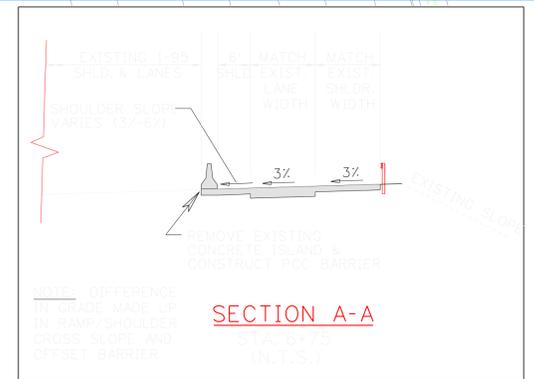
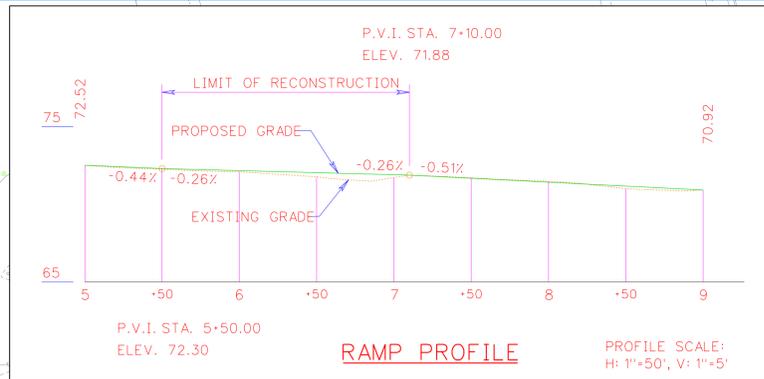
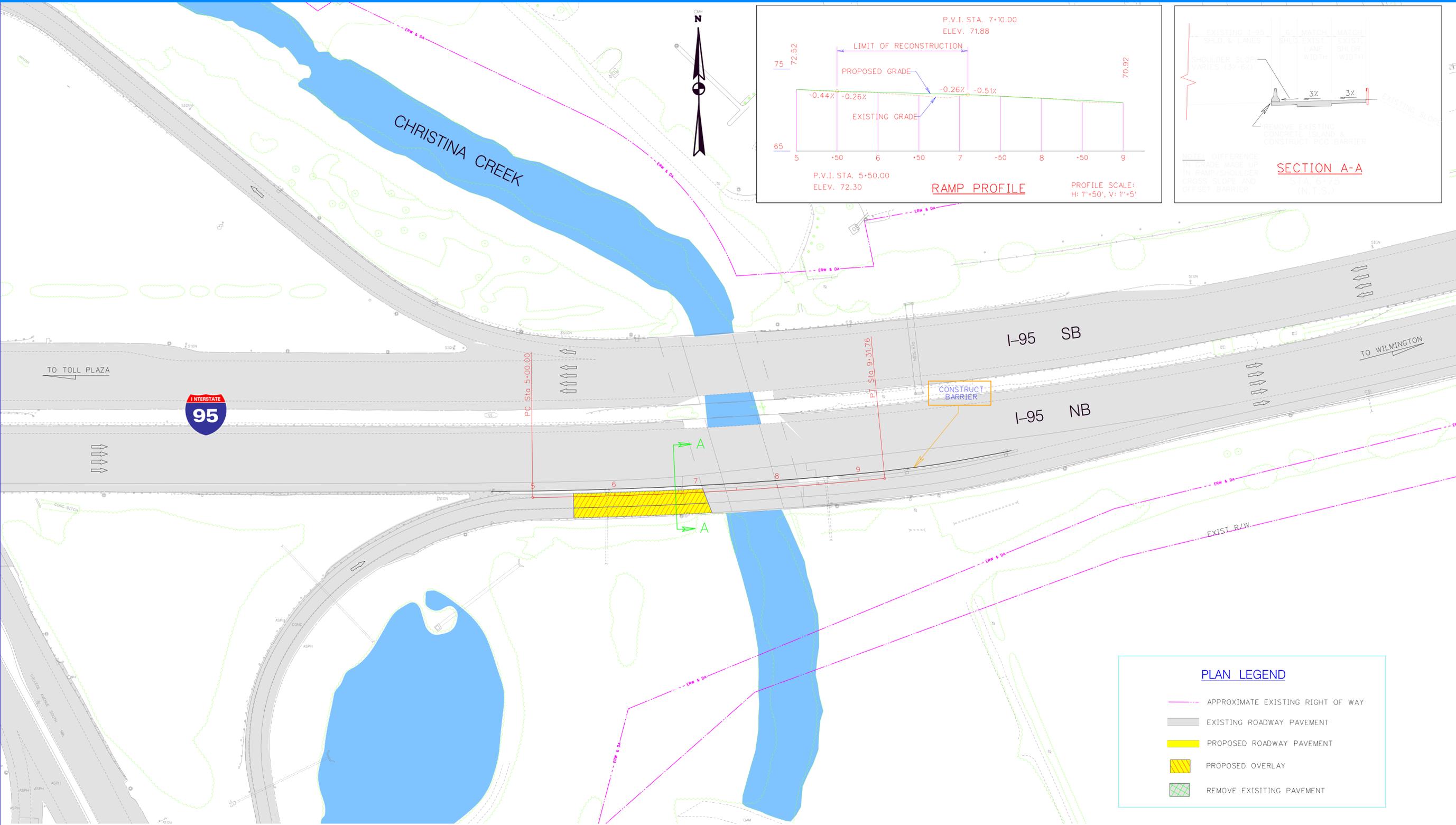


I-95 / SR 896 Interchange Improvements



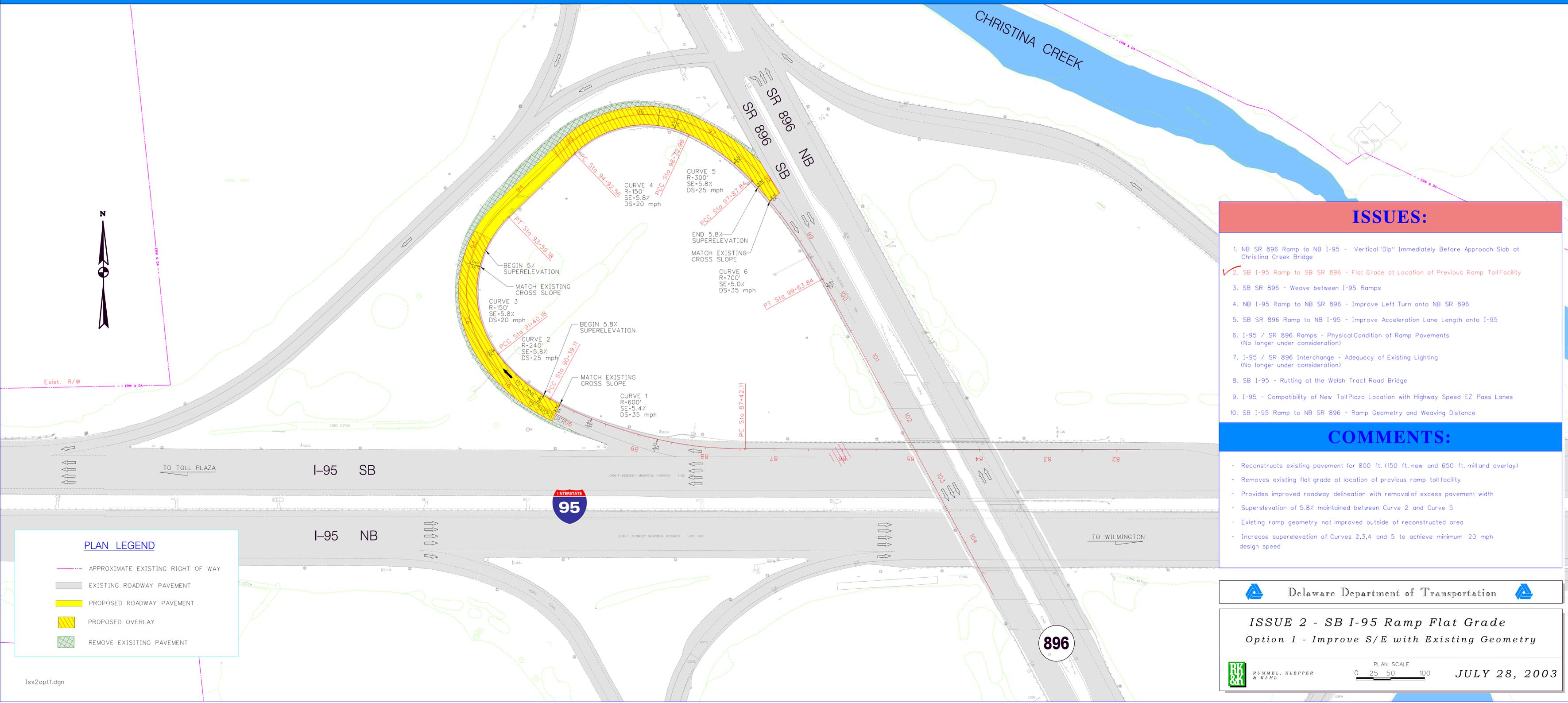
ISSUES:

