ACTT WORKSHOP

Pawtucket Bridge No. 550

BUILDING A FOUNDATION FOR THE FUTURE

U.S. Department of Transportation
Federal Highway Administration

WHY ACTT? Ê

- ACTT provides a fresh outlook by bringing national experts to your planning table.
- ACTT introduces innovations that have been tested elsewhere.
- ACTT saves time: according to FHWA's ACTT II report, published in March 2005, "most agencies have found ways to slice construction time by 30 percent or more."
- ACTT saves money: ACTT suggestions enabled New Jersey to reduce its budget for the Route 46 bridge project from $10 million to $7.2 million.
- ACTT works for you and your customer!

How Do I ACTT?

- Select a corridor: ACTT is most helpful when applied during the project development phase.
- Make a workshop proposal to ACTT team members, and submit a copy of your proposal to the FHWA Division Office. Include details on the project corridor, timeline and goals.
- Hold a pre-workshop meeting with the ACTT management team.
- Select a meeting site, and coordinate workshop details with the FHWA Division Office.
- Host the workshop.
- Draft a report for submittal to FHWA.
- Incorporate ACTT in to project operations.

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EXECUTIVE SUMMARY

An aging National infrastructure, coupled with a tremendous increase in transportation demand, has caused the number of highway construction activities to magnify in recent years. This, in turn, has led to an increase in driver frustration, as noted by researchers in the 2001 Federal Highway Administration (FHWA) report, *Moving Ahead: The American Public Speaks on Roadways and Transportation in Communities* (FHWA-OP-01-017):

> Improvements in traffic flow, pavement conditions, and work zones may result in the greatest rise in traveler satisfaction. Work zones are especially critical as travelers view road repairs as a major reason for traffic delays.

The researchers went on to discuss road management strategies, purporting the "get in, get out, stay out" philosophy that is the very foundation of Accelerated Construction Technology Transfer, or ACTT.

Initiated by the Transportation Research Board (TRB) and adopted by FHWA and the American Association of State Highway and Transportation Officials (AASHTO), ACTT is a strategic process that identifies innovative techniques and technologies to reduce construction time, enhance safety and improve quality on major highway projects. It has been used successfully to accelerate construction on numerous projects, with each achievement helping to make it accepted practice for highway construction projects nationwide.

In January 2005, the Rhode Island Department of Transportation (RIDOT) applied the ACTT concept to one of its projects by hosting a two-day workshop featuring nearly 60 experts from around the country. For its ACTT workshop, RIDOT selected a bridge project located on Interstate 95 (I-95) in the city of Pawtucket, just north of the State capital, Providence. The 695-foot-long bridge carries I-95 over the Seekonk River, Pleasant Street and Taft Street. Three corners of the bridge flare out to accommodate on- and off-ramps for the School Street interchange. With its unusual geometric layout and high traffic counts, the interchange is noted for frequent traffic congestion, and RIDOT must determine whether to replace or rehabilitate the existing, aging structure.

With the above in mind, RIDOT identified six skill sets that would benefit the most from the ACTT process:

- Structures.
- Construction.
- Geotechnical/Materials.
- Traffic/Safety/ITS/PR.
- Roadway/Geometric Design.
- Environment.

Each skill set focused on how the ACTT process applied to their area of expertise while discussing options for rehabilitating or replacing the bridge and alleviating long-standing traffic congestion.

Following discussion and skill set intermingling, each skill set presented a set of priority recommendations. As the host agency, RIDOT will determine which to implement.

1

WORKSHOP DETAILS

1.1. Opening Session

RIDOT held their ACTT workshop January 25-27, 2005, at the Providence Courtyard by Marriott. Participants convened for registration and the opening session on the afternoon of Tuesday, January 25.

