Construction completion..... Nov 2027

Appendix A



Connecticut Department of Transportation
 2800 Berlin Turnpike, P.O. Box 317546
 Newington, CT 06111

PARSONS
 330 Roberts Street, Suite 401
 East Hartford, CT 06108

Report of Meeting

STATE PROJECT NOS: 0079-0240/0245/0246 (I-91 / I-691 / Route 15 Interchange Improvements)
 DATE/TIME OF MEETING: June 24, 2021
 LOCATION OF MEETING: Virtual Meeting
 SUBJECT OF MEETING: Utility Coordination Meeting

IN ATTENDANCE

Name	Company	Email
Sebastian Cannamela	CTDOT	Sebastian.cannamela@ct.gov
Pinith Mar	CTDOT	Pinith.mar@ct.gov
Derek Brown	CTDOT	Derek.brown@ct.gov
Latoya Smith	CTDOT	Latoya.smith@ct.gov
Sajjad Alam	Parsons	Sajjad.alam@parsons.com
Ranjit Bhawe	Parsons	Ranjit.bhawe@parsons.com
Panos Oikonomou	Parsons	Panos.oikonomou@parsons.com
Tony Margiotta	GM2	Tony.margiotta@gm2inc.com
Paul Brand	GM2	pbrand@gm2inc.com
Ryan Allard	GM2	rallard@gm2inc.com
Colleen Jost	GM2	cjost@gm2inc.com
Dinesh Kanigolla	GM2	dkanigolla@gm2inc.com
Howard Weisberg	City of Meriden	hweisberg@meridenct.gov
Emile Pierides	City of Meriden	epierides@meridenct.gov
Frank Russo	City of Meriden	frusso@meridenct.gov
Rene Laliberte	City of Meriden	rlaliberte@meridenct.gov
Richard Meskill	City of Meriden	rmeskill@meridenct.gov
Greg Gryczewski	City of Meriden	ggryczewski@meridenct.gov
Eric Anderson	Eversource Gas	Eric.anderson@eversource.com
Michael Prentice	Eversource Electric	Michael.prentice@eversource.com
Marino Limauro	Frontier	Marino.a.limauro@ftr.com
Jose Cedeno	Cox	Jose.cedeno@cox.com

TRANSACTIONS AND DETERMINATIONS

Introduction: The purpose of this meeting was to provide an introduction to the overall interchange improvements project consisting of three separate construction projects, as well as promote conversation regarding potential impacts to existing utilities under the 79-245 design-build project.

PRIOR OFFLINE COORDINATION

- Terry Shea of Crown Castle Fiber cannot make the meeting. P.Brand to set up followup coordination with Crown Castle to determine facilities locations and potential impacts

- Samantha Meyer from WilTel/Lumen confirmed that WilTel/Lumen does not own any facilities within the project limits, but does lease some conduits. Any relocation with would need to be coordinated with the facility owner. P.Brand to follow up to find out who facility owner is and any impacts.
- Joseph Fazzino from City of Middletown confirmed they do not have any facilities within the project limits.
- Comcast did not respond (Jack Groat invited). Impacts unknown.
- Enbridge did not respond (Stanley Drauss was forwarded invite by Kenneth Ruel). Impacts unknown.
- Verizon Wireless did not respond (John Gavaletz invited)
- Buckeye did not respond (David Jones invited)

