I-295 Southbound Rehabilitation Project

Maine Turnpike Detour
Preferred commercial route and thru route to Portland and points south

Rte. 201 Detour
Preferred route to Brunswick and Freeport

Southbound I-295 closure - Exits 31 to 49

Temporary entrance ramp from US 201 onto I-295 southbound

Repairs to 3 bridges, plus guardrail, drainage & safety improvements and paving (Done prior to full closure)

Paving and guardrail improvements (Done prior to full closure)

To Augusta

To Lewiston

To Portland

Bowdoinham

Richmond

Brunswick

Topsham

Bath

Gardiner
I-295 Southbound Rehabilitation Project

• Existing Conditions
• Value Engineering Study
• Design
  – Pavement Design Alternatives
  – Life Cycle Cost Analysis
• Safety - Traffic Control
  – Closure of Southbound and Detour
• Construction
I-295: Existing Conditions
I-295: Existing Conditions

- 9” to 10” Jointed Plain Concrete Pavement
- Individual slabs 12’ wide, 20 ‘ long
- Constructed in early to mid 1970’s
- Visible signs of materials distress (cracking and spalling) and structural issues
- Positive test for ASR from Turner-Fairbank Highway Research Center
I-295: Jointed Plain Concrete Pavement
Steel Layout

Direction of Travel

NOTE:
THE 20 FT SLAB SPACING MAY BE DECREASED WHEN APPROACHING TRANSVERSE EXPANSION JOINTS TO INSURE PROPER LOCATION.
Alkali-Silica Reaction

ASR is a chemical reaction between the alkali in the cement and silica in certain aggregates (chert, quartzite, shale, obsidian, opal, sandstone)
Alkali-Silica Reaction

ASR Mechanism:

A gel is formed from the chemical reaction between the cement and aggregate

• The gel attracts available water in the concrete and expands

• Expansion of the gel creates stress in the concrete, resulting in cracks in the aggregate and concrete

The characteristic visible distress in a concrete pavement with ASR is called *map cracking*
Map Cracking
Map Cracking
Alkali-Silica Reaction

Other common distresses include:

- Pop outs
- Punchouts
- Spalling
Pop outs
Size of a quarter
Pop outs
4” diameter
Spalling/Punch-outs
Spalling/Punch-outs
Transverse joint
I-295: Repairs

• Many repair methods were used to address the deteriorating conditions of the pavement:
  • Thin overlay (NovaChip)
  • Slab replacement
  • Expansion Joints
  • Joint seal
  • Patching
  • Partial Depth Crack Repair
• These repairs were done in preparation for an overlay
Thin surface overlay (Nova Chip)
Slab Replacement (concrete)
Expansion Joints
Joint Seal
Patching
Partial Depth Crack Repair
Repairs

- MaineDOT personnel cut cores on the longitudinal crack
- Found that the cracks seen on the surface went through the entire depth of the slab
- Broken slabs $\rightarrow$ a structural failure
I-295: VE Analysis

• Original project scope was to place an HMA overlay over the existing/repaired concrete pavement
• Because of the progression of the ASR and the current condition of the pavement, management decided that other pavement treatments needed to be explored = higher construction $$$
• Federal Highway Administration requires a VE analysis on projects on the NHS costing $25 million or more
I-295: VE Analysis

• Value Engineering as defined by FHWA is
  – the systematic application of recognized techniques by a multi-disciplined team to identify the function of a product or service, establish a worth for that function, generate alternatives through the use of creative thinking, and provide the needed functions to accomplish the original purpose of the project, reliably, and at the lowest life-cycle cost without sacrificing safety, necessary quality, and environmental attributes of the project.
I-295: VE Analysis

The value engineering analysis as should incorporate:

• a multi-disciplined team approach
• VE Job Plan
• the identification and evaluation of function, cost and worth
• the use of creativity to speculate on alternatives that can provide the required functions (search for solutions from new and unusual sources)
• the evaluation of the best and lowest life-cycle cost alternatives
• the development of acceptable alternatives into fully supported recommendations
• the presentation/formal reporting of all VE recommendations to management for review, approval, and implementation
I-295: VE Analysis

• Value Engineering Team
  – Team included personnel from design, construction, traffic, finance, planning and FHWA
I-295: Pavement Alternatives

- **Alternative 1**: HMA structural overlay over existing concrete pavement
- **Alternative 2**: Rubblize existing concrete pavement and overlay with HMA
- **Alternative 3**: Remove concrete pavement and place new HMA
- **Alternative 4**: Remove concrete pavement and place new concrete pavement
I-295: Alternative Design Considerations

• Bridges
  – Vertical clearances at all bridges must be 16 ft (min)

• Highway
  – Long-term quality
  – Timely deliverance
  – Safety
  – Ease of Construction
  – No environmental impacts (no mitigation)
I-295: Pavement Design

• The ME-PDG was used to develop all design alternatives
• A 20-year and 40-year design period was used for the analysis
• Performance Criteria - the IRI must meet the performance requirements at 15 years for HMA and 35 years for concrete
I-295: Pavement Design
I-295: Pavement Design
ME-PDG