Dan Sanayi, construction and systems preservation engineer for FHWA, served as the moderator, providing an overview of the ACTT concept. After hearing welcoming remarks from RIDOT Director James Capaldi and FHWA Rhode Island Division Administrator Lucy Garliauskas, the participants introduced themselves. David Huft, research program manager for the South Dakota Department of Transportation, explained the importance of the ACTT process in "Why ACTT, Why Now." This was followed by Eric Seabury and Dick Snow's overview of the Pawtucket Bridge No. 550 project. The group then headed out for a bus tour of the project area. Dinner followed, with the ACTT participants intermingling at an informal icebreaker reception.

1.2. Workshop Process

The Rhode Island gathering followed the traditional ACTT workshop structure, with the skill sets breaking out into individual groups on Wednesday morning and coming back together to present their initial findings prior to lunch. Wednesday afternoon was spent intermingling and developing each skill set's final recommendations, which team spokespersons presented to the group Thursday morning.

1.3. Skill Set Goals

Participants in each skill set had an established set of goals that was unique to their subject area.

Structures

- Reduce construction time.
- Recommend wall and bridge type selections that would reduce the number of construction phases and the construction timeframe.
- Consider precast and prefabricated sections that would reduce the construction timeframe.
- Reduce structures cost.
- Minimize the length of traffic closures.
- Recommend environmentally friendly construction methods.

Construction

- Minimize environmental impacts.
- Minimize lane closures.
- Minimize traffic impacts.
- Consider demolition methods and procedures.
- Investigate the feasibility of awarding multiple construction contracts versus one large contract.
- Shorten the length of the contract(s).
- Time the contract phasing so that work could be completed in a single construction season.

Geotechnical/Materials

- Utilize methods and materials that would allow for faster construction.
- Recommend methods to reduce turn-around time and personnel requirements.
- Investigate pier, abutment and wall types.

Traffic/Safety/ITS/PR

- Use incident management systems and other ITS innovations.
- Use media relations to keep the traveling public informed.
- Reduce or eliminate work zone congestion.
- Consider the effects of lane closures.

Roadway/Geometric Design

- Minimize traffic congestion at the interchange.
- Increase the available merge and weave lengths.
- Minimize roadway widening.

Environment

- Ensure that the project complies with air quality standards and regulations.
- Maintain or improve water quality during and after construction.
- Investigate context sensitive solutions (CSS).

2

PROJECT DETAILS

2.1. Project Scope

The scope of the Pawtucket Bridge No. 550 project is to 1) either rehabilitate or replace the 50-year-old bridge, and 2) make interchange improvements to alleviate chronic traffic congestion. To eliminate the safety and congestion problems caused by the interchange ramp configuration, the project also features construction of a new collector-distributor (C-D) road along the northbound side of the bridge. Traffic control during construction will be a major challenge.

Rehabilitating or replacing Pawtucket Bridge No. 550 will be a daunting task: it is a five-span, two-girder, pin and hanger (suspended cantilever) steel bridge. The fixed end spans are situated on reinforced concrete cantilever abutments, with the three interior spans supported on four reinforced concrete column piers. The bridge consists of two separate structures (one northbound and one southbound) spanning west to east, with a one-inch-wide open joint between the median barriers along the bridge centerline. The overall span of the bridge is 694 feet five inches between bearings, as measured along the I-95 centerline.

The current configuration has three 12-foot travel lanes in each direction. On the northbound structure, the bridge flares at each end to accommodate a variable-width acceleration/deceleration lane for the George Street on-ramp at the southwest corner and the School Street off-ramp at the southeast corner. The southbound structure features an increasing width deceleration lane for the George Street off-ramp at the northwest corner of the bridge. The typical bridge deck width out to out is 99 feet six inches, and the concrete bridge deck is seven inches thick.

