# I-80 Corridor Feasibility Study

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# Introduction of NDE in Utah

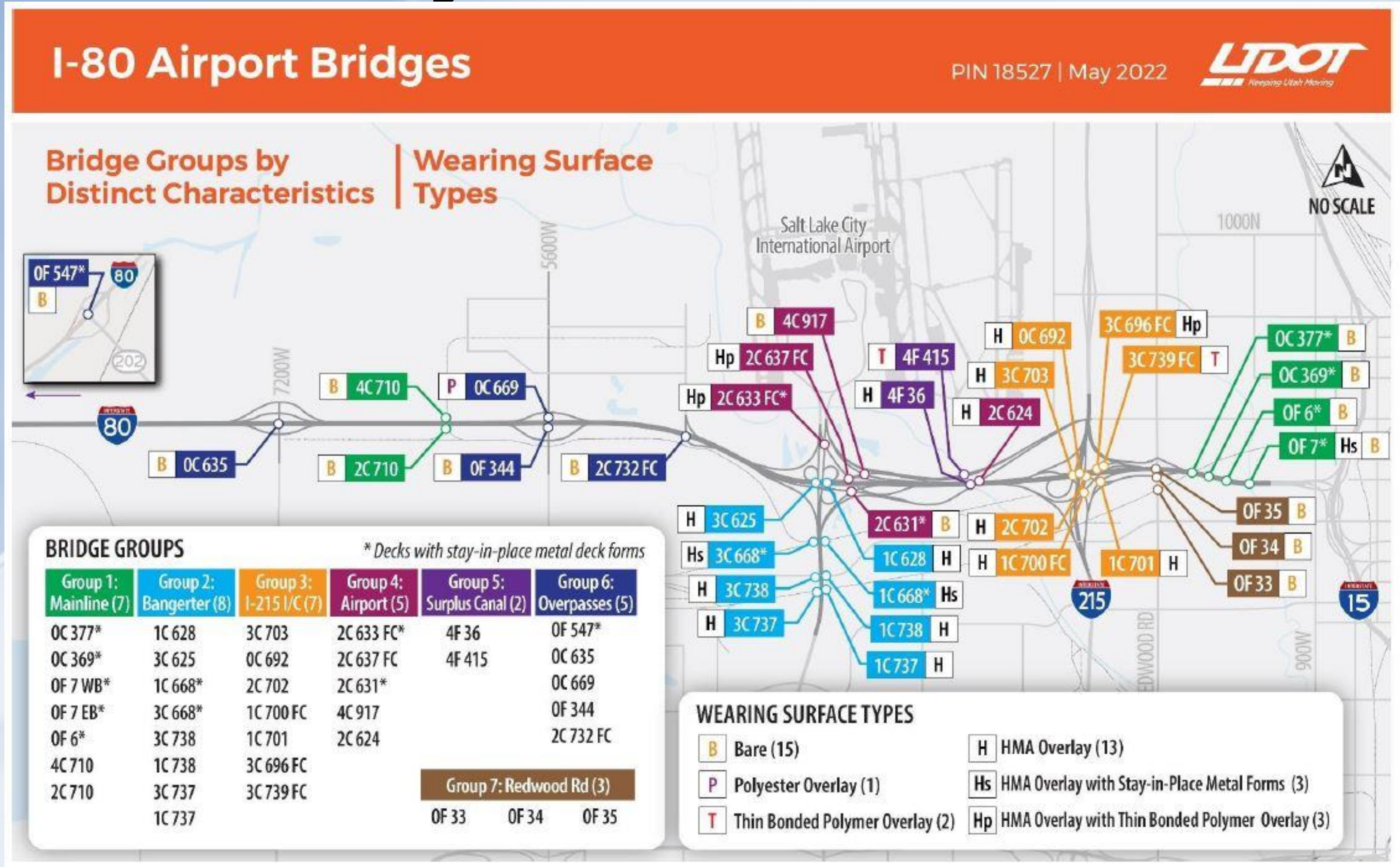
- The purpose of using these technologies was to validate condition findings that were gathered using more traditional methods (visual inspection, sounding, etc.)

- Advantages of using NDE methods include:
  - Rapid testing speed
  - Lower user impact
  - No repairs needed after testing
  - More informed decision making

# Data Implementation

- The Data gathered from NDE technology provides several useful advantages for project decision making. These include:
  - Verifying known quantities of deterioration, as well as new areas
  - Using test results to define preliminary project scoping
  - A helpful tool when determining how to prioritize or bundle multiple candidates
- Results can also help determine if more significant testing is required through coring, chloride testing, etc.

# Recent Study



# I-80 CAMP - Objective

Project Objective: To evaluate 36 bridges along one of Utah's most well used corridors (I-84), and create a comprehensive Corridor Asset Management Plan (CAMP) based on the results and evaluation of various testing methods and treatment options.

## Phase I

- Perform a National Investigation of successful and effective testing and treatment methods
- Create a targeted Testing Plan based on findings and recommendations from the National Investigation

## Phase II

- Conduct tests outlined in the approved Testing Plan
- Create a Feasibility Study for each bridge within the project based on test results
- Compile all recommendations together to create the CAMP and resulting project bundles over the next 20 years

# I-80 CAMP (Phase I) - National Investigation

- Several different source types were evaluated to determine effective testing methods, including NDE methods. Sources include:
  - AASHTO TSP2 Bridge Preservation Partnerships
  - State DOT websites and research publications
  - NCHRP Research Reports and Syntheses
  - FHWA website, reports, and TechBriefs
  - Journal papers
  - Conference proceedings
  - Informal interviews of select agency or industry experts

| Category | Evaluation/Testing Methods |
|---|---|
| NDE of Concrete | Sounding<br>Chain Drag/Hammer Sounding<br>Delam Tool<br>Rapid Automated Sounding<br>Deck Acoustic Response |
| | Impact Echo (IE)<br>NDT (Impact Echo) Deck Tester |
| | Swiss (Schmidt) Rebound Hammer |
| | Ultrasonic Pulse and Tomography |
| | Ultrasonic Surface Waves (USW) |
| | Relative Humidity (RH) |
| | Electrical Surface Resistivity |
| | Corrosion Potential<br>Half-cell Potential (HCP)<br>Vertical Electrical Impedance (VEI)<br>Kelvin Probe |
| | Corrosion Rate<br>Linear Polarization<br>Galvanostatic Pulse |
| | Magnetic Methods<br>Magnetic Flux Leakage (MFL) |
| | Ground Penetrating Radar (GPR)<br>Multi-channel GPR<br>Stepped Frequency GPR |
| | Infrared Thermography (IR)<br>Ultra-Time-Domain (IR-UTD) |
| | LiDAR |
| | High-Resolution Imagery (HRI) |
| | federned Aircraft Systems (UAS) |
| | Artificial Intelligence and NDE |
| | Foundation Testing<br>Pile Integrity Testing<br>Seismic Refraction<br>Magnetic Borehole Gradiometer<br>Parallel Seismic Pile Length Test |

# I-80 CAMP (Phase I) - Creation of the Testing Plan

- Based on findings from the National Investigation, a testing strategy was developed. This strategy combined various NDE technologies, along with selective sampling methods that would be used to validate overall findings

| Characteristic | NDE | | | | | | | SAMPLING | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SounDAR | Mobile 3D GPR[1] | HRI[2] | Cart-based GPR | Infrared Therm. (Static IR) | Ultra-time (IR-UTD)[3] | Substructure Sounding | Deck Chloride (Cl⁻) Cores | Substructure Chloride (Cl⁻) | Exploratory Drilling | Remove SIP Forms | Paint Testing[4] |
| Bare Deck | ✓ | ✓ | | | ✓ | | | ✓ | | | | |
| HMA Overlay | | ✓ | | | | ✓, * | | ✓ | | ✓ | | |
| TBPO Overlay | ✓ | ✓ | | | ✓ | | | ✓ | | | | |
| PPC Overlay | ✓ | ✓ | | | ✓ | | | ✓ | | | | |
| Bridges not approved for UAS | | | ✓ | | | | | | | | | |
| Approach Slab w/ HMA | | | | | | | | | | ✓ | | |
| Approach Slab w/Settlement > 3" | | | | ✓ | | | | | | | | |
| Overlaid Deck Underside < 5% Potential Blowout | | | | | | * | | | | | | |
| SIP Forms not over Railroad | | | | | | | | | | | ✓ | |
| Mainline Columns < 20 ft. from Lane or Cond. Based | | | | | | | ✓ | | ✓ | | | |
| Select Abutments with CS3 | | | | | | | ✓ | | ✓ | | | |
| Steel Girders | | | | | | | | | | | | ✓ |

*1: Mobile 3D GPR to also be performed on the approach slabs.*

*2: HRI to be collected in Phase II for the 11 bridges that do not have pix 4d data.*

*3: ✓: indicates top of deck testing, *: indicates both top and underside of deck testing.*