• **Input Parameters**
  – Design Period
  – Truck traffic and distribution
  – Climate/Weather data
  – HMA material properties
  – Concrete material properties
  – Base aggregate properties
  – Subgrade soil properties
I-295: Life Cycle Cost Analysis

- Types of Costs used in analysis
  - Initial/Agency cost –
    - Construction quantities and costs directly related to the initial design
    - Costs similar to all alts. disregarded
    - Cost of future maintenance treatments
  - User Cost
    - Vehicle operating costs
    - User delay costs
    - Crash costs
I-295: Pavement Alternatives

• Alternative 1: HMA overlay – 1.09

• Alternative 2: Rubblize/ HMA overlay – 1.0

• Alternative 3: New HMA – 1.34

• Alternative 4: New JPCP – 1.38
I-295: Alternative Selection

• Based on the design considerations and the LCCA, the team recommended Alternative 2: Rubblize and Overlay to management
  – 7” HMA
  – 3” milled off existing concrete pavement
  – 6” Rubblized concrete
  – 29 inches of existing base/subbase gravel
I-295: Alternative Selection

• In addition of the LCCA, Alternative 2: Rubblize and Overlay
  – Addresses ASR
  – No environmental impacts
  – A “Green” project since all construction waste materials will be utilized on the project
I-295: Alternative Selection

• The final approved pavement design
  – 8” HMA
  – 3” milled off existing concrete pavement
  – 6” Rubblized concrete
  – 29” existing gravel

• Includes 1” additional HMA
  – F.S. for unknowns
  – Reduced risk for Garvee Bond funding
I-295: Milling

- Top 3” of the concrete pavement to be milled
  - Millings placed on shoulder as new shoulder aggregate
I-295: Rubblization

• New process for MaineDOT
• Information from other State DOT’s with experience in rubblization used to develop the specification:
  – NYSDOT
  – IDOT
  – PennDOT
  – WisDOT
I-295: Rubblization

• Rubblization Method
  – Multi-head Breaker
  – Resonant Rubblizer
I-295: Rubblization

• Resonant Rubblizer selected for project
  – Specification included criteria for
    • Particle size
      – 6” or less
      – 2” or less at surface
    • Grading
    • Compaction – Rollers
    • Surface tolerance
      – Steel – must be debonded, exposed removed
      – Crack sealant removal
      – Patch removal
Why a full closure?

- Safety of public and work crews
- Minimizes time – 3 months versus 3 years
- Rubblizing of concrete may cause deterioration of 2\textsuperscript{nd} lane
- The Turnpike and Route 201 are available as alternate routes
Why not have I-295 northbound serve as both northbound and southbound?

- **Safety** *the northbound lanes are not designed for vehicles to travel safely in the southbound direction*
  - The existing 8’ shoulder is not sufficient for a breakdown lane
  - Guardrail end-treatments are not designed to handle head-on impacts from vehicles heading south
  - Expediting concrete deterioration may result in increased safety risks and unplanned closure of the northbound lanes.
  - Difficulties for “first responders” to get to crash sites
  - Increased number of vehicles in one lane increases the risk of crashes
Why not have I-295 northbound serve as both northbound and southbound?

• **Time and Money** necessary road improvements add time and money to build the crossovers, improve guardrails and reconstruct shoulders
  – New on and off ramps need to be constructed
  – Shoulders would need to be reconstructed
  – Funneling the current volume of traffic from two lanes into one lane would create back-ups in both directions

• **Predictability**
  – Motorists will seek alternate routes causing a “free-for-all” on 201 & other roads
Can the Turnpike and 201 handle the increase in traffic?

- I-295 southbound used by 13,500 vehicles daily during the peak of summer
- Try to push 50% onto Turnpike including commercial trucks
- Motorists headed to Portland and south will use Turnpike
- Traffic plan modified as needed
Route 201 Traffic Plan

• MaineDOT “patrol” will assist motorists with vehicle problems and report “hot spots”

• Make Route 201 look and feel like a work zone
  – Improvements made to Route 197 Intersection
  – Installing flashing lights at the intersections of Route 125 and at Route 138
  – Street lighting at major intersections
  – Work zone speed limits – fines doubled
  – Install radar speed signs
  – Temporary ramp in Topsham
How did we make this work?

- **Aggressive Communications Campaign**
  - Communication Advisory Panel – Reps from tourism, Freeport Merchants, truckers, Maine Turnpike Authority
  - Work with major employers, news media, paid media

- **Ongoing Dialogue**
  - Route 201 residents
  - Municipalities
  - First Responders Group

- **Flexibility**
  - Adjust traffic plan as necessary
  - Plentiful signage and message boards
  - 24/7 On-Site Availability
  - “Roving” MaineDOT vehicle with water/gasoline/roadside assistance
  - E-mail alerts
Incentives

• User costs factored into Incentive/Disincentive

• Payout exponential

• 20 day cap on bonus, no cap on penalty
Results

• Work expected to take 2 seasons if 1 lane of traffic was maintained

• Contractor allowed 2 ½ months

• Finished 21 days early
  – Received Maximum Bonus - $2 Million

• No major accidents on detour
Questions??