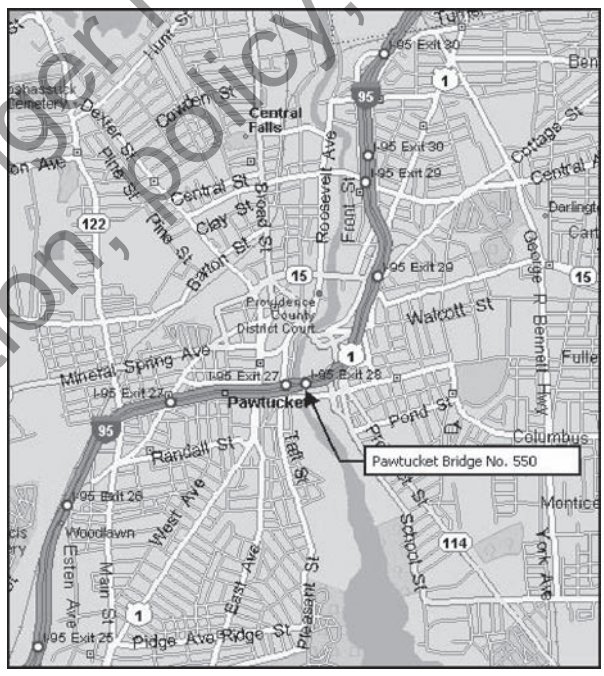

Figure 1
Project Location

The bridge superstructure consists of three primary framing components: 1) two main girders along each bound, 2) transverse floor beams that are attached to these girders, and 3) longitudinal stringers spanning between every floor beam. Four pin and hanger joints located in spans one, three and five allow for thermal expansion and contraction.

RIDOT rehabilitated the bridge in the 1980s, replacing the bituminous wearing surface and the waterproofing membrane, repairing several sections of the concrete deck, and raising the southeast corner of the bridge to accommodate roadway superelevation. In 1994, the agency replaced all of the deck joints; retrofitted the existing

carbon steel pins and hangers with stainless steel assemblies; and replaced the existing rocker-type girder bearings with lead-core elastomeric isolation bearings.

The challenges facing RIDOT today are numerous. Many of the bridge's steel framing components show advanced corrosion. The concrete deck requires replacement. Several of the riveted girder connections must be retrofitted to improve inadequate fatigue resistance, and the bridge rails need to be replaced with crash-tested systems. The labor costs involved with repairing this type of structure are great; therefore, RIDOT must decide whether to rehabilitate or replace Pawtucket Bridge No. 550.

Figure 2
Bridge No. 550 Aerial View

And there are major traffic issues as well. The northbound section of the bridge carries the George Street on-ramp at the beginning of the bridge and the School Street off-ramp at the end. This causes merging on-ramp traffic to weave with pending off-ramp traffic in the bridge-shoulder lane, which is only 695 feet long. The resulting congestion and numerous accidents have prompted RIDOT to incorporate interchange improvements as part of the Pawtucket Bridge No. 550 project.

Prior to the workshop, RIDOT investigated the interchange options that they believed would relive congestion and improve safety while facilitating staged construction of Pawtucket Bridge No. 550. The selected option incorporates a separate C-D road to take the George Street on-ramp and the School Street off-ramp traffic out of the mainline traffic stream. This option requires the widening of several upstream and downstream bridges, as well as a significant amount of retaining wall construction along the widened sections.

2.2. Workshop Priorities

As the project currently stands, three key decisions remain:

- The scope of the Pawtucket Bridge No. 550 project must be finalized. The options include a major superstructure repair with associated widening to accommodate interchange improvements or a full replacement with a wider structure.
  - The rehabilitation option would cost an estimated $30 million, including interchange improvements, and would be completed in five phases over six years.
  - The replacement option would cost an estimated $40 million and would be completed in six phases over five seasons.
- The effect on local traffic patterns due to permanently closing the George Street on-ramp should be evaluated to determine if this is a viable option.
- The possibility of temporarily closing the School Street off-ramp, at least during part of construction, should be evaluated. Temporary closure of the ramp would affect construction phasing and bridge widening.