MEETING MINUTES

- S.Cannamela from CTDOT began by introducing the project. The original project was separated into three contracts for funding reasons. The first contract is 79-245 and will be advertised as design/build this fall.
- Introductions of attendees
- T.Margiotta of GM2 introduced the overall project limits and the general limits of each contract and noted that the main goal of this meeting was to coordinate for 79-245 as the design/build contract
- T.Margiotta pointed out there are six bridges over municipal roads, three under 79-245 and three under 79-240 at Bee Street and Preston/Baldwin Ave where overhead dips under the existing bridges. Focus at this point was on the bridges that cross Bee Street – 01828 & 01829 crossing I-91 north and southbound; 01835 and 01836 crossing I-691 east and westbound.
- T.Margiotta also noted the other bridges that will be rehabbed under 079-240 and 079-245
- D.Brown of CTDOT noted that the standard practice for CTDOT in these situations is to have the overhead moved underground beneath the overpasses to facilitate construction and future maintenance.
- M.Prentice from Eversource Electric confirmed he has reviewed the locations and that these overhead will need to be moved underground. The poles east of Bridge 01828 are owned by Eversource, west of Bridge 01829 through 01836 are owned by Frontier
- S.Cannamela and D.Brown of CTDOT confirmed these projects are 100% reimbursable to the utility companies for relocations since they are limited access highways.
- D.Brown noted that the funding for these two contracts are separate, with 79-245 being obligated first because of design/build and only one bridge at each location is being worked on under 79-245 (northbound 91/eastbound 691), while the other is under 79-240 (southbound/westbound)
- M.Prentice noted that it would be ideal to have the relocations occur at the same time; S.Cannamela noted that this is feasible since it's necessary to relocate under both bridges at the same time, funding for the relocations could likely be secured under 79-245.
- M.Prentice asked about timing for relocations; P.Brand noted that April 1, 2022/early spring would be ideal to be out of the way design/build contractor; M.Prentice noted that would depend on winter weather and when asphalt plants reopen so that Bee Street can be repaved properly
- S.Alam noted that information on the relocations needs to be included in the design/build package, so preliminary sketches are critical
- D.Brown asked for timeframe for Eversource and other utilities to provide Preliminary Engineering sketches for the relocations; M.Prentice said it would take about a month (late July 2021) to have sketches done. Cox and Frontier both agreed that was enough time

- P.Brand asked utility owners to provide any mapping not already supplied, noted that GM2 would work with City of Meriden to get a handle on existing UG utilities and depths in Bee Street and Preston Ave, noted there is also storm system there
- M.Prentice noted that typically Eversource does not relocate Frontier's poles on fully reimbursable projects, however M.Limauro of Frontier noted that Frontier is experiencing high volume and would be open to having Eversource do the relocations.
- F.Russo from City of Meriden recommended that the project reline the existing sanitary main in Bee Street if there will be any pile driving in the vicinity.
- T.Margiotta noted that no pile driving was anticipated.
- Focus shifted to the structures over Preston/Baldwin Ave
- M.Limauro believes Frontier has facilities at all six bridges, will confirm.
- M.Prentice noted that Eversource Electric is already underground at bridges 03051 and 03052.
- J.Cedeno from Cox noted that they still have facilities under 03051 and 03052, including fiber that will have to be relocated underground
- F.Russo noted that the sanitary in Preston/Baldwin is a 10" clay and fairly shallow (will provide more info), recommended relining the clay pipe prior to construction to avoid damage.
- E.Anderson of Eversource Gas noted there is an existing main in Preston/Baldwin Ave, will provide more details, typically 2' to 3' deep and either plastic or steel; E.Anderson does not see any other conflicts with 79-245 but will further review
- F.Russo asked about the 8" sanitary main flowing south from the rest stop to Preston Ave; T.Margiotta and P.Brand noted that the highway is being widened over the top of the sanitary main, but the existing manholes will have risers adjusted to new grade
- M.Prentice noted there is UG electric with two hex-vaults along the east side of 91-northbound; P.Brand asked to provide any mapping of those, as only one vault was located by field survey
- R.Meskill asked about any water services to the rest stop; GM2 is not aware of any, will check as-builts, may have a well there
- M.Limauro noted that UG relocation for Frontier will need to include Steve Barrett from Frontier; GM2 will include in meeting invites moving forward

ACTION ITEMS

- All utility owners to do the following:
 - Provide Preliminary Estimate of relocation by 7/9/21
 - Provide Preliminary Engineering Sketches by 7/30/21
 - Provide any additional mapping of facilities not already shared
 - Review facilities within Contracts 79-240 and 79-246 for any conflicts
- Parsons/GM2 to do the following:
 - Follow up with Crown Castle
 - Follow up with Enbridge to confirm no facilities
 - Follow up with Comcast to confirm no facilities
 - Parsons to schedule follow up meeting on 79-240 and 79-246 Contracts