- NB SR 896 Ramp to NB I-95 - Vertical "Dip" Immediately Before Approach Slab at Christina Creek Bridge
- SB I-95 Ramp to SB SR 896 - Flat Grade at Location of Previous Ramp Toll Facility
- SB SR 896 - Weave between I-95 Ramps
- NB I-95 Ramp to NB SR 896 - Improve Left Turn onto NB SR 896
- SB SR 896 Ramp to NB I-95 - Improve Acceleration Lane Length onto I-95
- I-95 / SR 896 Ramps - Physical Condition of Ramp Pavements (No longer under consideration)
- I-95 / SR 896 Interchange - Adequacy of Existing Lighting (No longer under consideration)
- SB I-95 - Rutting at the Welsh Tract Road Bridge
- I-95 - Compatibility of New Toll Plaza Location with Highway Speed EZ Pass Lanes
- SB I-95 Ramp to NB SR 896 - Ramp Geometry and Weaving Distance

COMMENTS:

- Corrects vertical "dip" at approach to Christina Creek Bridge
- New barrier installed to provide better separation between through lanes and ramp
- Existing inlets (2) need to be adjusted

I-95 / SR 896 Interchange Improvements



ISSUES:

1. NB SR 896 Ramp to NB I-95 - Vertical "Dip" Immediately Before Approach Slab at Christina Creek Bridge
- ✓ 2. SB I-95 Ramp to SB SR 896 - Flat Grade at Location of Previous Ramp Toll Facility
3. SB SR 896 - Weave between I-95 Ramps
4. NB I-95 Ramp to NB SR 896 - Improve Left Turn onto NB SR 896
5. SB SR 896 Ramp to NB I-95 - Improve Acceleration Lane Length onto I-95
6. I-95 / SR 896 Ramps - Physical Condition of Ramp Pavements (No longer under consideration)
7. I-95 / SR 896 Interchange - Adequacy of Existing Lighting (No longer under consideration)
8. SB I-95 - Rutting at the Welsh Tract Road Bridge
9. I-95 - Compatibility of New Toll Plaza Location with Highway Speed EZ Pass Lanes
10. SB I-95 Ramp to NB SR 896 - Ramp Geometry and Weaving Distance

COMMENTS:

- Reconstructs existing pavement for 800 ft. (150 ft. new and 650 ft. mill and overlay)
- Removes existing flat grade at location of previous ramp toll facility
- Provides improved roadway delineation with removal of excess pavement width
- Superelevation of 5.8% maintained between Curve 2 and Curve 5
- Existing ramp geometry not improved outside of reconstructed area
- Increase superelevation of Curves 2,3,4 and 5 to achieve minimum 20 mph design speed

PLAN LEGEND

- APPROXIMATE EXISTING RIGHT OF WAY
- EXISTING ROADWAY PAVEMENT
- PROPOSED ROADWAY PAVEMENT
- PROPOSED OVERLAY
- REMOVE EXISTING PAVEMENT

Delaware Department of Transportation

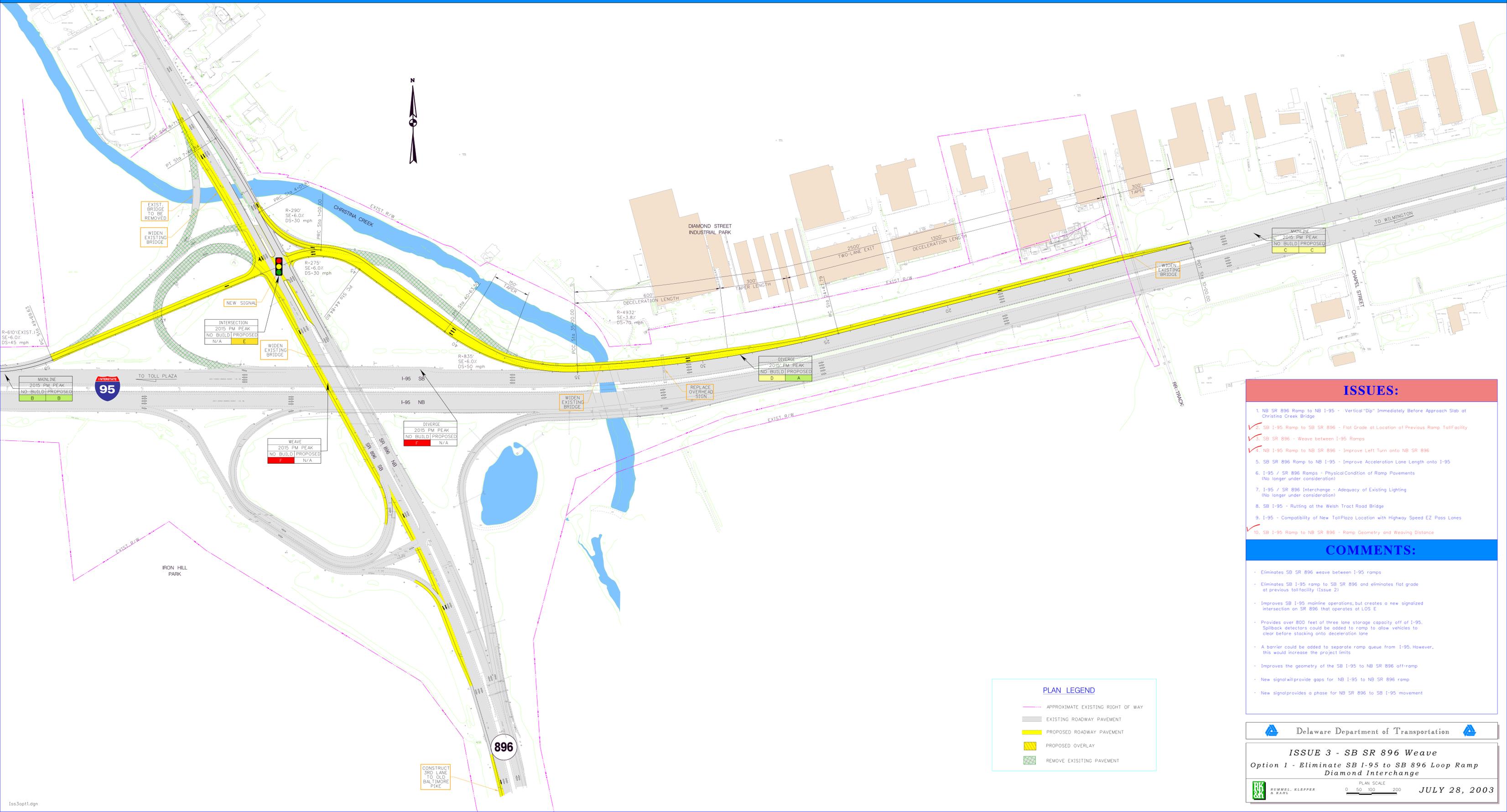
ISSUE 2 - SB I-95 Ramp Flat Grade
 Option 1 - Improve S/E with Existing Geometry



PLAN SCALE
 0 25 50 100

JULY 28, 2003

I-95 / SR 896 Interchange Improvements



ISSUES:

1. NB SR 896 Ramp to NB I-95 - Vertical "Dip" Immediately Before Approach Slab at Christina Creek Bridge
2. SB I-95 Ramp to SB SR 896 - Flat Grade at Location of Previous Ramp Toll Facility
3. SB SR 896 - Weave between I-95 Ramps
4. NB I-95 Ramp to NB SR 896 - Improve Left Turn onto NB SR 896
5. SB SR 896 Ramp to NB I-95 - Improve Acceleration Lane Length onto I-95
6. I-95 / SR 896 Ramps - Physical Condition of Ramp Pavements (No longer under consideration)
7. I-95 / SR 896 Interchange - Adequacy of Existing Lighting (No longer under consideration)
8. SB I-95 - Rutting at the Welsh Tract Road Bridge
9. I-95 - Compatibility of New Toll Plaza Location with Highway Speed EZ Pass Lanes
10. SB I-95 Ramp to NB SR 896 - Ramp Geometry and Weaving Distance