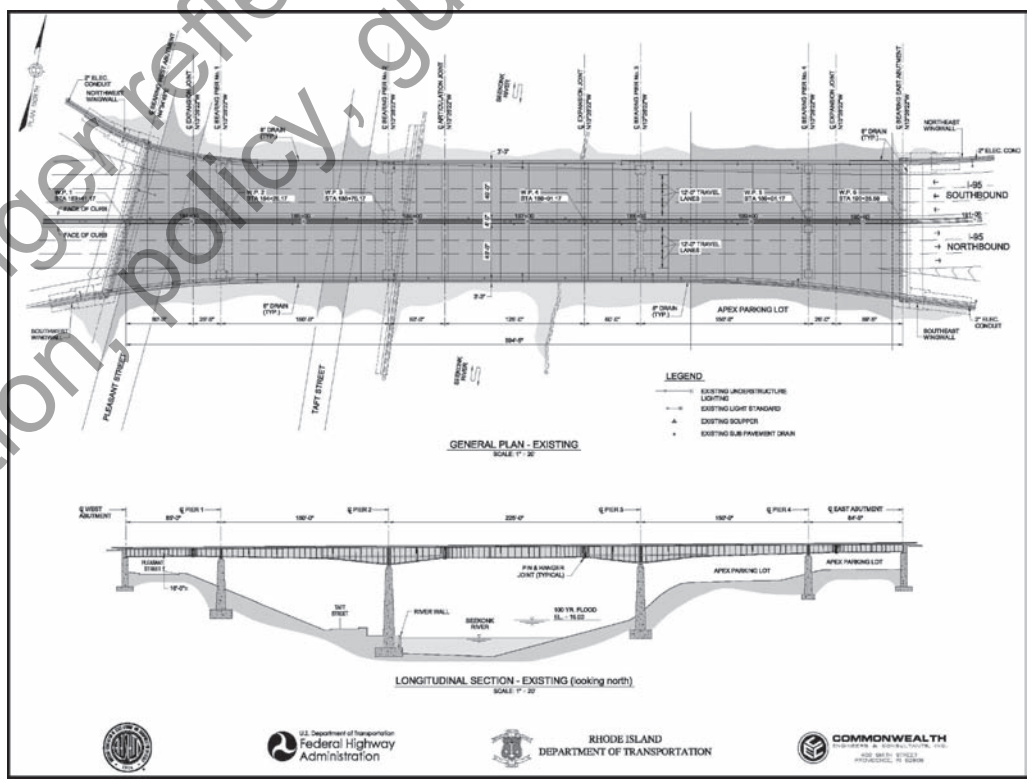

Figure 3
Pawtucket Bridge No. 550

2.3. Project Constraints

2.3.1. Traffic

The current average daily traffic (ADT) through the interchange is approximately 172,000 vehicles. The George Street/I-95 northbound on-ramp carries approximately 12,600 vehicles per day. Approximately 16,000 vehicles use the School Street/I-95 northbound off-ramp each day. What's more, I-95 serves as the major corridor between New York City to the south and Boston to the north, and there is no practical detour around the interchange. This means that traffic must be maintained during all phases of construction.

Because queue analyses show excessive travel delays with only two lanes open in each direction, RIDOT is requiring that all three travel lanes remain open in each direction throughout construction. Additionally, the School Street/I-95 northbound off-ramp must remain open, as it is used to access the downtown Pawtucket area as well as a nearby medical center, Pawtucket Memorial Hospital. The George Street/I-95 northbound on-ramp will be closed during construction, and the traffic and roadway skill sets were instructed to investigate the effects of closing that ramp permanently.