*4: See Section 6.4 for more details.*

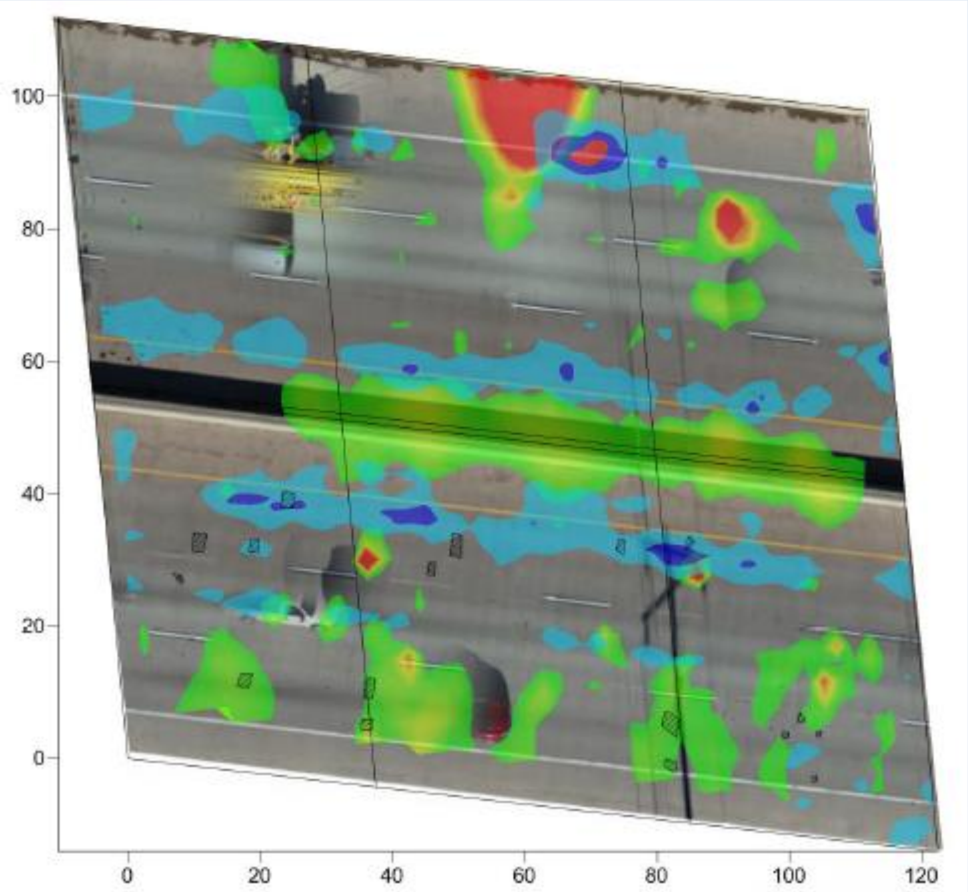
# I-80 CAMP (Phase II) - Executing the Testing Plan

- The following NDE methods were selected for the overall study, and were performed on a number of bridges within the corridor
  - Automated Acoustic Sounding (SounDAR)
  - Mobile 3D and Cart-based GPR
  - High Resolution Imagery (HRI)
  - Infrared Thermography (Static IR)
  - Ultra Time Infrared Thermography (IR-UTD)
  - Substructure Sounding
- Testing in the field began in August, 2021 and lasted approximately 1 month. Data processing, evaluation, and reporting took an additional 5.5 months

# NDE – High Resolution Imagery (HRI)

| Name: | High Resolution Imagery (HRI) |
|---|---|
| # of Bridges Tested: | 11 |
| Descriptio n: | Used to collect images of the existing bridge decks and overlay systems. This test was primarily used as a tool to filter out markings from the riding surface that would be picked up with other tests, and to document existing patches and spalls. |

| Pros: | Cons: |
|---|---|
| • Can be used at high speeds<br>• Can perform other tests at the same time<br>• Low user impact | • Result is images only, no automation in determining condition |



# NDE – Automated Acoustic Sounding (SounDAR)

| Name: | Automated Acoustic Sounding (SounDAR) |
|---|---|
| # of Bridges Tested: | 18 |
| Description: | Automated form of sounding, mounted to the back of a vehicle. Identifies delaminations in concrete or overlay materials |

| Pros: | Cons: |
|---|---|
| - Can be used at high speeds<br>- Consistent automation | - Does not perform well on bridges with HMA overlays |

# NDE – Ground Penetrating Radar (GPR)

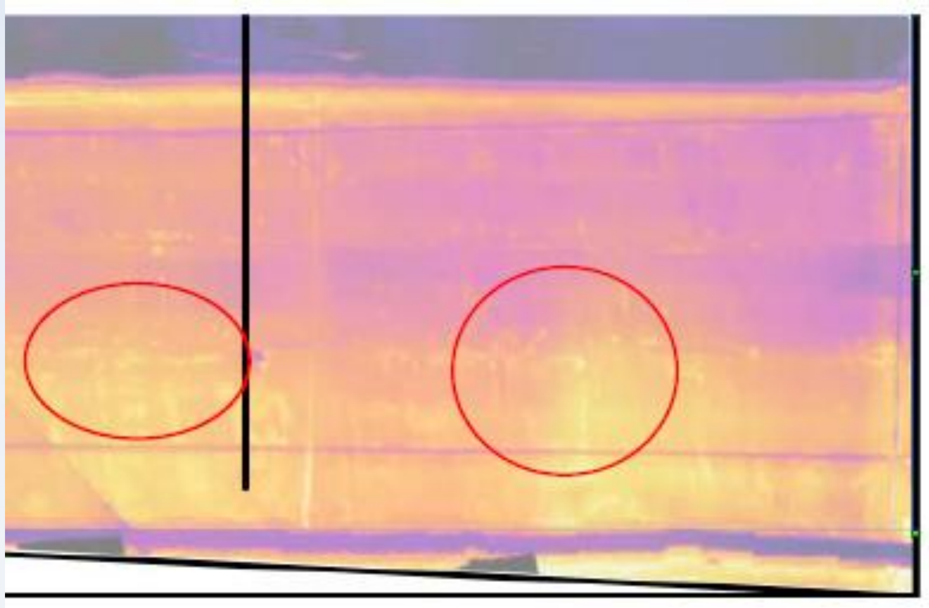
| | |
|---|---|
| Name: | Ground Penetrating Radar (GPR) |
| # of Bridges Tested: | 36 |
| Descriptio n: | Primarily used to determine overlay thickness, depth of rebar, and evaluate the likelihood of concrete deficiencies in the bridge deck (existing and predicted) |

| Pros: | Cons: |
|---|---|
| - Can be used at high speeds<br>- Consistent automation | - Requires longer periods of time to process results<br>- Data is not intuitive and difficult to interpret |

# NDE – Static Infrared Thermography (IR)

| Name: | Static Infrared Thermography (IR) |
|---|---|
| # of Bridges Tested: | 18 |
| Description: | Performed concurrently with HRI testing, this test captures a snapshot of the thermal state of the riding surface. Images taken at precise times to show inconsistent temperature changes in hopes of finding delaminations and defects |

| Pros: | Cons: |
|---|---|
| - Can be used at high speeds<br>- Consistent automation | - Prone to environmental events<br>- Timing of test is difficult to determine and execute |



# NDE – Ultra-Time Domain IR (IR-UTD)

| Name: | Ultra Time Domain Infrared Thermography (IR-UTD) |
|---|---|
| # of Bridges Tested: | 19 (19 top side and 10 underside) |
| Description: | Infrared camera mounted in one location for a longer period of time, capturing temperature cycles more accurately than static images. |

| Pros: | Cons: |
|---|---|
| - Low user impact<br>- Simple set up and equipment | - Prone to environmental events<br>- Accuracy |

# I-80 – Tests Results and Feasibility Study

- Based on the data from both NDE and traditional testing methods, the project team was able to make recommendations for the treatment options of each structure within the corridor

- Quantity thresholds were developed to consistently decide between treatment alternatives (i.e. Deck Replacement vs Rehabilitation)

| | | Deck Treatments | | | | | | Deck Protections | | | | | Additional Preservation Recommendations | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Structure Number | Total Bridge Replacement | Structural Pothole Patching | Shallow Hydro-Demolition | Deep Hydro-Demolition | Deck Replacement | Do Nothing | HMWM Overlay | PPC Overlay | TBPO Overlay | HMA Overlay | Do Nothing | Approach Slabs | Joints | Parapet Repairs | Parapet Sealing | PS Girders | Steel Girders & Paint | Bearings | Pin and Hanger | Abutments | Wingwalls | Bent Caps | Bent Wall/Columns | Erosion Mitigation | Drainage |
| Mainline | 0F 6 | | | ✓ | | | | | ✓ | | | | ✓ | | ✓ | ✓ | ✓ | | | | | | | ✓ | | |
| | 0F 7 (EB) | | | | ✓ | | | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | | | | |
| | 0F 7 (WB) | | | | ✓ | | | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | | | | | |
| | 0C 369 | | | ✓ | | | | | ✓ | | | | ✓ | | | ✓ | | ✓ | | | | | | | | |
| | 0C 377 | | | ✓ | | | | | ✓ | | | | ✓ | | | ✓ | | ✓ | ✓ | | ✓ | ✓ | | | | |
| | 2C 710 | | ✓ | | | | | ✓ | | | | | ✓ | | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | | | | |
| | 4C 710 | | ✓ | | | | | ✓ | | | | | ✓ | | | ✓ | | ✓ | ✓ | | | ✓ | | | | |