COMMENTS:

- Eliminates SB SR 896 weave between I-95 ramps
- Eliminates SB I-95 ramp to SB SR 896 and eliminates flat grade at previous toll facility (Issue 2)
- Improves SB I-95 mainline operations, but creates a new signalized intersection on SR 896 that operates at LOS E
- Provides over 800 feet of three lane storage capacity off of I-95. Spillback detectors could be added to ramp to allow vehicles to clear before stacking onto deceleration lane
- A barrier could be added to separate ramp queue from I-95. However, this would increase the project limits
- Improves the geometry of the SB I-95 to NB SR 896 off-ramp
- New signal will provide gaps for NB I-95 to NB SR 896 ramp
- New signal provides a phase for NB SR 896 to SB I-95 movement

PLAN LEGEND

- - - - - APPROXIMATE EXISTING RIGHT OF WAY
- - - - - EXISTING ROADWAY PAVEMENT
- - - - - PROPOSED ROADWAY PAVEMENT
- - - - - PROPOSED OVERLAY
- - - - - REMOVE EXISTING PAVEMENT

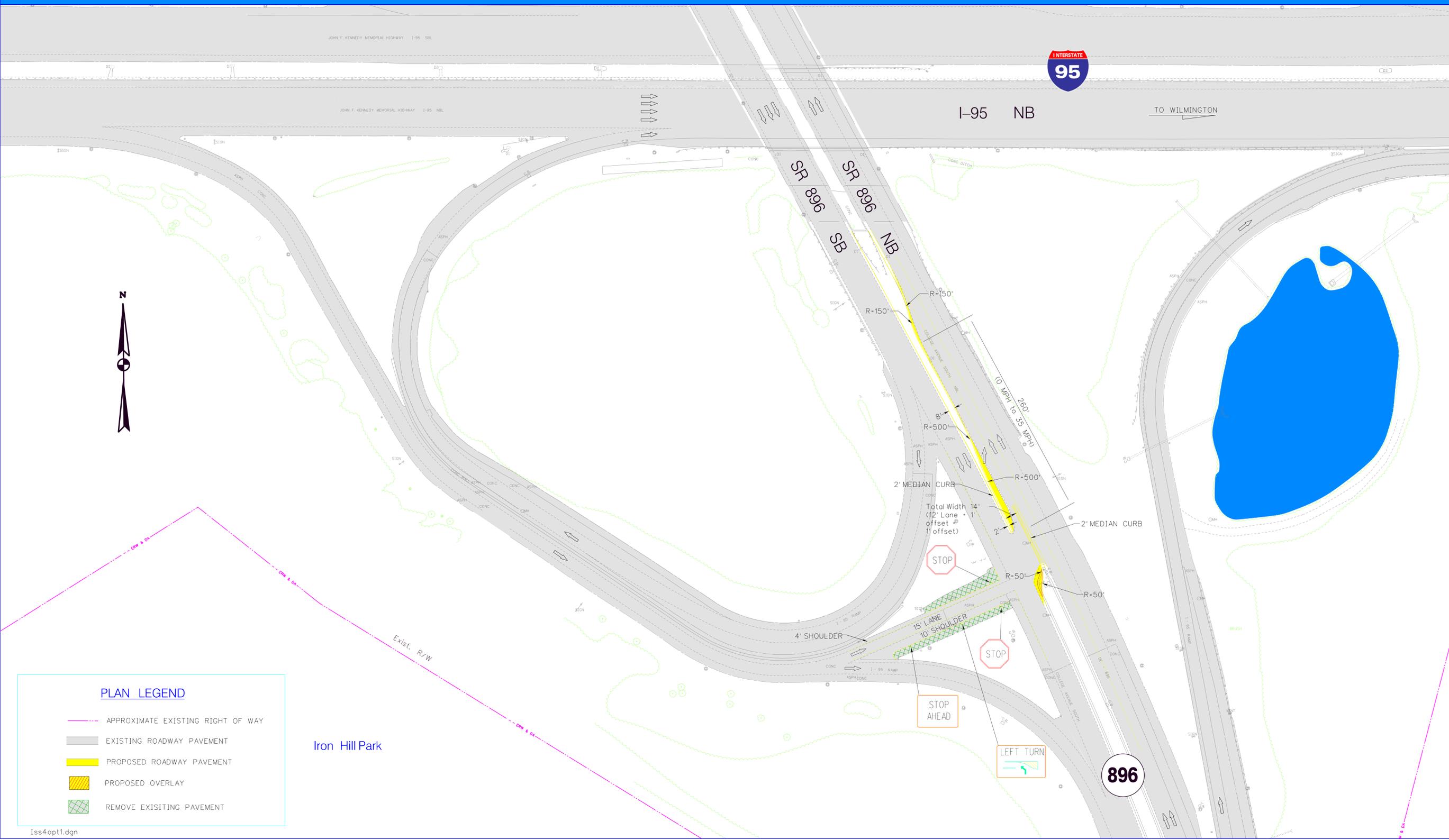
Delaware Department of Transportation

ISSUE 3 - SB SR 896 Weave
 Option 1 - Eliminate SB I-95 to SB 896 Loop Ramp
 Diamond Interchange

PLAN SCALE
 0 50 100 200
 JULY 28, 2003



I-95 / SR 896 Interchange Improvements



ISSUES:

1. NB SR 896 Ramp to NB I-95 - Vertical "Dip" Immediately Before Approach Slab at Christina Creek Bridge
2. SB I-95 Ramp to SB SR 896 - Flat Grade at Location of Previous Ramp Toll Facility
3. SB SR 896 - Weave between I-95 Ramps
- ✓ 4. NB I-95 Ramp to NB SR 896 - Improve Left Turn onto NB SR 896
5. SB SR 896 Ramp to NB I-95 - Improve Acceleration Lane Length onto I-95
6. I-95 / SR 896 Ramps - Physical Condition of Ramp Pavements (No longer under consideration)
7. I-95 / SR 896 Interchange - Adequacy of Existing Lighting (No longer under consideration)
8. SB I-95 - Rutting at the Welsh Tract Road Bridge
9. I-95 - Compatibility of New Toll Plaza Location with Highway Speed EZ Pass Lanes
10. SB I-95 Ramp to NB SR 896 - Ramp Geometry and Weaving Distance

COMMENTS:

- Improves left turn channelization and separation from NB SR 896 allowing for a two-stage gap acceptance
- Delineators could be added to channelizing island to enhance visibility of two stage condition
- Improved signing along ramp to better identify left turn condition
- Provides better lane width definition along approach leg of ramp
- Sight distance for vehicles stopped at the end of the ramp looking north (oncoming SB SR 896 through traffic) is not improved and may be inadequate when there is traffic in the auxiliary lane (NB I-95 loop ramp)
- Can extend median acceleration lane to provide additional length without widening the existing bridge

- Signal Warrant
- Signal Warrant Analysis was performed in August 2002
 - Relatively low volume of vehicles turning left from the ramp (9 vehicles AM; 15 vehicles PM)
 - Capacity Analysis indicated that the left turn from the unsignalized intersection operates at LOS E during the AM peak and LOS F during the PM peak
 - Signal Warrant 6 - Coordinated Signal System was the only warrant met. Since the intersection does not meet any of the other warrants, Warrant 6 may not be a substantial reason to justify signal installation
 - Recent accident history of rear-end collisions on the weaving segment prior to the intersection and of angle collisions involving left turns from the intersection
 - There was one reported fatality involving an accident with a left turning vehicle
 - Recommendations included geometric improvements at the intersection and/or a redesign of the interchange
- Eliminate Ramp
- FHWA recommended the following process to remove the NB I-95 to NB SR 896 Ramp movement:
 - Issue should be presented to local MPO, the public and possibly the National Truckers Association
 - Full report should be prepared and submitted to Delaware FHWA Office
 - Delaware FHWA would take issue to FHWA Headquarters and possibly AASHTO
 - Concern of the national implications created by closing a ramp due to safety issues
 - FHWA has suggested gaining approval may be difficult. Therefore we recommend finding an alternate solution for the ramp