Submitted by: *Sajjad B Alam*

Sajjad Alam, PE
Project Manager – Parsons

Date Submitted: Jul 09, 2021A

Appendix B

CONSTRUCTION COST ESTIMATE

State Project No. 79-240
I-91/ I-691/ Route 15 Interchange Improvements
MERIDEN AND MIDDLETOWN

PRELIMINARY DESIGN

October 22, 2021

PROJECT COSTS	
HIGHWAY ITEMS	\$ 30,819,000
DRAINAGE ITEMS	\$ 2,857,000
SIGNAGE AND PAVEMENT MARKINGS ITEMS	\$ 2,613,000
MAINTENANCE AND PROTECTION OF TRAFFIC ITEMS	\$ 1,683,000
STRUCTURES ITEMS****	\$ 43,723,000
ILLUMINATION	\$ 2,000,000
IMS UTILITY RELOCATION	\$ 300,000
ENVIRONMENTAL COMPLIANCE	\$ 500,000
BASE ESTIMATE - SUBTOTAL (A)	\$ 84,495,000

MINOR ITEM ALLOWANCE	
MINOR ITEMS	13.0% \$ 10,984,350
BASE PLUS MINOR ITEMS - SUBTOTAL (B)	\$ 95,479,350

CONSTRUCTION COST		
Clearing and Grubbing	2.0%	\$ 1,909,587
Maintenance and Protection of Traffic	3.0%	\$ 2,864,381
Mobilization	6.5%	\$ 6,206,158
Construction Staking	1.0%	\$ 954,794
LUMP SUM ITEM TOTAL - % OF SUBTOTAL (B)	12.5%	\$ 11,934,919

TOTAL CONSTRUCTION COST	\$ 107,414,269
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Contingencies	18.0%	\$ 19,334,568
Incidentals*	13.0%	\$ 13,963,855
Utility Relocations	2.0%	\$ 2,148,285

SUBTOTAL (with additive costs)	\$ 142,860,977
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TOTAL PROJECT COSTS WITH ADDITIVE COSTS	\$ 142,900,000
INFLATION (Not Compounded) @ 3.5% (to 2025)	\$ 20,006,000

TOTAL PLUS INFLATION	\$ 163,000,000
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Estimate 0079-0240

Estimated Cost:\$96,816,766.75

Contingency: 68.00%

Estimated Total: \$162,652,168.14

I-91/I-691/Route 15 Interchange
Southbound Improvements

Base Date: 10/19/21

Spec Year: 11

Unit System: E

Work Type: STRUCTURAL CONCRETE

Highway Type: Interstate

Urban/Rural Type: Urban

Season: FALL 9/22 - 12/22

County: Various Counties

Latitude of Midpoint: 420000

Longitude of Midpoint: -730000

District: 01

Federal Project Number:

State Project Number: 0079-0240

Estimate Type: Preliminary Design

<u>Line #</u>	<u>Item Number</u>	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	<u>Extension</u>
<u>Description</u>					
<u>Supplemental Description</u>					
Group 0001: HIGHWAY AND TRAFFIC ITEMS					
0007	0202000 Earth Excavation	67,635.00	c.y.	\$22.80	\$1,542,078.00
0008	0202100 Rock Excavation	2,029.00	c.y.	\$24.33	\$49,365.57
0009	0202502 REMOVAL OF CONCRETE PAVEMENT	32,412.00	s.y.	\$22.40	\$726,028.80
0010	0202529 CUT BITUMINOUS CONCRETE PAVEMENT	54,440.00	l.f.	\$1.98	\$107,791.20
0011	0207000 BORROW	5,000.00	c.y.	\$22.00	\$110,000.00
0012	0209001 FORMATION OF SUBGRADE	110,386.00	s.y.	\$3.00	\$331,158.00
0013	0211000 ANTI-TRACKING PAD	340.00	s.y.	\$25.37	\$8,625.80
0014	0219003 SEDIMENTATION CONTROL FILTER FABRIC FENCE SYSTEM	53,448.00	l.f.	\$6.40	\$342,067.20
0015	0219011 SEDIMENT CONTROL SYSTEM AT CATCH BASIN ** See Special Provisions **	233.00	ea.	\$119.20	\$27,773.60
0016	0304002 PROCESSED AGGREGATE BASE	36,795.00	c.y.	\$44.40	\$1,633,698.00
0017	0401152 CONCRETE PAVEMENT REPLACEMENT FOR ROADWAY (FULL DEPTH)	2,885.00	c.y.	\$1,500.00	\$4,327,500.00
0018	0404101 BITUMINOUS CONCRETE PATCHING - PARTIAL DEPTH	1,123.00	s.y.	\$149.43	\$167,809.89
0019	0406125 BITUMINOUS CONCRETE SURFACE PATCH	1,123.00	s.y.	\$61.64	\$69,221.72
0020	0406158 PMA S0.375	27,460.00	ton	\$104.20	\$2,861,332.00
0021	0406159 PMA S0.5	102,828.00	ton	\$92.20	\$9,480,741.60
0022	0406160 PMA S1	40,468.00	ton	\$93.00	\$3,763,524.00