# I-80 – Corridor Asset Management Plan (CAMP)

- From the individual Feasibility Studies of each bridge, an overarching plan was developed to properly address each structure within the corridor over a 20 year period
- Eight projects were created through this effort, and were grouped based on location, scope, and priority of work
- This final report included project costs, maintenance of traffic considerations, schedules, and justification for decisions made

| | I-80 Mainline | | | | | | | Bangerter | | | | | | | | I-215 Interchange | | | | | | | Airport | | | | | Surplus | | Overpass | | | | | Redwood | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Projects | 0F 6 | 0F 7 (EB) | 0F 7 (WB) | 0C 369 | 0C 377 | 2C 710 | 4C 710 | 1C 628 | 3C 625 | 1C 668 | 3C 668 | 1C 737 | 3C 737 | 1C 738 | 3C 738 | 0C 692 | 3C 696 FC | 1C 700 FC | 1C 701 | 2C 702 | 3C 703 | 3C 739 FC | 2C 624 | 2C 631 | 2C 633 FC | 2C 637 FC | 4C 917 | 4F 36 | 4F 415 | 0F 344 | 0F 547 | 0C 635 | 0C 669 | 2C 732 | 0F 33 | 0F 34 | 0F 35 | Total Bridges | Construction Start (yr) | Duration (yrs) | FY 2022 Cost ($000) | Inflation Adjusted Cost* ($000) |
| 1 – Structural Pothole Patching & Surfacing Project | | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | ✓ | | ✓ | ✓ | | | | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | 19 | 2023 | 1 | $7,873 | $8,188 |
| 2 – Hydro Demolition & Substructure Rehab | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | | | | | | | | | | ✓ | | | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | 13 | 2026 | 3 | $29,680 | $34,721 |
| 3 – Bridge Replacement; 0C 669 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | | | | | 1 | 2029 | 1 | $14,464 | $19,034 |
| 4 – High Priority Steel Paint | | | | | | | | ✓ | ✓ | | | | | ✓ | ✓ | | | | | | | | | ✓ | ✓ | ✓ | | | | | | | | ✓ | | | | 8 | 2030 | 2 | $17,023 | $23,297 |
| 5 – Deck Replacements; Bangerter | | | | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | | | | | | | | | | | | | | 8 | 2032 | 3 | $30,019 | $44,435 |
| 6 – Deck Replacements; I-215 | | | | | | | | | | | | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | | | | | | | 7 | 2035 | 3 | $32,651 | $54,366 |
| 7 – Deck Replacements; Airport | | | | | | | | | | | | | | | | | | | | | | | ✓ | | ✓ | ✓ | | | | | | | | | | | | 3 | 2038 | 1 | $28,039 | $52,517 |
| 8 – Mid to Low Priority Steel Paint | | | | ✓ | ✓ | | | | | | | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | | | | | | | | | | 11 | 2039 | 2 | $21,787 | $42,439 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Total: | 16 | $181,536 | $278,997 |

* Adjusted cost is calculated from 2022 values and is inflated 4% per year based on the construction start year.

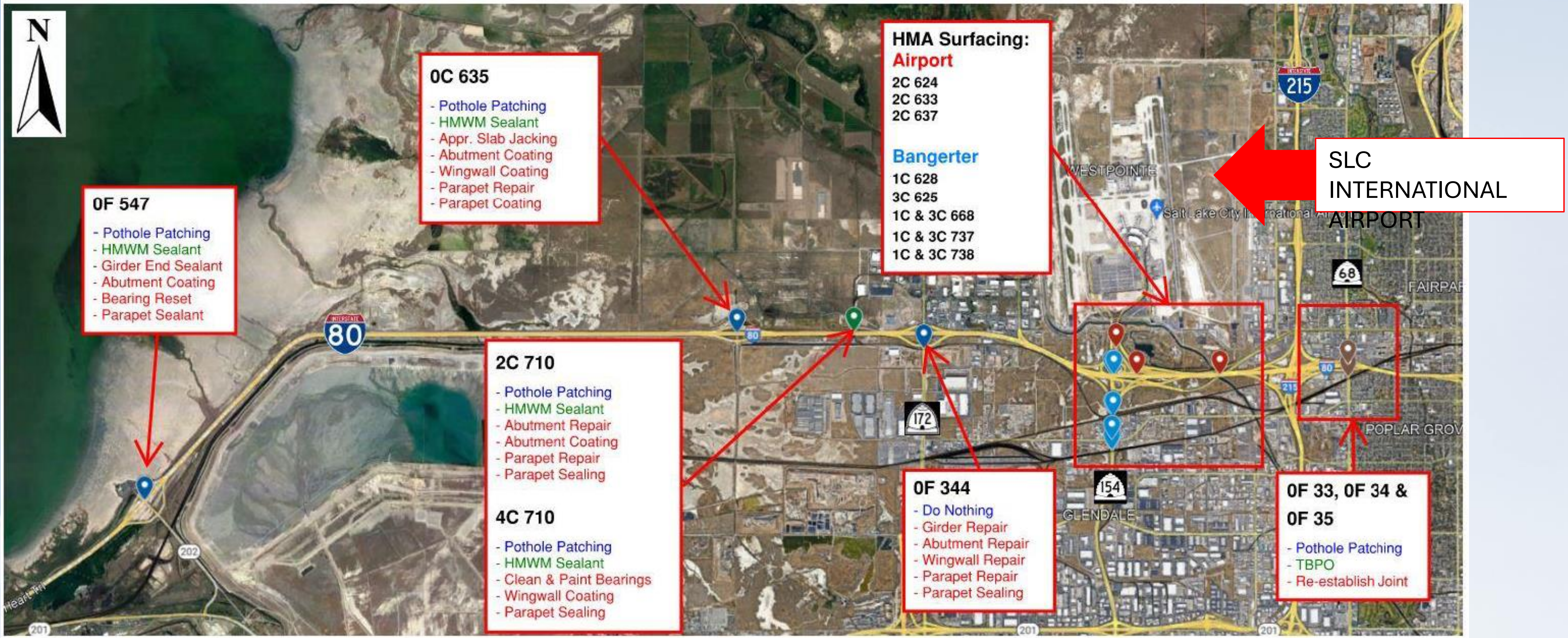
# I-80 – Lessons Learned

| Successes | Possible Improvements |
|---|---|
| • Achieved a great deal of coordination between project team, stakeholders, maintenance forces, etc<br>• Gained valuable information on test variety and capabilities<br>• Possess a well documented and elaborate plan for this corridor over the next 20 years<br>• Validated some of the decision making currently used within the Department | • Limit testing methods to most effective technologies<br>• Take into account environmental factors while recommending tests<br>• Individual project reports |

# Conclusion

- UDOT found this study and the associated test results extremely useful in evaluating and programming future projects
- The Department has already applied to two separate grants based off of the work completed within this study as part of the Bridge Investment Program (BIP)
- We plan on using some of this same NDE technology for other projects going forward, for example, a deck preservation project along I-15 in 2023.