 Delaware Department of Transportation 

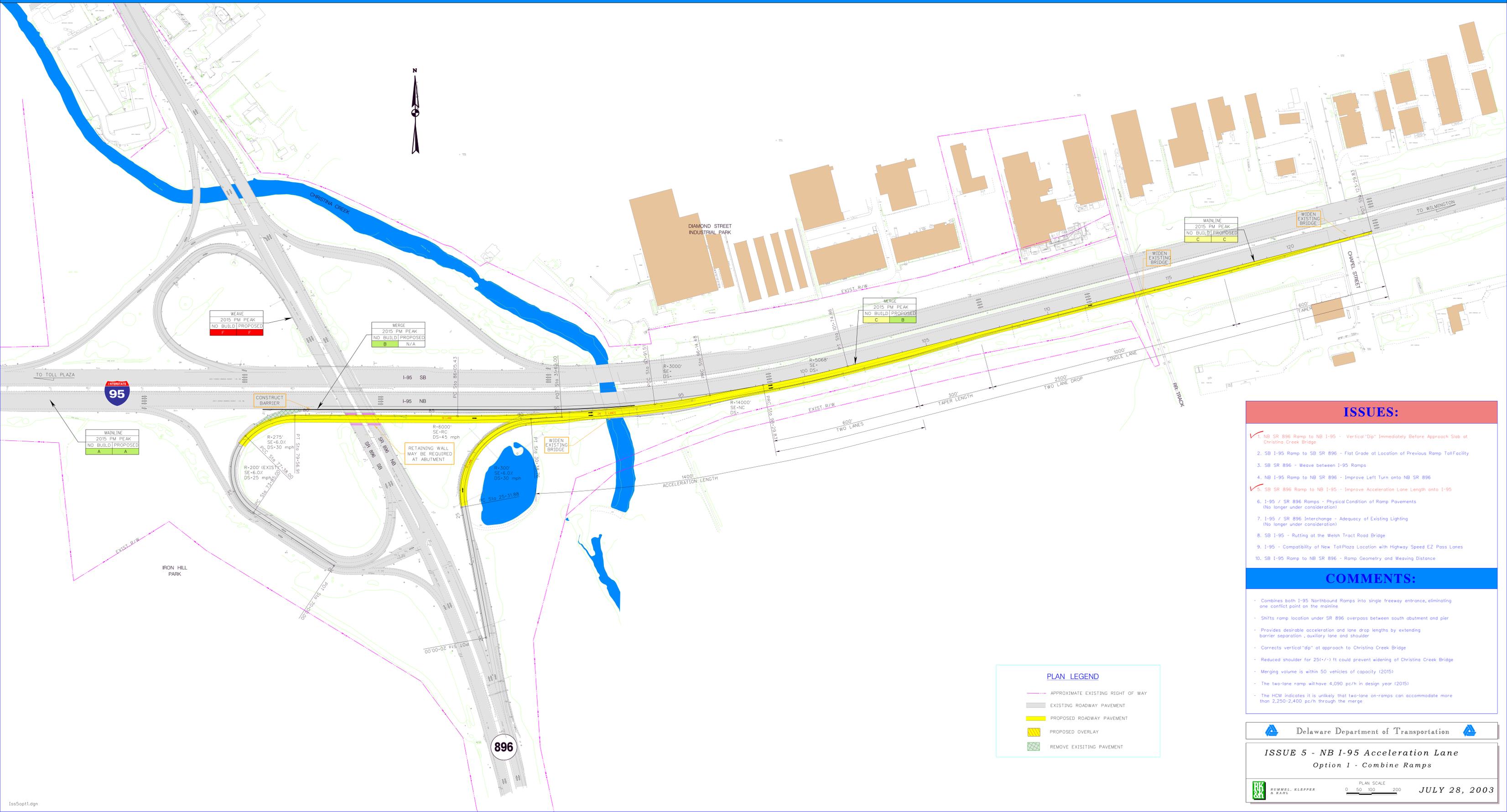
ISSUE 4 - Left Turn Onto NB SR 896
Option 1 - Provide Left Turn Channelization

 RUMMEL, KLEPPER & RAHL

PLAN SCALE
 0 25 50 100

JULY 28, 2003

I-95 / SR 896 Interchange Improvements



ISSUES:

1. NB SR 896 Ramp to NB I-95 - Vertical "Dip" Immediately Before Approach Slab at Christina Creek Bridge
2. SB I-95 Ramp to SB SR 896 - Flat Grade at Location of Previous Ramp Toll Facility
3. SB SR 896 - Weave between I-95 Ramps
4. NB I-95 Ramp to NB SR 896 - Improve Left Turn onto NB SR 896
5. SB SR 896 Ramp to NB I-95 - Improve Acceleration Lane Length onto I-95
6. I-95 / SR 896 Ramps - Physical Condition of Ramp Pavements (No longer under consideration)
7. I-95 / SR 896 Interchange - Adequacy of Existing Lighting (No longer under consideration)
8. SB I-95 - Rutting at the Welsh Tract Road Bridge
9. I-95 - Compatibility of New Toll Plaza Location with Highway Speed EZ Pass Lanes
10. SB I-95 Ramp to NB SR 896 - Ramp Geometry and Weaving Distance

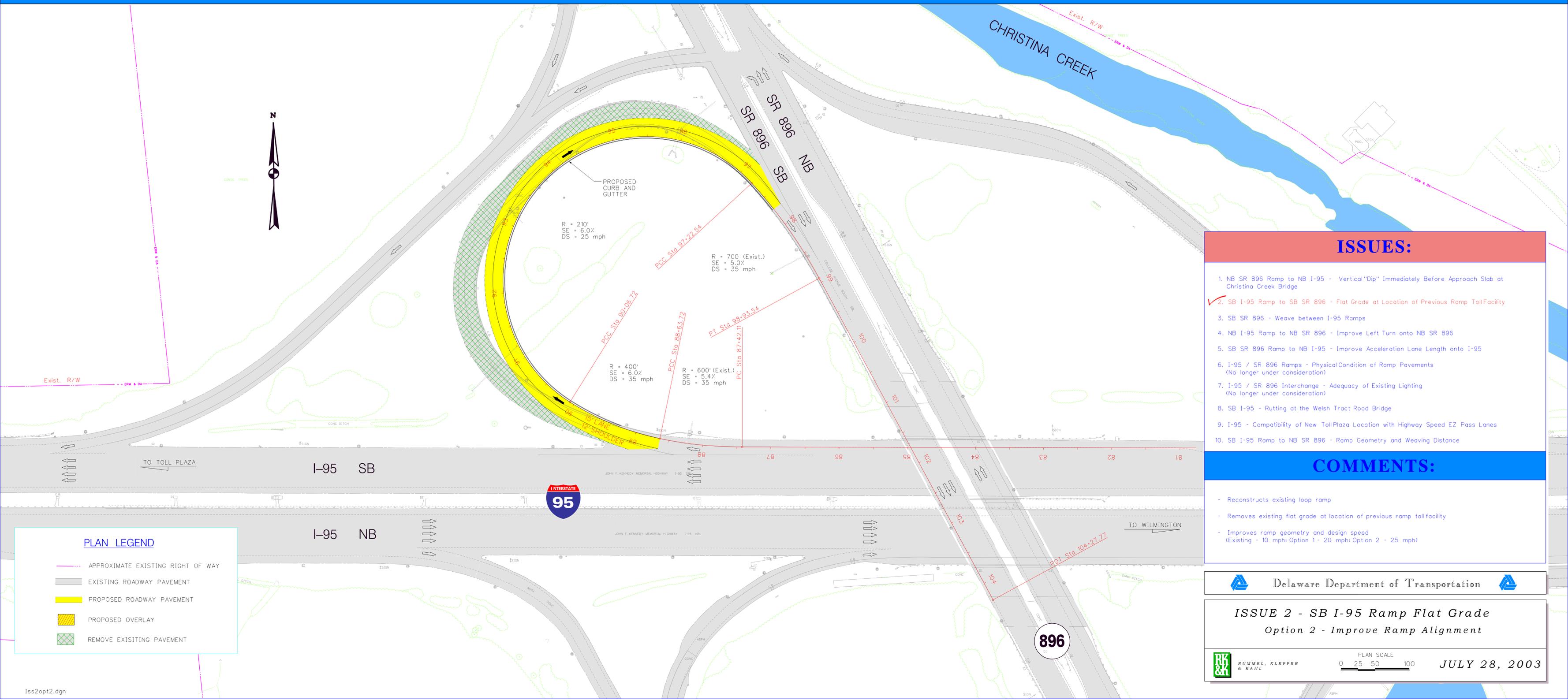
COMMENTS:

- Combines both I-95 Northbound Ramps into single freeway entrance, eliminating one conflict point on the mainline
- Shifts ramp location under SR 896 overpass between south abutment and pier
- Provides desirable acceleration and lane drop lengths by extending barrier separation, auxiliary lane and shoulder
- Corrects vertical "dip" at approach to Christina Creek Bridge
- Reduced shoulder for 25(+/-) ft could prevent widening of Christina Creek Bridge
- Merging volume is within 50 vehicles of capacity (2015)
- The two-lane ramp will have 4,090 pc/h in design year (2015)
- The HCM indicates it is unlikely that two-lane on-ramps can accommodate more than 2,250-2,400 pc/h through the merge

PLAN LEGEND

- APPROXIMATE EXISTING RIGHT OF WAY
- EXISTING ROADWAY PAVEMENT
- PROPOSED ROADWAY PAVEMENT
- PROPOSED OVERLAY
- REMOVE EXISTING PAVEMENT

I-95 / SR 896 Interchange Improvements



PLAN LEGEND

- APPROXIMATE EXISTING RIGHT OF WAY
- EXISTING ROADWAY PAVEMENT
- PROPOSED ROADWAY PAVEMENT
- PROPOSED OVERLAY
- REMOVE EXISTING PAVEMENT

ISSUES:

1. NB SR 896 Ramp to NB I-95 - Vertical "Dip" Immediately Before Approach Slab at Christina Creek Bridge
- ✓ 2. SB I-95 Ramp to SB SR 896 - Flat Grade at Location of Previous Ramp Toll Facility
3. SB SR 896 - Weave between I-95 Ramps
4. NB I-95 Ramp to NB SR 896 - Improve Left Turn onto NB SR 896
5. SB SR 896 Ramp to NB I-95 - Improve Acceleration Lane Length onto I-95
6. I-95 / SR 896 Ramps - Physical Condition of Ramp Pavements (No longer under consideration)
7. I-95 / SR 896 Interchange - Adequacy of Existing Lighting (No longer under consideration)
8. SB I-95 - Rutting at the Welsh Tract Road Bridge
9. I-95 - Compatibility of New Toll Plaza Location with Highway Speed EZ Pass Lanes
10. SB I-95 Ramp to NB SR 896 - Ramp Geometry and Weaving Distance

COMMENTS:

- Reconstructs existing loop ramp
- Removes existing flat grade at location of previous ramp toll facility
- Improves ramp geometry and design speed (Existing - 10 mph; Option 1 - 20 mph; Option 2 - 25 mph)

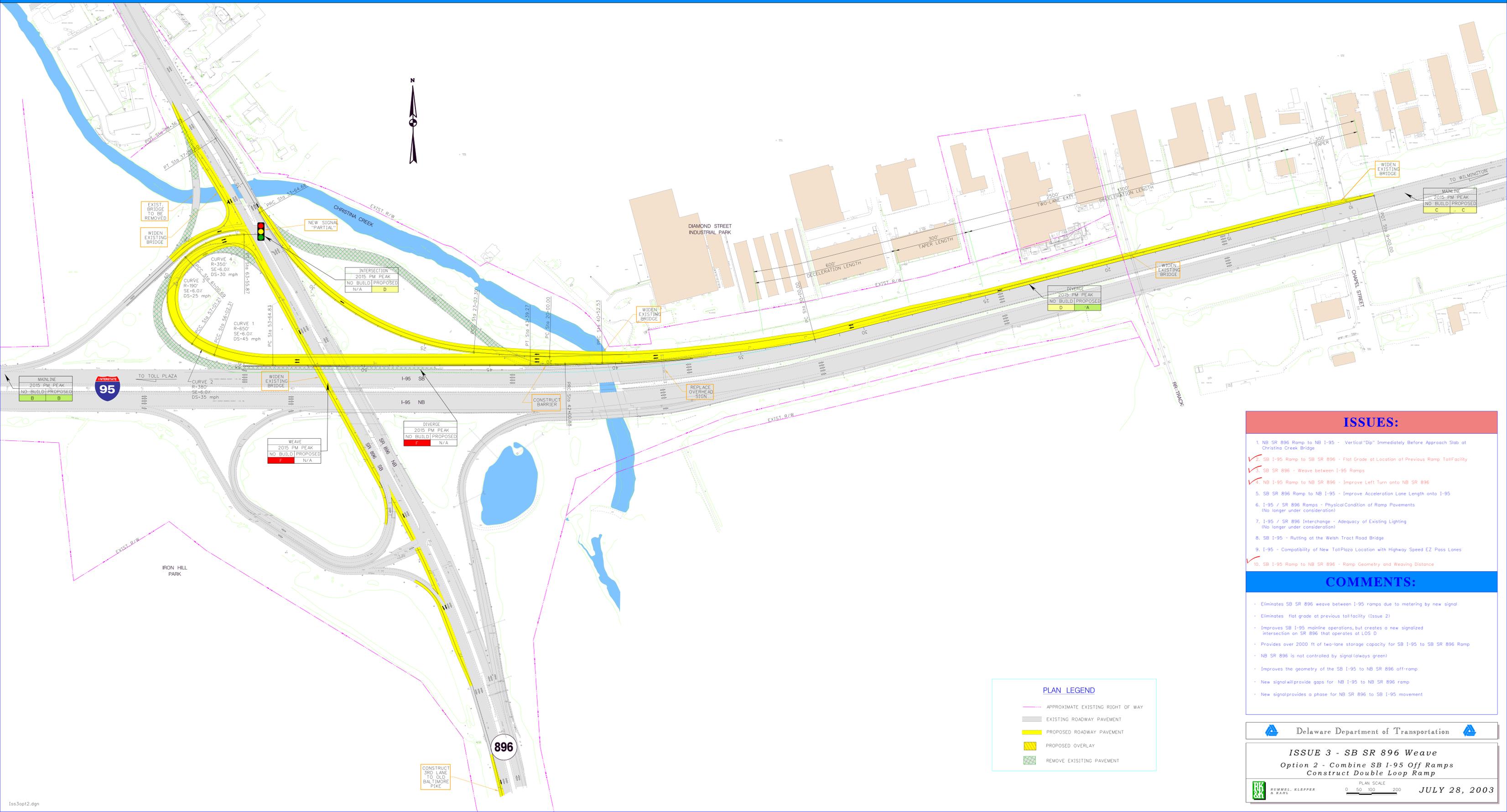
Delaware Department of Transportation

ISSUE 2 - SB I-95 Ramp Flat Grade
Option 2 - Improve Ramp Alignment

RUMMEL, KLEPPER & KAHL

PLAN SCALE
 0 25 50 100
 JULY 28, 2003

I-95 / SR 896 Interchange Improvements



ISSUES:

1. NB SR 896 Ramp to NB I-95 - Vertical "Dip" Immediately Before Approach Slab at Christina Creek Bridge
2. SB I-95 Ramp to SB SR 896 - Flat Grade at Location of Previous Ramp Toll Facility
3. SB SR 896 - Weave between I-95 Ramps
4. NB I-95 Ramp to NB SR 896 - Improve Left Turn onto NB SR 896
5. SB SR 896 Ramp to NB I-95 - Improve Acceleration Lane Length onto I-95
6. I-95 / SR 896 Ramps - Physical Condition of Ramp Pavements (No longer under consideration)
7. I-95 / SR 896 Interchange - Adequacy of Existing Lighting (No longer under consideration)
8. SB I-95 - Rutting at the Welsh Tract Road Bridge
9. I-95 - Compatibility of New Toll Plaza Location with Highway Speed EZ Pass Lanes
10. SB I-95 Ramp to NB SR 896 - Ramp Geometry and Weaving Distance

COMMENTS:

- Eliminates SB SR 896 weave between I-95 ramps due to metering by new signal
- Eliminates flat grade at previous toll facility (Issue 2)
- Improves SB I-95 mainline operations, but creates a new signalized intersection on SR 896 that operates at LOS D
- Provides over 2000 ft of two-lane storage capacity for SB I-95 to SB SR 896 Ramp
- NB SR 896 is not controlled by signal (always green)
- Improves the geometry of the SB I-95 to NB SR 896 off-ramp
- New signal will provide gaps for NB I-95 to NB SR 896 ramp
- New signal provides a phase for NB SR 896 to SB I-95 movement