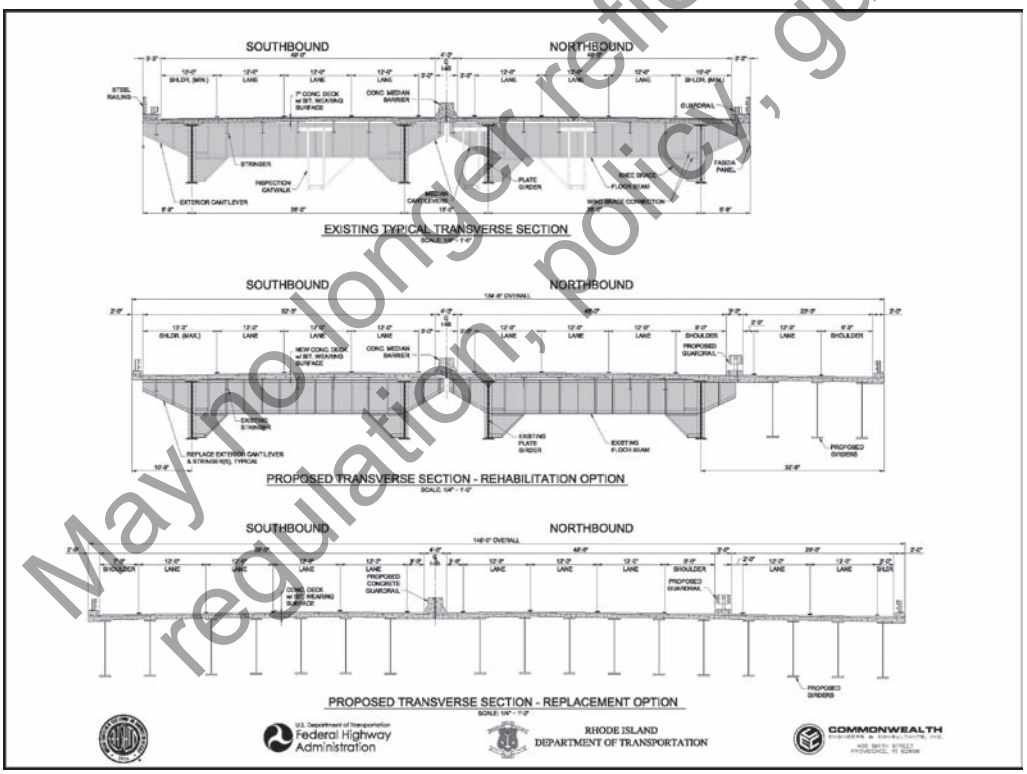

Figure 4
Existing and Preliminary Bridge Cross Sections

2.3.2. Time

As any type of construction work causes delays, RIDOT's goal is to minimize the amount of time that roadway traffic patterns will be affected. Where possible, RIDOT wants to use advance construction for components such as foundations. The agency is open to installing temporary traffic barriers so that all construction work could be performed behind the barriers during normal working hours, avoiding major lane closures. Temporary lane closures, if necessary, would be allowed only at night or on weekends.

2.3.3. Work Area

The existing bridge features on- and off-ramps on three of its four corners, and one, the School Street off-ramp, must remain open throughout the construction cycle. This not only affects the phasing of the project, but it also serves to limit the space available for the contractor's work area. Further, the unique two-girder construction of the bridge does not allow phased construction in the traditional sense, as the structure cannot be dismantled within lane widths: it must be dismantled as a complete bound (northbound and southbound).

3.1 Structures

The structures group recommended that the bridge be replaced instead of repaired: the advantages of higher capacity and lower long-term maintenance costs outweigh the higher initial cost and longer construction time associated with replacing the structure. The team's priority recommendations follow.

Constructability

- Close the George Street/I-95 northbound on-ramp during construction. Consider permanent closure as well.
- Keep all three traffic lanes together in each direction. Avoid lane splitting.
- Detail longitudinal deck joints to accommodate deflection differentials between construction phases.
- Use multi-span continuous girders for the bridge framing.
  - Three span (requiring the closure of Pleasant Street) – 140'/225'/140'.
  - Three span (requiring re-alignment of Pleasant Street) – 230'/260'/150'.
  - Four span (requiring re-alignment of Pleasant Street) – 100'/130'/260'/150'.

Construction Option 1 – Horizontal Skidding

- Eliminate the skewed west abutment at Pleasant Street. Pleasant Street should be re-aligned to accommodate this.
- Erect temporary jacking towers along both the north and south sides of the bridge.
- Construct a new three-lane superstructure to the south of the existing bridge on the temporary shoring towers.
- After diverting northbound traffic onto the newly constructed structure and southbound traffic onto the existing northbound section, demolish the existing southbound structure.
- After constructing the replacement southbound structure and moving traffic onto it, demolish the existing northbound structure.
- Close northbound I-95 for one evening and horizontally skid the previously constructed section into place.