# I-80 Project 1



# I-80 Project 1

| STRUCTURE NUMBER | STRUCTURE NAME | MILE POST | GRANULAR BACKFILL BORROW (PLAN QUANTITY) | REMOVE APPROACH SLAB AND PARAPETS | ASPHALT SURFACING REMOVAL (STRUCTURES) | HIGHLY MODIFIED HOT MIX ASPHALT (HMMA) *; SEE NOTE 10 | PAVEMENT MARKING PAINT * | ASPHALT POLYMER TREATMENT * | RELIEF JOINT SEALING | PARAPET JOINT SEALING | INSPECTION HOLE | REINFORCING STEEL COATED (PLAN QUANTITY) | STRUCTURAL CONCRETE | STRUCTURAL CONCRETE - FIBER | THIN BONDED POLYMER OVERLAY, TYPE I | THIN BONDED POLYMER OVERLAY, TYPE III | BRIDGE DECK METHACRYLATE RESIN TREATMENT | PENETRATING CONCRETE SEALER | PARAPET SEALING | PREPARE STRUCTURE FOR NEW CORBEL | PARAPET REPAIR | CURB REPAIR | SIDEWALK REPAIR | GIRDER END PROTECTION | STRUCTURAL POTHOLE PATCHING | OPEN POTHOLE DECK REPAIR | STRUCTURAL STEEL | COMPRESSION JOINT SEAL (TYPE A) | COMPRESSION JOINT SEAL (TYPE A) MODIFICATION | JOINT GLAND REPLACEMENT | WATERPROOFING MEMBRANE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CU YD | EACH | SQ YD | TON | GAL | SQ YD | FT | FT | EACH | LBS | CU YD | CU YD | SQ FT | SQ FT | SQ FT | SQ FT | FT | EACH | FT | FT | FT | EACH | SQ FT | SQ FT | LBS | FT | FT | FT | SQ FT |
| F 547 | SR-202 OVER I-80 | 1.49 | - | - | - | - | * | - | - | - | - | - | - | - | - | 11,805 | - | - | 555 | - | - | - | - | 10 | 2,365 | - | - | - | - | - | - |
| C 635 | 7200 W OVER I-80 | 0.08 | 32 | 2 | - | - | * | - | - | - | - | 29,937 | 50 | 77 | - | - | 15,970 | - | 540 | 2 | - | - | - | - | 2,800 | - | 515 | 120 | - | - | - |
| C 710 | EB I-80 OVER SL AND GW RR | 112.78 | - | - | - | - | * | - | - | - | - | - | - | - | - | - | 7,565 | - | 355 | - | 2 | - | - | - | 1,060 | - | - | - | 80 | - | - |
| C 710 | WB I-80 OVER SL AND GW RR | 112.77 | - | - | - | - | * | - | - | - | - | - | - | - | - | - | 7,565 | - | 355 | - | - | - | - | - | 1,290 | - | - | 80 | - | - | - |
| C 633 | SB SR-154 RAMP TO I-80 OVER SR-154 NB | 0.07 | - | - | 2,435 | * | * | - | 80 | - | - | - | - | - | - | - | - | - | 1,140 | - | - | - | - | - | - | 4,410 | - | - | - | 45 | 21,900 |
| C 637 | SB SR-154 RAMP TO I-80 EB OVER I-80 | 0.43 | - | - | 3,790 | * | * | - | 80 | - | - | - | - | - | - | - | - | - | 1,775 | - | - | - | - | - | - | 6,880 | - | - | - | 85 | 34,070 |
| C 624 | EB I-80 OFF RAMP OVER I-80 & SURPLUS CANAL | 1.45 | - | - | 3,265 | * | * | - | 125 | - | - | - | - | - | - | - | - | - | 1,560 | - | - | - | - | - | - | 5,950 | - | - | - | - | 29,355 |
| C 628 | NB SR-154 OVER I-80 | 23.69 | - | - | 2,555 | * | * | - | 105 | - | - | - | - | - | - | - | - | - | 905 | - | - | - | - | - | - | 4,600 | - | - | - | - | 22,980 |
| C 625 | SB SR-154 OVER I-80 | 2.69 | - | - | 3,040 | * | * | - | 125 | - | - | - | - | - | - | - | - | - | 885 | - | - | - | - | - | - | 5,470 | - | - | - | - | 27,335 |
| C 668 | NB SR-154 OVER UPRR SOUTH OF SL AIRPORT | 23.29 | - | - | 2,025 | * | * | - | 160 | - | - | - | - | - | - | - | - | - | 480 | - | - | - | - | - | - | 3,645 | - | - | - | - | 18,205 |
| C 668 | SB SR-154 OVER UPRR SOUTH OF SL AIRPORT | 2.25 | - | - | 1,565 | * | * | - | 125 | - | - | - | - | - | - | - | - | - | 475 | - | - | - | - | - | - | 2,820 | - | - | - | - | 14,085 |
| C 738 | NB SR-154 OVER 700 S | 23.06 | - | - | 940 | * | * | * | 85 | 210 | 6 | - | - | - | - | - | - | - | 415 | - | - | - | - | - | - | 1,690 | - | - | - | - | - |
| C 738 | SB SR-154 OVER 700 S | 1.97 | - | - | 940 | * | * | - | 85 | - | - | - | - | - | - | - | - | - | 415 | - | - | - | - | - | - | 1,690 | - | - | - | - | 8,440 |
| C 737 | NB SR-154 OVER UPRR | 22.93 | - | - | 1,015 | * | * | - | 85 | - | - | - | - | - | - | - | - | - | 450 | - | - | - | - | - | - | 1,830 | - | - | - | - | 9,135 |
| C 737 | SB SR-154 OVER UPRR | 1.87 | - | - | 1,015 | * | * | - | 85 | - | - | - | - | - | - | - | - | - | 450 | - | - | - | - | - | - | 1,830 | - | - | - | - | 9,135 |
| F 35 | SR-68 OVER I-80 | 59.17 | - | - | - | - | * | - | - | - | - | - | - | - | 20,795 | - | - | 4,450 | 540 | - | - | 5 | 10 | - | 420 | - | - | 185 | - | - | - |
| F 34 | SR-68 OVER 200 S | 59.09 | - | - | - | - | * | - | - | - | - | - | - | - | 15,545 | - | - | 3,330 | 405 | - | - | - | - | - | 935 | - | - | 185 | - | - | - |
| F 33 | SR-68 OVER UPRR | 59.03 | - | - | - | - | * | - | - | - | - | - | - | - | 18,220 | - | - | 3,900 | 470 | - | - | - | 20 | - | 365 | - | - | 105 | - | - | - |
| | | TOTAL | 32 | 2 | 22,585 | * | * | * | 1,140 | 210 | 6 | 29,937 | 50 | 77 | 54,560 | 11,805 | 31,100 | 11,680 | 12,170 | 2 | 2 | 5 | 30 | 10 | 9,235 | 40,815 | 515 | 675 | 80 | 130 | 194,640 |