<u>Line #</u>	<u>Item Number</u>	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	<u>Extension</u>
<u>Description</u>					
<u>Supplemental Description</u>					
0023	0406236	96,737.00	gal	\$5.80	\$561,074.60
MATERIAL FOR TACK COAT					
0024	0406287	89,680.00	l.f.	\$0.60	\$53,808.00
RUMBLE STRIPS-AUTOMATED					
0025	0406314	113,930.00	l.f.	\$0.56	\$63,800.80
80 MIL PAVEMENT MARKING GROOVE 5in WIDE					
0026	0406315	20,073.00	l.f.	\$0.81	\$16,259.13
80 MIL PAVEMENT MARKING GROOVE 7in WIDE					
0027	0406316	27,224.00	l.f.	\$0.94	\$25,590.56
80 MIL PAVEMENT MARKING GROOVE 9in WIDE					
0028	0406317	4,233.00	l.f.	\$1.17	\$4,952.61
80 MIL PAVEMENT MARKING GROOVE 13in WIDE					
0029	0409002	224,687.00	s.y.	\$7.00	\$1,572,809.00
STANDARD MILLING OF BITUMINOUS CONCRETE (GREATER THAN 4in UP TO 8in)					
** See Special Provisions **					
0030	0406999	20,000.00	est.	\$1.00	\$20,000.00
ASPHALT ADJUSTMENT COST (ESTIMATED COST)					
0031	0506026	1,810.00	s.f.	\$128.00	\$231,680.00
RETAINING WALL					
0032	0586001.10	56.00	ea.	\$3,760.00	\$210,560.00
TYPE 'C' CATCH BASIN - 0' - 10' DEEP					
0033	0586040.10	24.00	ea.	\$4,526.87	\$108,644.88
TYPE 'C-L' CATCH BASIN - 0' - 10' DEEP					
0034	0586100.10	46.00	ea.	\$4,060.64	\$186,789.44
TYPE 'C-M' CATCH BASIN - 0' - 10' DEEP					
0035	0586500.10	1.00	ea.	\$3,204.47	\$3,204.47
MANHOLE - 0' - 10' DEEP					
0036	0586600	58.00	ea.	\$1,125.01	\$65,250.58
RESET CATCH BASIN					
0037	0586750	79.00	ea.	\$659.31	\$52,085.49
TYPE 'C' CATCH BASIN TOP					
0038	0586760	43.00	ea.	\$619.87	\$26,654.41
TYPE 'C-L' CATCH BASIN TOP					
0039	0586770	54.00	ea.	\$866.69	\$46,801.26
TYPE 'C-M' CATCH BASIN TOP					