PLAN LEGEND

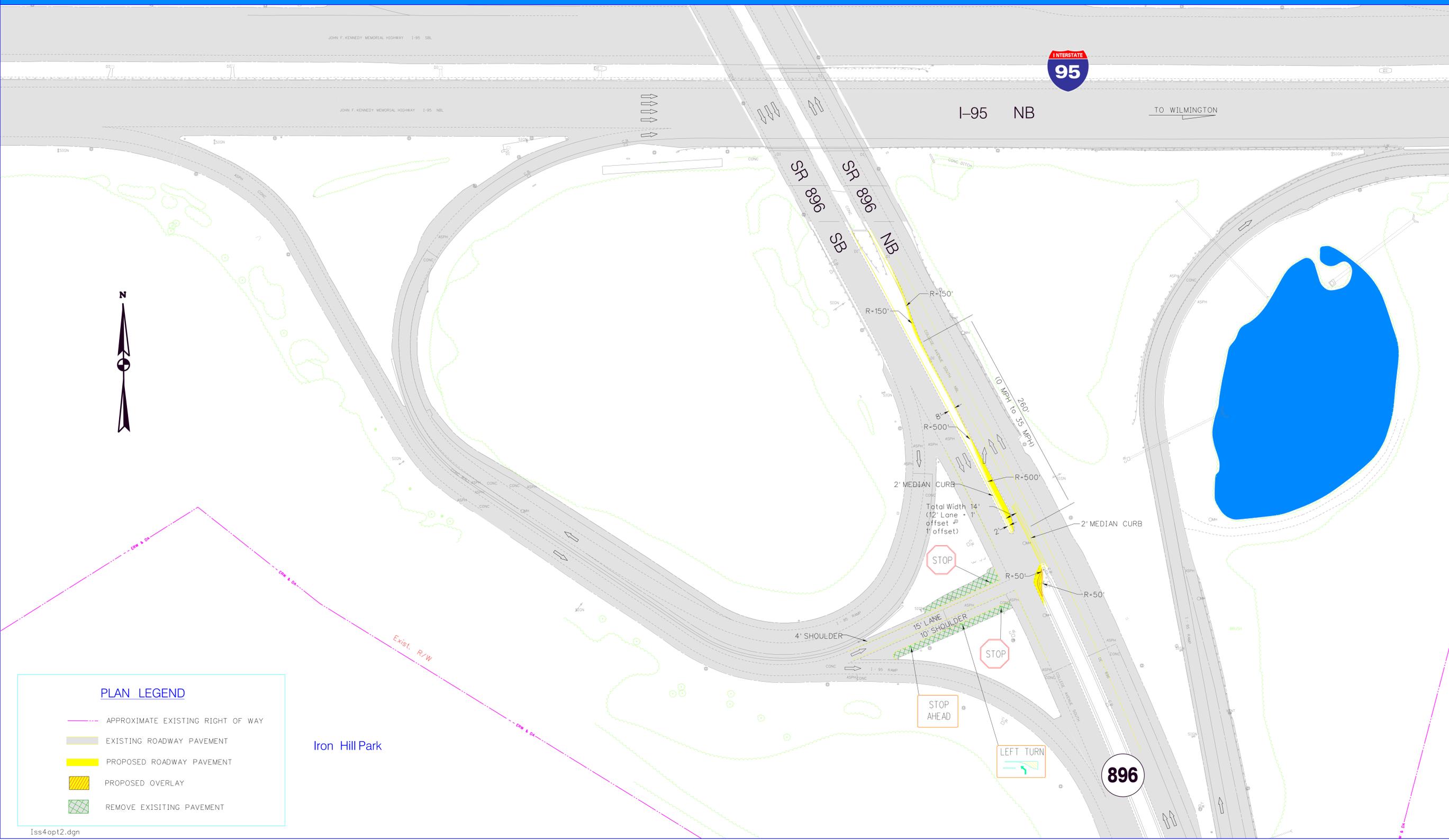
- APPROXIMATE EXISTING RIGHT OF WAY
- EXISTING ROADWAY PAVEMENT
- PROPOSED ROADWAY PAVEMENT
- PROPOSED OVERLAY
- REMOVE EXISTING PAVEMENT

Delaware Department of Transportation

ISSUE 3 - SB SR 896 Weave
 Option 2 - Combine SB I-95 Off Ramps
 Construct Double Loop Ramp

RUMMEL, KLEPPER & RAHL PLAN SCALE 0 50 100 200 JULY 28, 2003

I-95 / SR 896 Interchange Improvements



ISSUES:

- NB SR 896 Ramp to NB I-95 - Vertical "Dip" Immediately Before Approach Slab at Christina Creek Bridge
- SB I-95 Ramp to SB SR 896 - Flat Grade at Location of Previous Ramp Toll Facility
- SB SR 896 - Weave between I-95 Ramps
- NB I-95 Ramp to NB SR 896 - Improve Left Turn onto NB SR 896**
- SB SR 896 Ramp to NB I-95 - Improve Acceleration Lane Length onto I-95
- I-95 / SR 896 Ramps - Physical Condition of Ramp Pavements (No longer under consideration)
- I-95 / SR 896 Interchange - Adequacy of Existing Lighting (No longer under consideration)
- SB I-95 - Rutting at the Welsh Tract Road Bridge
- I-95 - Compatibility of New Toll Plaza Location with Highway Speed EZ Pass Lanes
- SB I-95 Ramp to NB SR 896 - Ramp Geometry and Weaving Distance

COMMENTS:

- Improves left turn channelization and separation from NB SR 896 allowing for a two-stage gap acceptance
 - Delineators could be added to channelizing island to enhance visibility of two stage condition
 - Improved signing along ramp to better identify left turn condition
 - Provides better lane width definition along approach leg of ramp
 - Sight distance for vehicles stopped at the end of the ramp looking north (oncoming SB SR 896 through traffic) is not improved and may be inadequate when there is traffic in the auxiliary lane (NB I-95 loop ramp)
 - Can extend median acceleration lane to provide additional length without widening the existing bridge
- Signal Warrant
- Signal Warrant Analysis was performed in August 2002
 - Relatively low volume of vehicles turning left from the ramp (9 vehicles AM; 15 vehicles PM)
 - Capacity Analysis indicated that the left turn from the unsignalized intersection operates at LOS E during the AM peak and LOS F during the PM peak
 - Signal Warrant 6 - Coordinated Signal System was the only warrant met. Since the intersection does not meet any of the other warrants, Warrant 6 may not be a substantial reason to justify signal installation
 - Recent accident history of rear-end collisions on the weaving segment prior to the intersection and of angle collisions involving left turns from the intersection
 - There was one reported fatality involving an accident with a left turning vehicle
 - Recommendations included geometric improvements at the intersection and/or a redesign of the interchange
- Eliminate Ramp
- FHWA recommended the following process to remove the NB I-95 to NB SR 896 Ramp movement:
 - Issue should be presented to local MPO, the public and possibly the National Truckers Association
 - Full report should be prepared and submitted to Delaware FHWA Office
 - Delaware FHWA would take issue to FHWA Headquarters and possibly AASHTO
 - Concern of the national implications created by closing a ramp due to safety issues
 - FHWA has suggested gaining approval may be difficult. Therefore we recommend finding an alternate solution for the ramp

PLAN LEGEND

- APPROXIMATE EXISTING RIGHT OF WAY
- EXISTING ROADWAY PAVEMENT
- PROPOSED ROADWAY PAVEMENT
- PROPOSED OVERLAY
- REMOVE EXISTING PAVEMENT