QUANTITIES

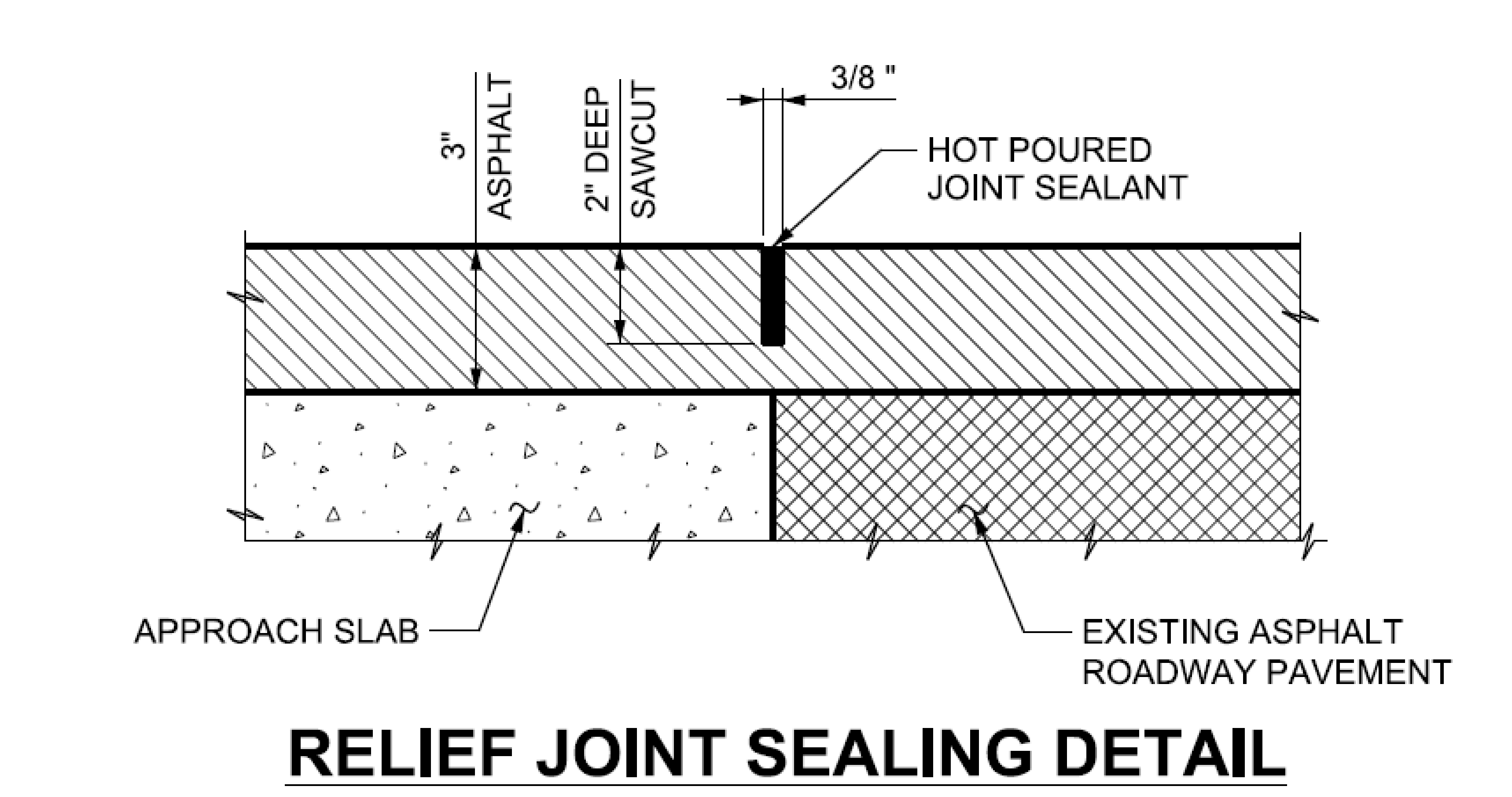
* INCLUDED IN ROADWAY QUANTITIES

# I-80 Project 1

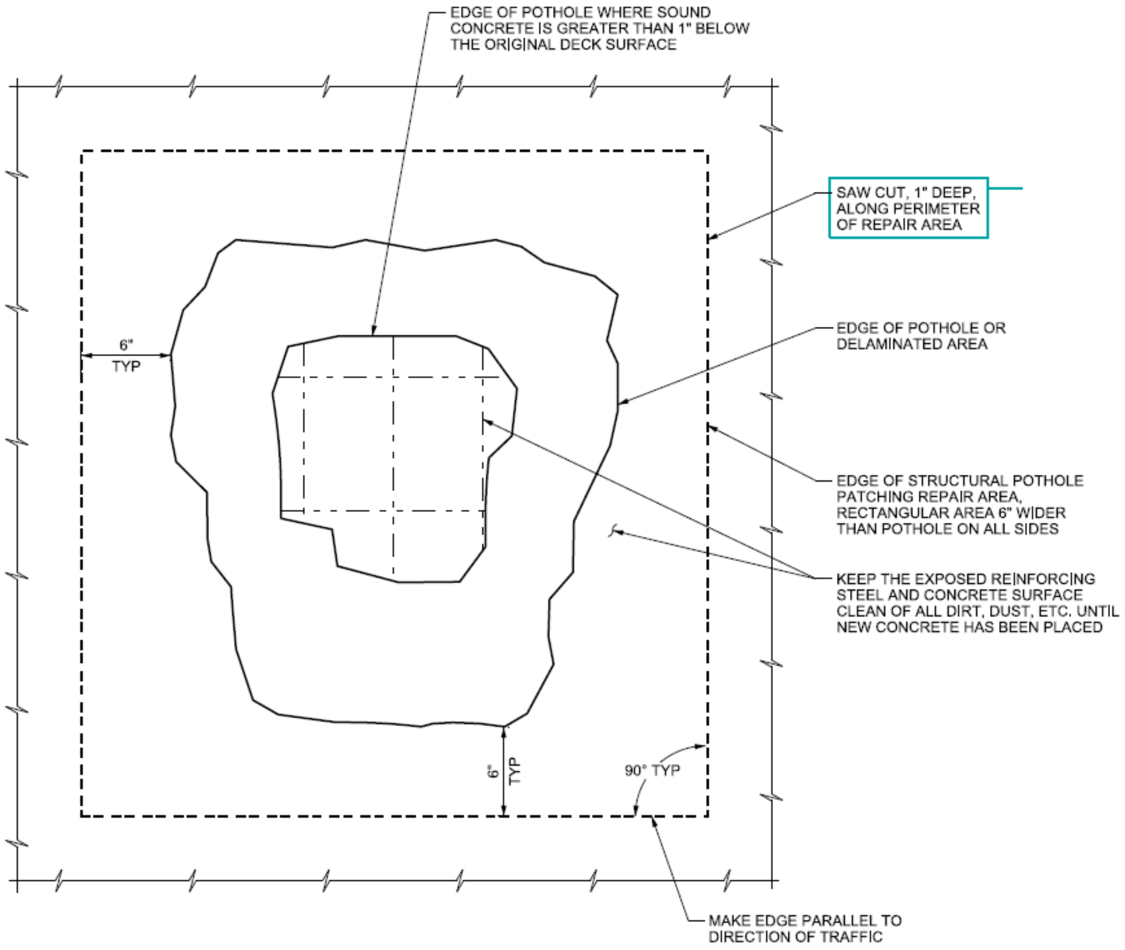
PAY ITEMS

- OVERLAYS
  - Asphalt Surfacing Removal (Structures), Highly Modified Hot Mix Asphalt (HMHMA) and Waterproofing Membrane
    - Asphalt Polymer Treatment, Parapet Joint Sealing and Inspection Hole
  - Thin Bonded Polymer Overlay, Type I and III
  - Bridge Deck Methacrylate Resin Treatment
- APPROACH SLAB REPLACEMENT
  - Granular Backfill Borrow, Remove Approach Slab and Parapets, Reinforcing Steel Coated (Plan Quantity), Structural Concrete, Structural Concrete – Fiber, Prepare Structure for New Corbel and Structural Steel
- OTHER
  - Pavement Marking Paint, Relief Joint Sealing, Penetrating Concrete Sealer, Parapet Sealing, Parapet Repair, Curb Repair, Sidewalk Repair, Girder End Protection, Structural Pothole Patching, Open Pothole Deck Repair, Compression Joint Seal (Type A), Compression Joint Seal (Type A) Modification and Joint Gland Replacement

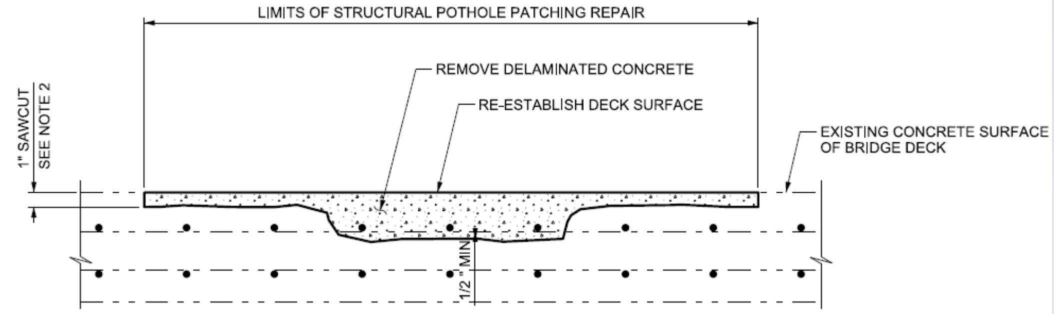
# I-80 Project 1 Differences



# I-80 Project 1 Differences



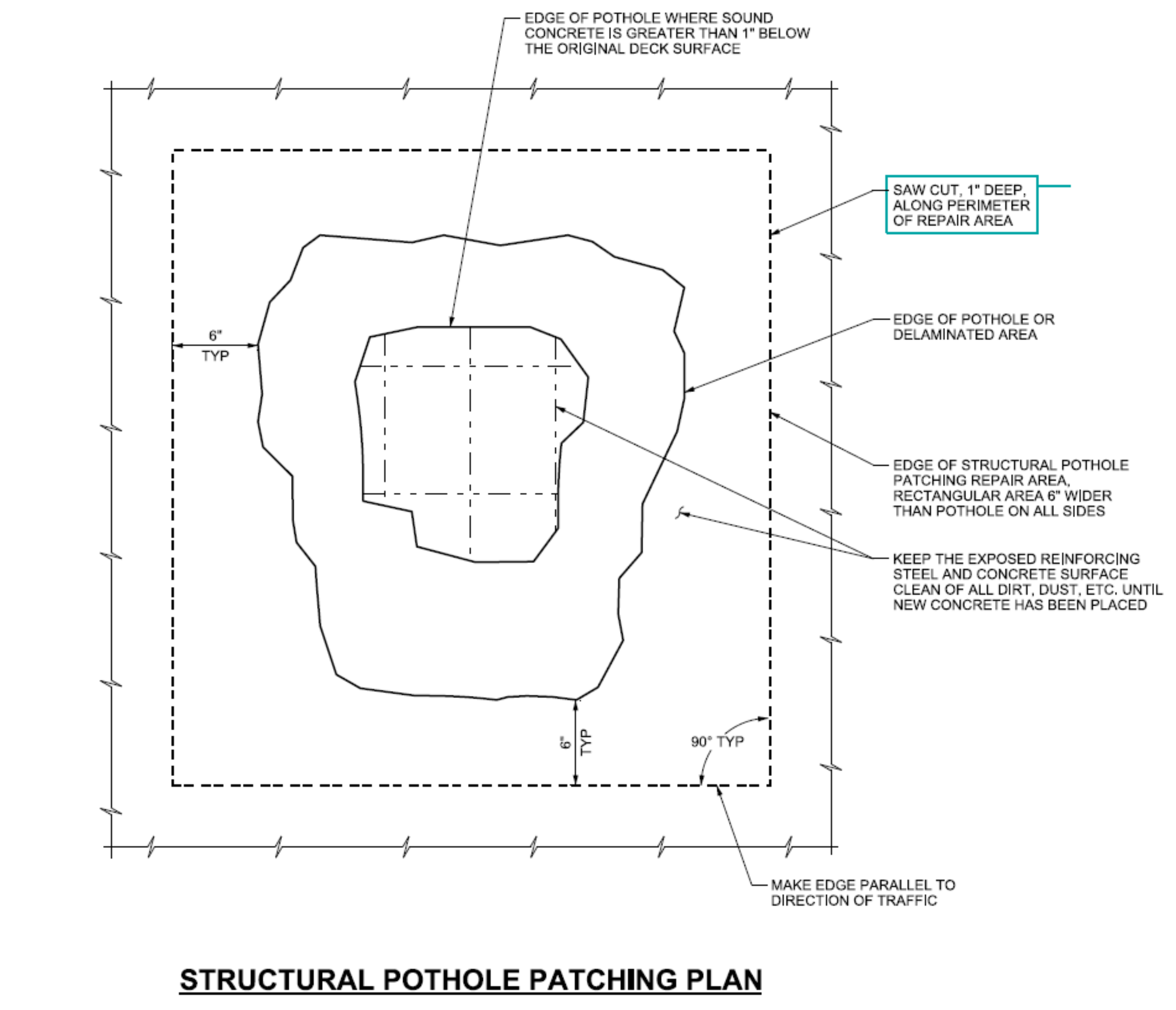

STRUCTURAL POTHOLE PATCHING PLAN

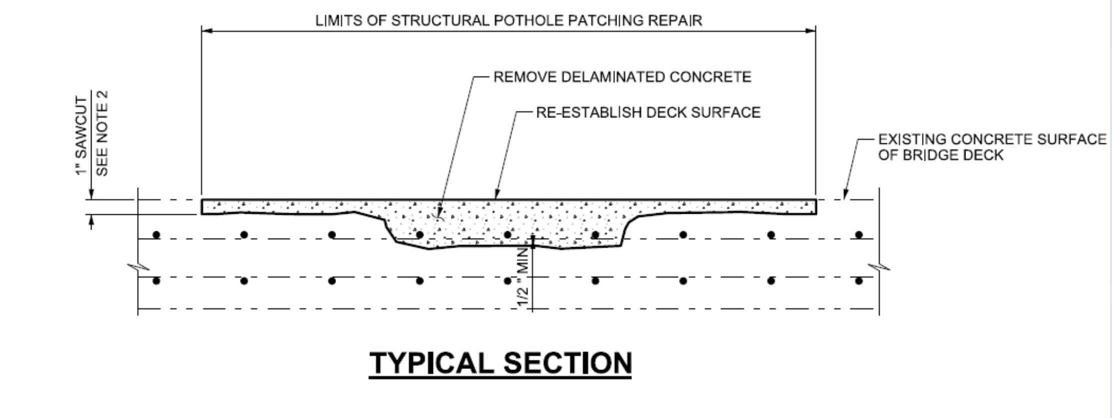



TYPICAL SECTION

STRUCTURAL POTHOLE PATCHING (SPP)