Construction Option 2 – Longitudinal Launching

- Use construction staging similar to that used for the horizontal skidding option.
- Construct a launching pit at the east end of the bridge, and launch the new bridge beams from east to west.

The team noted that a major benefit to this option is that cranes would not be required for erecting the bridge. Cranes would still be needed to remove the existing structure.

Construction Option 3 – Conventional Construction

- Use staged construction methods similar to the first option.
- Use prefabricated substructures and slabs.
- Provide contractor incentives and disincentives to accelerate the construction schedule.

The team noted that viable crane locations are a concern.

Recommended Cost Reduction Options

- Shorten bridge length. The two eastern-most spans are located over vacant space and are unnecessary. This area could be filled, reducing the area of new bridge construction and future maintenance requirements.
- Eliminate the west abutment skew; all beams could be fabricated identically, maximizing economy and efficiency.
- Re-use as many of the original substructures as possible.
- Maximize girder spacing: this would require less steel and fewer bearings and connections.
- Utilize constant depth beams, and consider using high performance steel (HPS) for the major bridge framing.
- Use high performance concrete (HPC) for the pier caps and deck.
- Consider integral abutments.

Environmental/Traffic Concerns

- Need to remove lead paint from the existing bridge.
- Need to keep construction out of the river: this would eliminate costly dewatering and the time-consuming permits necessary for this type of work.
- Minimize excavation and the potential for encountering contaminated soil.
- Eliminate, or least minimize, deck drains.
- Build off-line.
- Consider night and weekend work.
- Close the roadway on the weekend.

Conclusions

Of the three options presented, the structures group preferred horizontal skidding to the others. This option provides the most construction time outside the traffic stream and, therefore, the least adverse impacts to traffic.

3.2 Construction

Citing the same reasons as the structures group, the construction skill set recommended that the bridge be replaced rather than repaired.

Contracting Options

- Shorten bridge length.
- Investigate closing the northbound or southbound direction for three months to perform a "hyperfix" and open the roadway to traffic much sooner.
- Consider beam launching to minimize crane usage.
- Upgrade secondary roadways so School Street traffic could be detoured.
  - If School Street traffic is maintained, five construction phases will be necessary.
  - If School Street is closed, the work can be completed much more quickly.
- Utilize A-plus-B bidding to solicit the best contract package, i.e., the lowest price and the shortest construction timeframe.

Construction Option 1 – Conventional Construction

- Use smaller cranes and shorter beam lengths.
- Use existing piers for temporary support.

Construction Option 2 – Horizontal Skidding

- Use a modified version of the method developed by the structures group.
- Construct the new bridge in three phases:
  - Build the northbound structure off-line south of the current structure.
  - Shift the northbound traffic to the new superstructure, and demolish the northbound section.
  - Move the northbound section into place and build another section off-line.

Phased Construction Alternatives

- Consider the following phasing plan:
  - Phase 1 – traffic improvements.
  - Phase 2 – substructure contract (acting concurrently with phase one).
  - Phase 3 – superstructure replacement contract.

Traffic Improvements

- Close George Street/I-95 northbound on-ramp.
- Change Division Street to one-way traffic (eastbound).
- Contract local roadway improvements concurrently with advanced substructure work: interstate traffic would not be affected.

Environmental Issues

- Limit work to outside of the flood plain.
- Address difficult access from the north.
- Devise scenarios where working in the river is permissible.

Conclusions

Like the structures group, the construction team preferred the horizontal skidding approach, as this method minimizes crane usage. Due to space and right-of-way constraints, the team felt that southbound traffic should not be shifted outward (north of the bridge). They stated that traffic improvements to local roadways, the use of Intelligent Transportation Systems (ITS) and other detour methods would reduce construction time and lane closures.