Iron Hill Park

Delaware Department of Transportation

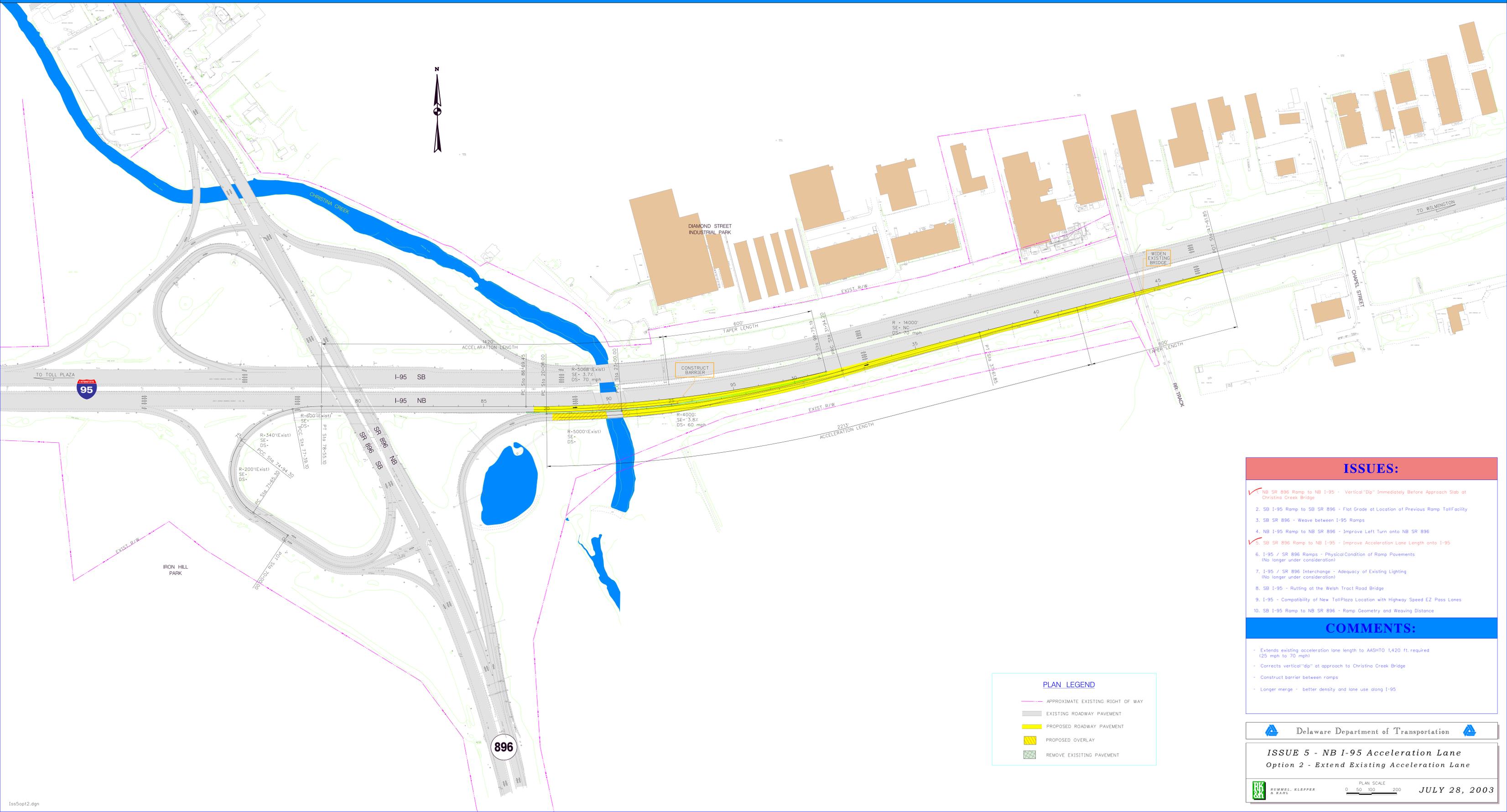
ISSUE 4 - Left Turn Onto NB SR 896
 Option 2 - Provide Left Turn Channelization

RUMMEL, KLEPPER & RAHL

PLAN SCALE: 0 25 50 100

JULY 28, 2003

I-95 / SR 896 Interchange Improvements



PLAN LEGEND

- APPROXIMATE EXISTING RIGHT OF WAY
- EXISTING ROADWAY PAVEMENT
- PROPOSED ROADWAY PAVEMENT
- PROPOSED OVERLAY
- REMOVE EXISTING PAVEMENT

ISSUES:

- ✓ NB SR 896 Ramp to NB I-95 - Vertical "Dip" Immediately Before Approach Slab at Christina Creek Bridge
2. SB I-95 Ramp to SB SR 896 - Flat Grade at Location of Previous Ramp Toll Facility
3. SB SR 896 - Weave between I-95 Ramps
4. NB I-95 Ramp to NB SR 896 - Improve Left Turn onto NB SR 896
- ✓ SB SR 896 Ramp to NB I-95 - Improve Acceleration Lane Length onto I-95
6. I-95 / SR 896 Ramps - Physical Condition of Ramp Pavements (No longer under consideration)
7. I-95 / SR 896 Interchange - Adequacy of Existing Lighting (No longer under consideration)
8. SB I-95 - Rutting at the Welsh Tract Road Bridge
9. I-95 - Compatibility of New Toll Plaza Location with Highway Speed EZ Pass Lanes
10. SB I-95 Ramp to NB SR 896 - Ramp Geometry and Weaving Distance

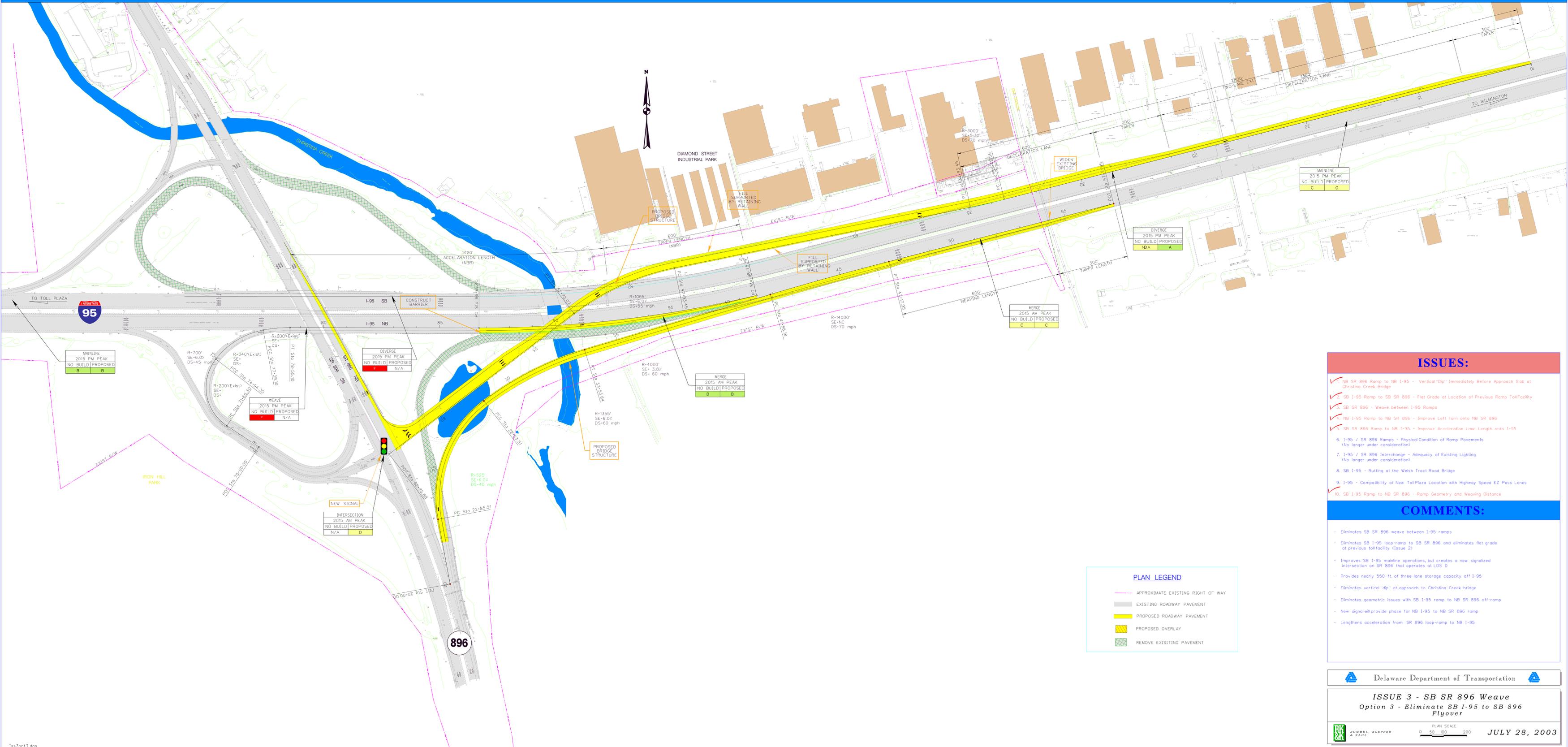
COMMENTS:

- Extends existing acceleration lane length to AASHTO 1,420 ft. required (25 mph to 70 mph)
- Corrects vertical "dip" at approach to Christina Creek Bridge
- Construct barrier between ramps
- Longer merge - better density and lane use along I-95



ISSUE 5 - NB I-95 Acceleration Lane
Option 2 - Extend Existing Acceleration Lane

I-95 / SR 896 Interchange Improvements



ISSUES:

- ✓ 1. NB SR 896 Ramp to NB I-95 - Vertical "Dip" Immediately Before Approach Slab at Christina Creek Bridge
- ✓ 2. SB I-95 Ramp to SB SR 896 - Flat Grade at Location of Previous Ramp Toll Facility
- ✓ 3. SB SR 896 - Weave between I-95 Ramps
- ✓ 4. NB I-95 Ramp to NB SR 896 - Improve Left Turn onto NB SR 896
- ✓ 5. SB SR 896 Ramp to NB I-95 - Improve Acceleration Lane Length onto I-95
6. I-95 / SR 896 Ramps - Physical Condition of Ramp Pavements (No longer under consideration)
7. I-95 / SR 896 Interchange - Adequacy of Existing Lighting (No longer under consideration)
8. SB I-95 - Rutting at the Welsh Tract Road Bridge
9. I-95 - Compatibility of New Toll Plaza Location with Highway Speed EZ Pass Lanes
- ✓ 10. SB I-95 Ramp to NB SR 896 - Ramp Geometry and Weaving Distance

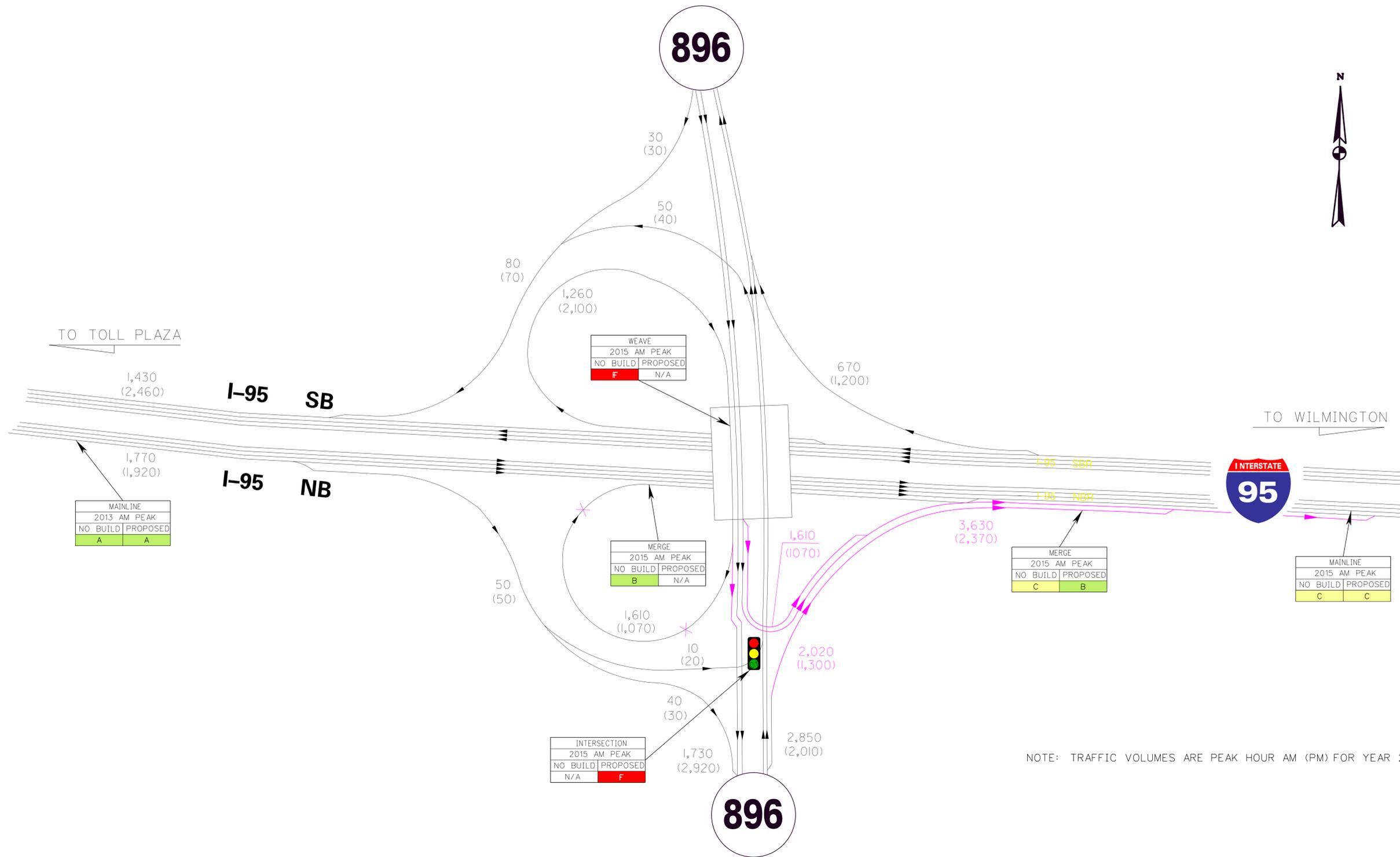
COMMENTS:

- Eliminates SB SR 896 weave between I-95 ramps
- Eliminates SB I-95 loop/ramp to SB SR 896 and eliminates flat grade at previous toll facility (Issue 2)
- Improves SB I-95 mainline operations, but creates a new signalized intersection on SR 896 that operates at LOS D
- Provides nearly 550 ft. of three-lane storage capacity off I-95
- Eliminates vertical "dip" at approach to Christina Creek bridge
- Eliminates geometric issues with SB I-95 ramp to NB SR 896 off-ramp
- New signal will provide phase for NB I-95 to NB SR 896 ramp
- Lengthens acceleration from SR 896 loop-ramp to NB I-95

PLAN LEGEND

- APPROXIMATE EXISTING RIGHT OF WAY
- EXISTING ROADWAY PAVEMENT
- PROPOSED ROADWAY PAVEMENT
- PROPOSED OVERLAY
- REMOVE EXISTING PAVEMENT

I-95 / SR 896 Interchange Improvements



NOTE: TRAFFIC VOLUMES ARE PEAK HOUR AM (PM) FOR YEAR 2015

ISSUES:

- NB SR 896 Ramp to NB I-95 - Vertical "Dip" Immediately Before Approach Slab at Christina Creek Bridge
- SB I-95 Ramp to SB SR 896 - Flat Grade at Location of Previous Ramp Toll Facility
- SB SR 896 - Weave between I-95 Ramps
- NB I-95 Ramp to NB SR 896 - Improve Left Turn onto NB SR 896
- SB SR 896 Ramp to NB I-95 - Improve Acceleration Lane Length onto I-95
- I-95 / SR 896 Ramps - Physical Condition of Ramp Pavements (No longer under consideration)
- I-95 / SR 896 Interchange - Adequacy of Existing Lighting (No longer under consideration)
- SB I-95 - Rutting at the Welsh Tract Road Bridge
- I-95 - Compatibility of New Toll Plaza Location with Highway Speed EZ Pass Lanes
- SB I-95 Ramp to NB SR 896 - Ramp Geometry and Weaving Distance

COMMENTS:

- This configuration eliminates the weave along SB SR 896
- Requires converting the left through lane on SB SR 896 to a left turn lane and develops the SB I-95 to SB SR 896 ramp as the second through lane on SB SR 896
- A new signal would be installed along SR 896 (LOS F)
- A phase could be added to the signal to provide time for the left turn from NB I-95 to NB SR 896
- Queue length on SB SR 896 would be approximately 1,260 feet, possibly blocking the NB SR 896 to SB I-95 left turn
- The combined volumes on the NB I-95 on-ramp from SB and NB SR 896 is approximately 4,090 pc/h during the 2015 AM peak
- The HCM states that it is unlikely that two-lane on-ramps can accommodate more than 2,250 to 2,400 pc/h through a merge
- Congestion and slow moving traffic on the on-ramp meters the ability for southbound left turns to move through the intersection