# I-80 Project 1 Differences




OPEN POTHOLE DECK REPAIR

# I-80 Project 1 Differences

1. Concrete Coating and Abutment and Wingwall Repairs removed
2. Parapet Sealing added
3. Joint Gland Replacement added

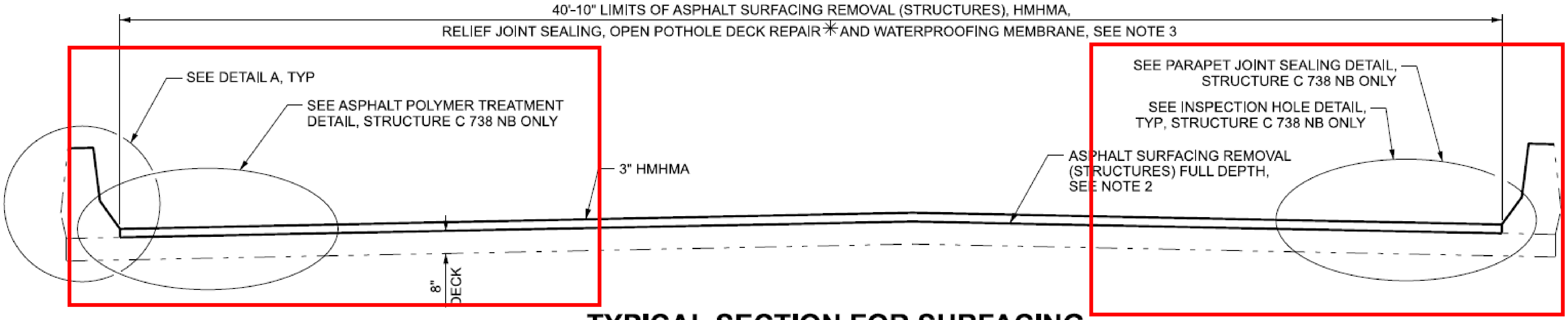
# I-80 Project 1 Differences


RESET ELASTOMERIC BEARINGS

# Highly Modified Hot Mix Asphalt (HMHMA)

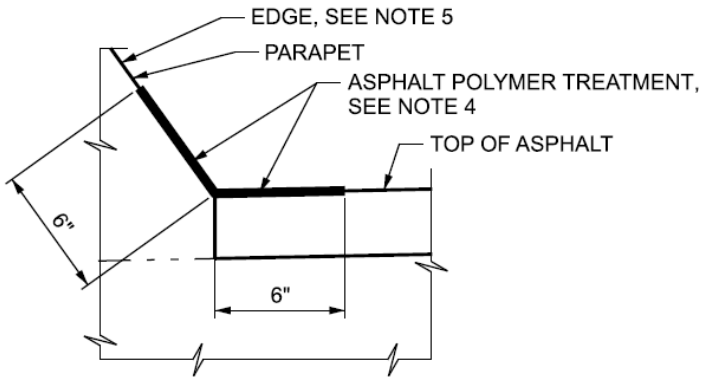
- 5% TO 7% Polymer
- Target rate of 3.5% voids
- 15 Year treatment life
- Cost