<u>Line #</u>	<u>Item Number</u>	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	<u>Extension</u>
0040	0601651 RETAINING WALL (SITE NO. 1) ** See Special Provisions **	1.00	LS	\$244,145.00	\$244,145.00
0041	0601652 RETAINING WALL (SITE NO. 2)	1.00	LS	\$114,750.00	\$114,750.00
0042	0601653 RETAINING WALL (SITE NO. 3) ** See Special Provisions **	1.00	LS	\$1,206,375.00	\$1,206,375.00
0043	0601654 RETAINING WALL (SITE NO. 4) ** See Special Provisions **	1.00	LS	\$1,479,750.00	\$1,479,750.00
0044	0601655 RETAINING WALL (SITE NO. 5) ** See Special Provisions **	1.00	LS	\$699,400.00	\$699,400.00
0045	0601656 RETAINING WALL (SITE NO. 6)	1.00	LS	\$26,550.00	\$26,550.00
0046	0601657 RETAINING WALL (SITE NO. 7) ** See Special Provisions **	1.00	LS	\$101,125.00	\$101,125.00
0047	0601658 RETAINING WALL (SITE NO. 8) ** See Special Provisions **	1.00	LS	\$82,200.00	\$82,200.00
0048	0601659 RETAINING WALL (SITE NO. 9) ** See Special Provisions **	1.00	LS	\$275,550.00	\$275,550.00
0049	0601660 RETAINING WALL (SITE NO. 10) ** See Special Provisions **	1.00	LS	\$262,500.00	\$262,500.00
0050	0601661 RETAINING WALL (SITE NO. 11) ** See Special Provisions **	1.00	LS	\$52,000.00	\$52,000.00
0051	0601662 RETAINING WALL (SITE NO. 12) ** See Special Provisions **	1.00	LS	\$117,450.00	\$117,450.00
0052	0601663 RETAINING WALL (SITE NO. 13) ** See Special Provisions **	1.00	LS	\$396,800.00	\$396,800.00
0053	0601664 RETAINING WALL (SITE NO. 14)	1.00	LS	\$83,125.00	\$83,125.00
0054	0601665 RETAINING WALL (SITE NO. 15)	1.00	LS	\$7,800.00	\$7,800.00
0055	0601666 RETAINING WALL (SITE NO. 16) ** See Special Provisions **	1.00	LS	\$109,375.00	\$109,375.00
0056	0601667 RETAINING WALL (SITE NO. 17) ** See Special Provisions **	1.00	LS	\$31,000.00	\$31,000.00
0057	0601668 RETAINING WALL (SITE NO. 18)	1.00	LS	\$120,875.00	\$120,875.00

<u>Line #</u>	<u>Item Number</u>	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	<u>Extension</u>
** See Special Provisions **					
0058	0601669 RETAINING WALL (SITE NO. 19)	1.00	LS	\$128,800.00	\$128,800.00
** See Special Provisions **					
0059	0601670 RETAINING WALL (SITE NO. 20)	1.00	LS	\$123,600.00	\$123,600.00
0060	0601671 RETAINING WALL (SITE NO. 21)	1.00	LS	\$58,700.00	\$58,700.00
** See Special Provisions **					
0061	0601155 10' X 8' PRECAST CONCRETE BOX CULVERT	160.00	I.f.	\$3,500.00	\$560,000.00
0062	0652014 30" R.C. CULVERT END	2.00	ea.	\$800.00	\$1,600.00
0063	0652016 42" R.C. CULVERT END	2.00	ea.	\$800.00	\$1,600.00
0064	0653100 CLEAN EXISTING CULVERT - 12" TO 42" DIAMETER	1,910.94	I.f.	\$8.78	\$16,778.05
0065	0653101 CLEAN EXISTING CULVERT - GREATER THAN 42" DIAMETER	175.00	I.f.	\$46.20	\$8,085.00
0066	0686000.12 12" R.C. PIPE - 0' - 10' DEEP	4.00	I.f.	\$73.40	\$293.60
0067	0686000.15 15" R.C. PIPE - 0' - 10' DEEP	5,703.00	I.f.	\$72.27	\$412,155.81
0070	0686000.18 18" R.C. PIPE - 0' - 10' DEEP	194.00	I.f.	\$88.13	\$17,097.22
0071	0686000.24 24" R.C. PIPE - 0' - 10' DEEP	211.00	I.f.	\$115.40	\$24,349.40
0072	0686000.30 30" R.C. PIPE - 0' - 10' DEEP	3,054.00	I.f.	\$142.00	\$433,668.00
0073	0686000.36 36" R.C. PIPE - 0' - 10' DEEP	114.00	I.f.	\$142.00	\$16,188.00
0074	0686000.42 42" R.C. PIPE - 0' - 10' DEEP	116.00	I.f.	\$142.00	\$16,472.00
0075	0686230.15 15" HIGH DENSITY POLYETHYLENE PIPE - 0' - 10' DEEP	1,188.00	I.f.	\$32.32	\$38,396.16
0076	0686230.30 30" HIGH DENSITY POLYETHYLENE PIPE - 0' - 10' DEEP	437.00	I.f.	\$150.00	\$65,550.00