3.3 Geotechnical/Materials

Like the first two groups, the geotechnical/materials group recommended replacing versus repairing the bridge. Based on the information available, the group found no abnormal soil conditions that would require extensive foundation design. As a result, the team felt that, with micropile retrofitting, the existing foundations could possibly be re-used. They also noted that mechanically stabilized earth (MSE) retaining walls would allow for unlimited aesthetic treatments.

Foundation Options

- Evaluate foundation types depending on loading condition:
  - Seismic.
  - Scour.
- Consider spread footings on rock.
- Consider spread footings on MSE.
- Use micropiles – they have low headroom requirements and would allow access to difficult areas.
- Use drilled shafts. (There may be issues with boulders and other obstructions.)

Embankment Options

- Use MSE wall structures.
- Consider the impacts of fill on existing structures:
  - EPS geofoam.
  - Lightweight foamed concrete.
  - Shredded tires.
  - Numerous facing treatments.
- Consider fill placement under existing structure – use flowable fill for final lift in tight areas.

Material Issues: Re-Use of Existing Piers

- Determine viability of removing concrete deck and reusing existing piers.
- Evaluate condition/deterioration of the existing steel beams.
- Determine the extent of lead paint on the steel beams.
- Determine foundation capacity needs.
- Restore the concrete facing on the existing piers and abutments.
- Determine the condition of the underground footings before final design: their current condition is unknown.

Other Considerations

- Determine the presence/absence of contaminated soils.
- Address traffic maintenance during construction: it is a large concern.
- Consider the equipment necessary to place large beams when locating access and staging areas.
- Utilize CSS.
- Determine the best suited contracting mechanism.
- Check material availability before final design.
- Make worker/public safety a priority.

Conclusions

Like the other groups, the geotechnical/materials group recommended structure replacement over repairing the existing bridge. They saw foundation re-use as a viable option but noted that the existing substructures must be evaluated in regards to their condition, structural capacity and retrofit/strengthening practicality. The team noted that utilities are not an issue on this project.

3.4 Traffic/Safety/ITS/PR

The traffic/safety/ITS/PR group focused on project needs and constraints in order to facilitate traffic flow and public information on the Pawtucket Bridge No. 550 project. They outlined a number of key issues in their list of recommendations and advocated a 24-hour construction workday.

Overarching Traffic Concerns

The team noted the following constraints on the project area:

- Maintaining three full-width traffic lanes in each direction.
- Maintaining School Street/I-95 northbound off-ramp traffic and access to the Pawtucket Memorial Hospital.
- Putting traffic on the historic Division Street Bridge.
- Rerouting traffic: local one-way street patterns complicate potential detour routes, and narrow local streets may not be able to accommodate large traffic volumes.

The team recommended using the following tools to mitigate traffic concerns:

- Movable traffic barriers.
- Management of acceptable traffic delays using Quick Zone.
- An incident detection system.
- Portable smart zones featuring cameras, signs and detectors on alternate routes.
- Better traffic signal coordination on local roads for detoured/rerouted traffic.
- Traffic law enforcement for speed control.
- Off-peak rolling road closures.
- Lane rentals.
- Contractor incentives/disincentives.

Safety

- Consider closure of both the George Street/I-95 northbound on-ramp and the School Street/I-95 northbound off-ramp, permanently if possible. This would eliminate conflicts between merging and exiting traffic and reduce the number of crashes on the bridge.
- Improve local streets to handle traffic loads.

An effective public relations campaign is necessary to keep motorists informed of construction activities.

Intelligent Transportation Systems (ITS)

- Provide real time traffic information.
- Expand the existing network.
- Provide additional coverage for Division Street.
- Utilize Smart Zone.
- Use Highway Advisory Radio (HAR) to broadcast current information.
- Use the 511 National traveler information system.
- Use message signs to display travel time.
  - Portable message signs and dynamic message signs (DMS): northbound, southbound, on I-295 in Massachusetts.
  - Advanced trailblazer signs for Pawtucket Memorial Hospital.