# Highly Modified Hot Mix Asphalt (HMHMA)



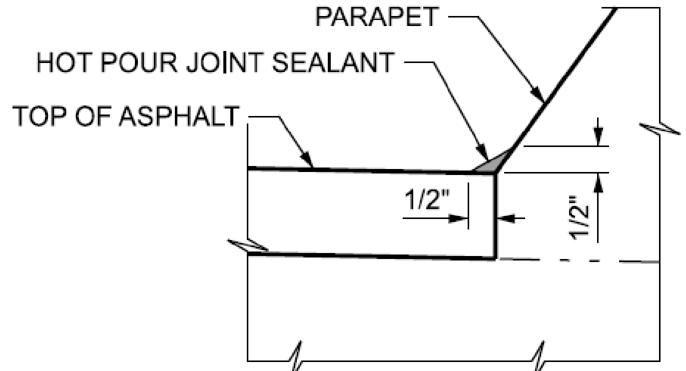

**TYPICAL SECTION FOR SURFACING**

SB SHOWN, NB SIMILAR




**ASPHALT POLYMER TREATMENT DETAIL**

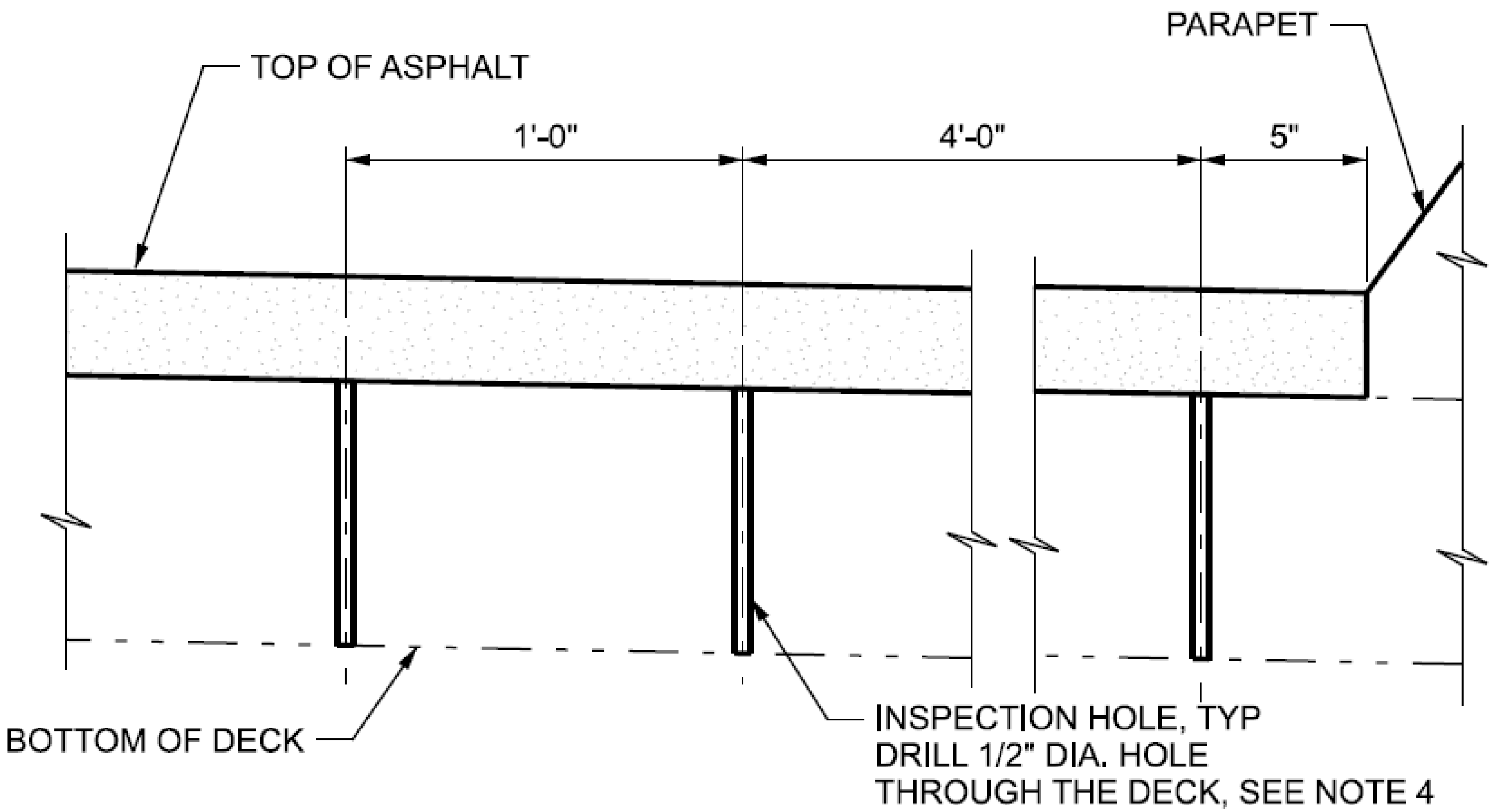
WEST PARAPET AT STRUCTURE C 738 NB ONLY




**PARAPET JOINT SEALING DETAIL**

EAST PARAPET AT STRUCTURE C 738 NB ONLY

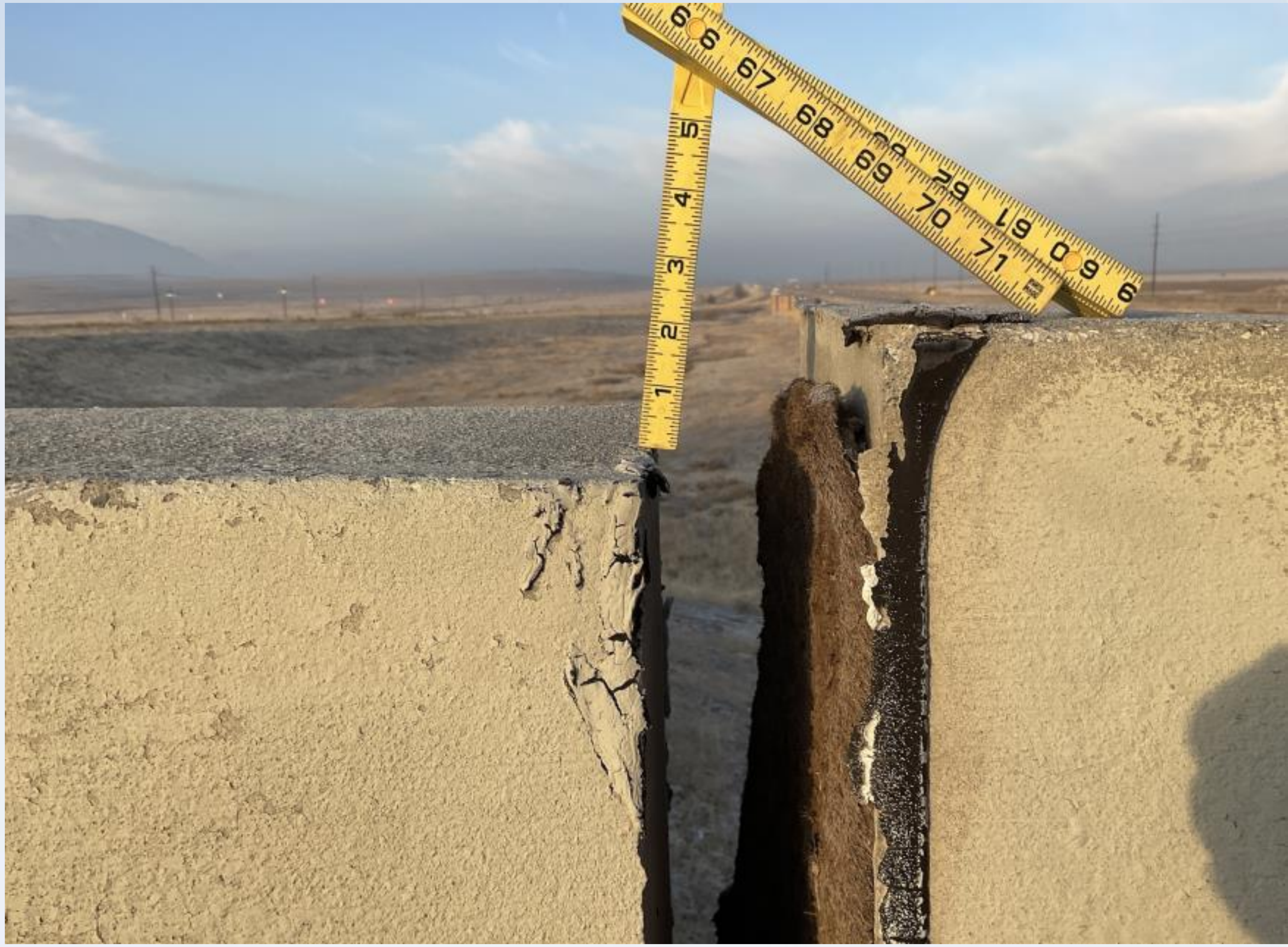
# Highly Modified Hot Mix Asphalt (HMHMA)