<u>Line #</u>	<u>Item Number</u>	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	<u>Extension</u>
<u>Description</u>					
<u>Supplemental Description</u>					
0077	0703011 INTERMEDIATE RIPRAP	57.00	c.y.	\$107.95	\$6,153.15
0078	0703012 MODIFIED RIPRAP	31.67	c.y.	\$118.89	\$3,765.25
0079	0821127 REMOVAL OF PRECAST CONCRETE BARRIER CURB	1,270.00	l.f.	\$32.20	\$40,894.00
0080	0821176 PRECAST CONCRETE BARRIER CURB (27" X 42")	2,742.00	l.f.	\$33.60	\$92,131.20
0081	0821401 SINGLE SLOPE PRECAST CONCRETE BARRIER CURB (20in x 42")	16,518.00	l.f.	\$33.60	\$555,004.80
0082	0821513 VERTICAL FACE PRECAST CONCRETE BARRIER CURB (21in X 54in)	580.00	l.f.	\$160.75	\$93,235.00
0083	0822001 TEMPORARY PRECAST CONCRETE BARRIER CURB	34,902.00	l.f.	\$33.60	\$1,172,707.20
0084	0822002 RELOCATED TEMPORARY PRECAST CONCRETE BARRIER CURB	27,564.00	l.f.	\$9.60	\$264,614.40
0085	0910031 THRIE BEAM ATTACHMENT ** See Special Provisions **	76.00	ea.	\$5,000.00	\$380,000.00
0086	0910300 METAL BEAM RAIL (R-B MASH) ** See Special Provisions **	50,851.00	l.f.	\$21.96	\$1,116,687.96
0087	0910310 METAL BEAM RAIL (MD-B MASH) ** See Special Provisions **	2,139.00	l.f.	\$35.27	\$75,442.53
0088	0916126 NOISE BARRIER WALL	180,800.00	s.f.	\$50.00	\$9,040,000.00
0089	0911925 R-B END ANCHORAGE (TYPE I - 10GA)	28.00	ea.	\$1,543.40	\$43,215.20
0090	0912503 REMOVE METAL BEAM RAIL	52,467.00	l.f.	\$3.21	\$168,419.07
0091	0912509 REMOVE THREE CABLE GUIDE RAILING	5,631.00	l.f.	\$2.95	\$16,611.45
0092	0944000 FURNISHING AND PLACING TOPSOIL	62,222.00	s.y.	\$7.40	\$460,442.80

<u>Line #</u>	<u>Item Number</u>	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	<u>Extension</u>
<u>Description</u>					
<u>Supplemental Description</u>					
0093	0950005 TURF ESTABLISHMENT	62,222.00	s.y.	\$1.40	\$87,110.80
0094	0950013 EROSION CONTROL MATTING	54,955.00	s.y.	\$3.40	\$186,847.00
0095	0970006 TRAFFICPERSON (MUNICIPAL POLICE OFFICER) (ESTIMATED COST)	1.00	est.	\$50,000.00	\$50,000.00
0096	0978002 TRAFFIC DRUM	80.00	ea.	\$67.60	\$5,408.00
0097	1201800 MILE MARKER SIGN SUPPORT	20.00	ea.	\$50.00	\$1,000.00
0098	1201804 4 CHORD TRUSS CANTILEVER SIGN STRUCTURE	5.00	ea.	\$31,552.97	\$157,764.85
0099	1202239 OVERHEAD TRUSS SIGN SUPPORT FOUNDATION	23.00	ea.	\$67,976.48	\$1,563,459.04
0100	1203109 SIDE MOUNTED SIGN FOUNDATION	27.00	ea.	\$4,200.00	\$113,400.00
0101	1205207 TYPE DE-7 DELINEATOR	433.00	ea.	\$18.60	\$8,053.80
0102	1205214 TYPE DE-7A DELINEATOR	347.00	ea.	\$21.94	\$7,613.18
0103	1206011 REMOVAL OF EXISTING OVERHEAD SIGNING	1.00	LS	\$250,000.00	\$250,000.00
0104	1206013 REMOVAL OF EXISTING SIGNING	1.00	LS	\$50,000.00	\$50,000.00
0105	1207039 SIGN FACE - EXTRUDED ALUMINUM (TYPE IX RETROREFLECTIVE SHEETING)	8,523.00	s.f.	\$30.00	\$255,690.00
0106	1208931 SIGN FACE - SHEET ALUMINUM (TYPE IX RETROREFLECTIVE SHEETING)	2,461.00	s.f.	\$60.00	\$147,660.00
0107	1209114 HOT-APPLIED PAINTED PAVEMENT MARKINGS 4" YELLOW	119,795.00	l.f.	\$0.09	\$10,781.55
0108	1209124 HOT-APPLIED PAINTED PAVEMENT MARKINGS 4" WHITE	125,485.00	l.f.	\$0.09	\$11,293.65
0109	1209126 HOT-APPLIED PAINTED PAVEMENT MARKINGS 6" WHITE	52,262.00	l.f.	\$0.22	\$11,497.64