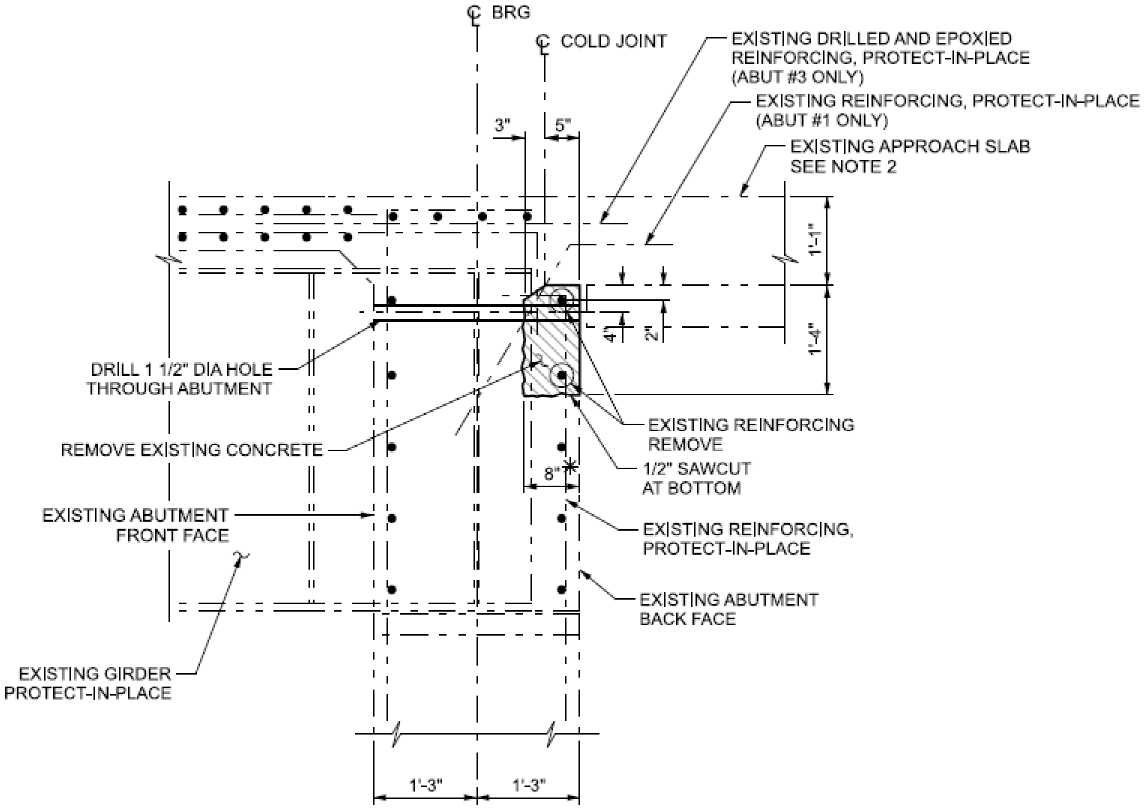

**INSPECTION HOLE DETAIL**

STRUCTURE C 738 NB ONLY
NORTHEAST CORNER SHOWN, NORTHWEST CORNER OPPOSITE HAND

# Approach Slab Replacement

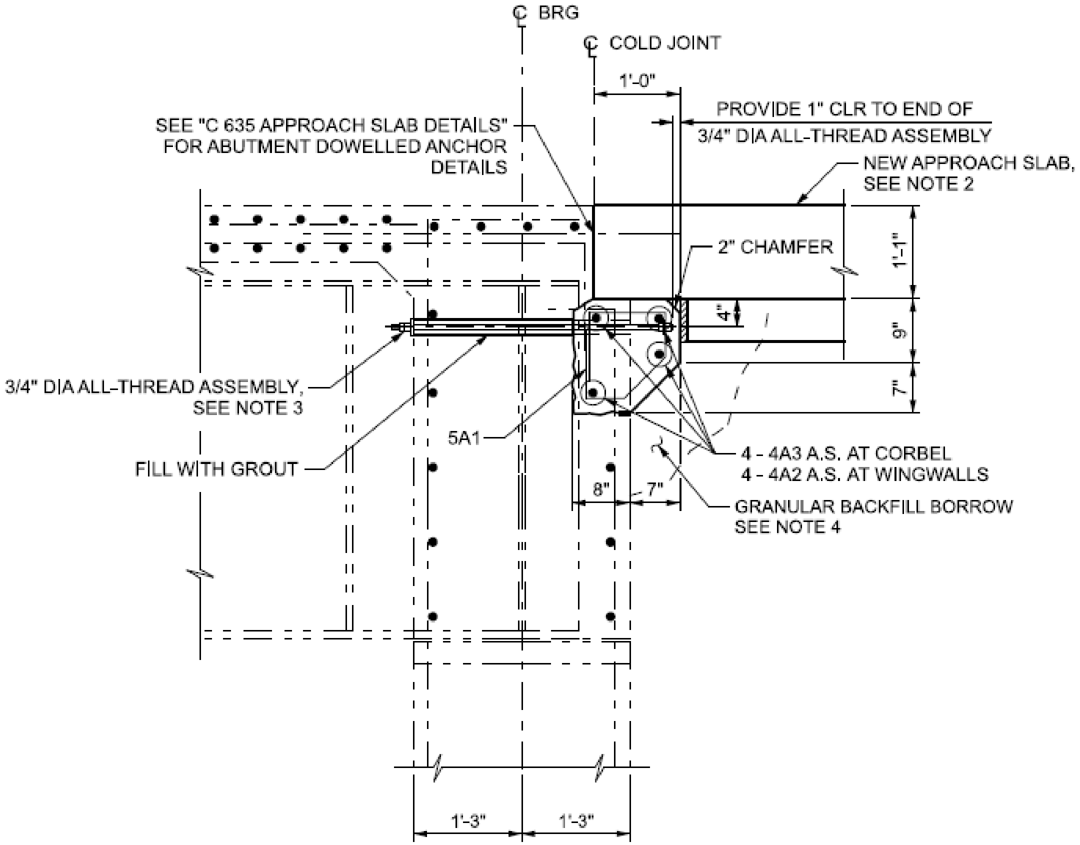


# Approach Slab Replacement



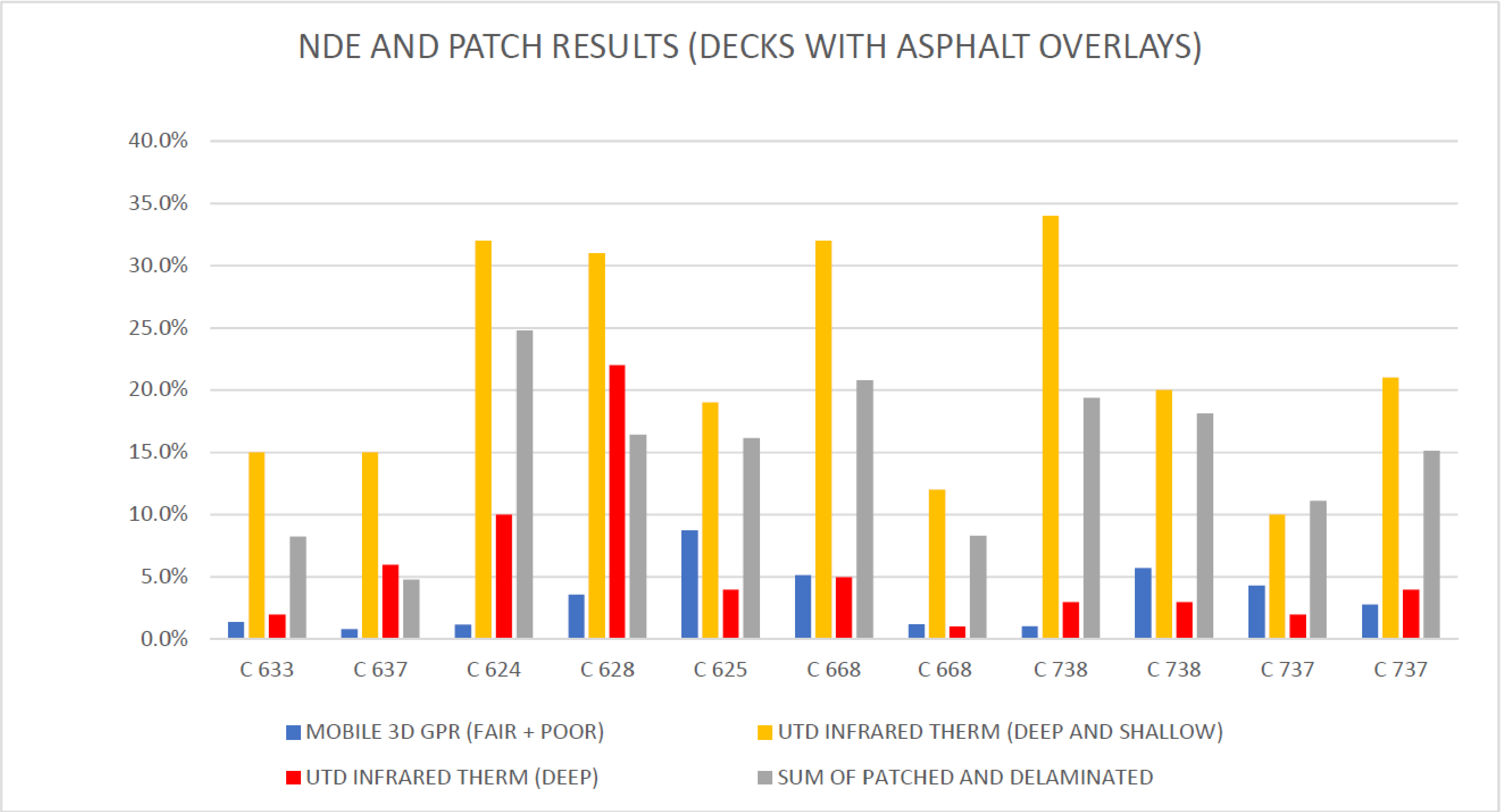

**SECTION A-A REMOVAL**

✳REDUCE REMOVAL DEPTH TO 6" AT GIRDER WEBS



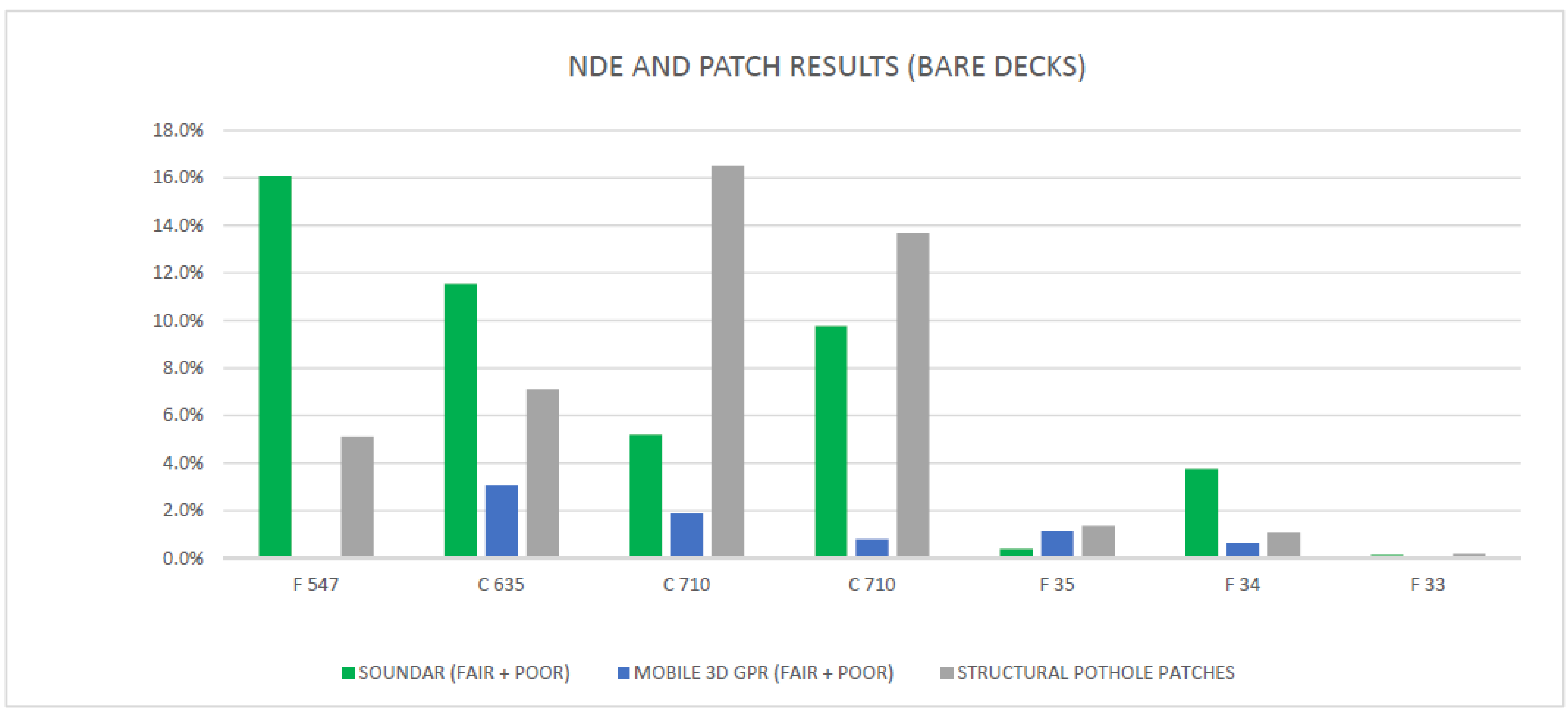

**SECTION A-A NEW CORBEL**

# Results



NDE AND PATCH RESULTS (DECKS WITH ASPHALT OVERLAYS)
40.0%
35.0%
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
C 633
C 637
C 624
C 628
C 625
C 668
C 668
C 738
C 738
C 737
C 737
MOBILE 3D GPR (FAIR + POOR)
UTD INFRARED THERM (DEEP AND SHALLOW)
UTD INFRARED THERM (DEEP)
SUM OF PATCHED AND DELAMINATED

# Results


NDE AND PATCH RESULTS (BARE DECKS)
18.0%
16.0%
14.0%
12.0%
10.0%
8.0%
6.0%
4.0%
2.0%
0.0%
F 547
C 635
C 710
C 710
F 35
F 34
F 33
SOUNDAR (FAIR + POOR)
MOBILE 3D GPR (FAIR + POOR)
STRUCTURAL POTHOLE PATCHES

# Questions

Rebecca Nix, UDOT Bridge Management Engineer
Cody Parker, UDOT Structures Project Engineer for Preservation