<u>Line #</u>	<u>Item Number</u>	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	<u>Extension</u>
<u>Description</u>					
<u>Supplemental Description</u>					
0110	1209128	36,665.00	I.f.	\$0.23	\$8,432.95
HOT-APPLIED PAINTED PAVEMENT MARKINGS 8" WHITE					
0111	1209129	3,426.00	I.f.	\$1.11	\$3,802.86
HOT-APPLIED PAINTED PAVEMENT MARKINGS 12" WHITE					
0112	1210101	57,770.00	I.f.	\$0.50	\$28,885.00
4" WHITE EPOXY RESIN PAVEMENT MARKINGS					
0113	1210102	56,170.00	I.f.	\$0.50	\$28,085.00
4" YELLOW EPOXY RESIN PAVEMENT MARKINGS					
0114	1210103	20,073.00	I.f.	\$0.60	\$12,043.80
6in WHITE EPOXY RESIN PAVEMENT MARKINGS					
0115	1210104	27,230.00	I.f.	\$0.60	\$16,338.00
8in WHITE EPOXY RESIN PAVEMENT MARKINGS					
0116	1210105	280.00	s.f.	\$4.71	\$1,318.80
EPOXY RESIN PAVEMENT MARKINGS, SYMBOLS AND LEGENDS					
0117	1210106	4,233.00	I.f.	\$3.29	\$13,926.57
12in WHITE EPOXY RESIN PAVEMENT MARKINGS					
0118	1220027	734.00	s.f.	\$8.28	\$6,077.52
CONSTRUCTION SIGNS					
0119	1802210.02	28.00	ea.	\$406.86	\$11,392.08
TEMPORARY SAND BARREL (200 lb.)					
0120	1802210.04	14.00	ea.	\$381.09	\$5,335.26
TEMPORARY SAND BARREL (400 lb.)					
0121	1802210.07	42.00	ea.	\$387.89	\$16,291.38
TEMPORARY SAND BARREL (700 lb.)					
0122	1802210.14	56.00	ea.	\$366.88	\$20,545.28
TEMPORARY SAND BARREL (1400 lb.)					
0123	1802210.21	28.00	ea.	\$386.43	\$10,820.04
TEMPORARY SAND BARREL (2100 lb.)					
0124	1802211.02	30.00	ea.	\$133.77	\$4,013.10
RELOCATION OF TEMPORARY SAND BARREL (200 lb.)					
0125	1802211.04	15.00	ea.	\$144.34	\$2,165.10
RELOCATION OF TEMPORARY SAND BARREL (400 lb.)					

<u>Line #</u>	<u>Item Number</u>	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	<u>Extension</u>
<u>Description</u>					
<u>Supplemental Description</u>					
0126	1802211.07	45.00	ea.	\$140.36	\$6,316.20
RELOCATION OF TEMPORARY SAND BARREL (700 lb.)					
0127	1802211.14	72.00	ea.	\$142.23	\$10,240.56
RELOCATION OF TEMPORARY SAND BARREL (1400 lb.)					
0128	1802211.21	30.00	ea.	\$145.53	\$4,365.90
RELOCATION OF TEMPORARY SAND BARREL (2100 lb.)					
0129	1803300	32.00	ea.	\$4,200.00	\$134,400.00
IMPACT ATTENUATION SYSTEM (TANGENTIAL)					
0130	1803324	2.00	ea.	\$6,800.49	\$13,600.98
IMPACT ATTENUATION SYSTEM (MEDIAN/GORE)					
0131	1807202	29.00	est.	\$1.00	\$29.00
REPAIR OF TEMPORARY IMPACT ATTENUATION SYSTEM (ESTIMATED COST)					

Total for Group 0001:\$52,938,112.75

Group 0002: BRIDGE 01829

0132	0503516	1.00	LS	\$1,310,153.00	\$1,310,153.00
MAINTAINING EXISTING BRIDGE					

Total for Group 0002:\$1,310,153.00

Group 0003: BRIDGE 03052

0133	0503516	1.00	LS	\$2,250,903.00	\$2,250,903.00
MAINTAINING EXISTING BRIDGE					

Total for Group 0003:\$2,250,903.00

Group 0004: BRIDGE 01831

0134	0503516	1.00	LS	\$2,740,996.00	\$2,740,996.00
MAINTAINING EXISTING BRIDGE					

Total for Group 0004:\$2,740,996.00

Group 0005: BRIDGE 01834

0135	0503516	1.00	LS	\$693,543.00	\$693,543.00
MAINTAINING EXISTING BRIDGE					

Total for Group 0005:\$693,543.00

<u>Line #</u>	<u>Item Number</u>	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	<u>Extension</u>
<u>Description</u>					
<u>Supplemental Description</u>					

Group 0006: BRIDGE 03046

0136	0503516	1.00	LS	\$654,353.00	\$654,353.00
MAINTAINING EXISTING BRIDGE					

Total for Group 0006:\$654,353.00

Group 0007: BRIDGE 01833

0137	0503516	1.00	LS	\$1,321,623.00	\$1,321,623.00
MAINTAINING EXISTING BRIDGE					

Total for Group 0007:\$1,321,623.00

Group 0008: BRIDGE 00797

0138	0503516	1.00	LS	\$389,015.00	\$389,015.00
MAINTAINING EXISTING BRIDGE					

Total for Group 0008:\$389,015.00

Group 0009: BRIDGE 01826

0139	0503516	1.00	LS	\$2,039,089.00	\$2,039,089.00
MAINTAINING EXISTING BRIDGE					

Total for Group 0009:\$2,039,089.00

Group 0010: BRIDGE 01819

0140	0503997	1.00	LS	\$13,047,185.00	\$13,047,185.00
REMOVE AND REPLACE STRUCTURE					

Total for Group 0010:\$13,047,185.00

Group 0011: BRIDGE 01824

0141	0503997	1.00	LS	\$4,696,604.00	\$4,696,604.00
REMOVE AND REPLACE STRUCTURE					

Total for Group 0011:\$4,696,604.00

Group 0015: Misc Project Items

0142	0101000	1.00	LS	\$500,000.00	\$500,000.00
ENVIRONMENTAL HEALTH AND SAFETY					

<u>Line #</u>	<u>Item Number</u>	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	<u>Extension</u>
<u>Description</u>					
<u>Supplemental Description</u>					

0143	1020040	1.00	LS	\$2,000,000.00	\$2,000,000.00
TEMPORARY ILLUMINATION					

0144	1112295	1.00	LS	\$300,000.00	\$300,000.00
RELOCATION OF IMS FIBER OPTIC CABLE					

Total for Group 0015:\$2,800,000.00

Group 8888: Construction Items

0145	0201001	1.00	LS	\$1,909,857.00	\$1,909,857.00
CLEARING AND GRUBBING					

0146	0971001	1.00	LS	\$2,864,381.00	\$2,864,381.00
MAINTENANCE AND PROTECTION OF TRAFFIC					

0147	0975004	1.00	LS	\$6,206,158.00	\$6,206,158.00
MOBILIZATION AND PROJECT CLOSEOUT					

0148	0980020	1.00	LS	\$954,794.00	\$954,794.00
CONSTRUCTION SURVEYING					

Total for Group 8888:\$11,935,190.00