Incident Management

- Conduct bi-weekly incident management meetings.
- Provide around-the-clock tow trucks in the work zone.
- Maintain records of pre-accident data, a history of the work area and construction monitoring.
- Use highway cameras.
- Monitor work zone safety.
- Promote alternate routes.

Public Relations/Safety

- Define the target audience:
  - Traveling public.
  - Local businesses.
  - Residents in the project area.
  - Civic and community leaders.
  - Elected officials.
  - Media.
- Keep the lines of communication open. Establish a point of contact person.
- Provide information on the RIDOT web site.
- Consider proposals for a public awareness program.

- Use television and radio traffic reports.
- Encourage flexible work schedules and working at home for commuters.
- Take advantage of public transportation; increase bus routes.
- Work with interested parties.
- Get the public involved with naming the bridge.
- Celebrate meeting project milestones.
- Keep the public informed!

The team noted the following barriers to implementation:

- Public acceptance of the project and its inconveniences.
- Traffic congestion and disruption to commuters.
- Availability of alternate routes.
- Local residents' concerns.
- Truck traffic.
- Road conditions – future resurfacing.
- Politics.
- Cost/funding availability.
- Coordination among all interested parties.

Conclusions

The team felt that challenging project constraints will require RIDOT to utilize the latest technology to mitigate potential traffic problems. Technologies such as HAR, DMS and traveler information systems should be used, along with an active public relations campaign, to inform the public far enough in advance that they can adapt to the construction project's limitations.

3.5 Roadway/Geometric Design

The roadway/geometrics group agreed with RIDOT's determination that the weaving condition at the interchange needs to be addressed, and they put forth their recommendations accordingly.

The team identified the following issues with the proposed C-D road:

- The close spacing between the George Street and Vernon Street on-ramps.
- The merging of the George Street on-ramp on a curve.
- The widening needed on the George Street overpass to accommodate the proposed C-D road.
- The lack of improvement to the conditions at the George Street/I-95 northbound on-ramp.
- The unnecessary weave on the proposed C-D road.

Alternative to C-D Road

- Eliminate George Street northbound on-ramp.
- Make Division Street a one-way traveling east.
  - Westbound traffic would use Main Street in the downtown area.
- Improve the School Street area.
  - Build a roundabout connecting Division Street, Prospect Street and School Street.
  - Straighten the alignment of School Street.
- Reconfigure George Street and local service roads such as Grace Street eastbound and Marrin Street westbound, and connect Marrin Street to Pleasant Street.

The group cited the following advantages to this configuration:

- It eliminates on-ramp weaves.
- It allows for advance roadwork.
- The George Street bridge is not modified.
- There are fewer traffic control impacts on I-95 (no on-ramp traffic).
- There is no additional width needed on Bridge No. 550 for weaving.
- It provides improved access to Pawtucket Memorial Hospital and along Division Street.

They also noted the following issues:

- Keeping Pleasant Street open. Consider constructing an arch over Pleasant Street.
- Potential property takings.
- Achieving buy-in by stakeholders:
- Local roadway improvements.
- Local traffic rerouting.

Conclusions

Much of the proposed widening work at Pawtucket Bridge No. 550 can be reduced, if not eliminated, by making local traffic improvements and reconfiguring traffic patterns. The problematic weave present at the interchange can be totally eliminated by redirecting entering and exiting traffic to other ramps that already exist along I-95. For this to be successful, local roadway improvements would need to be made. Eliminating the George Street northbound on-ramp and redirecting the traffic from that ramp would solve the weaving problem while reducing the bridge widening needed for the proposed C-D road.

3.6 Environment

The environment group began by discussing key project needs, after which they focused on addressing environmental and permitting concerns in a streamlined manner, all with the purpose of accelerating the project.

Overview of Key Recommendations

- Form a multi-disciplinary project design team.
- Establish a project development process that integrates engineering, environmental analysis, agency coordination and public involvement in to a collaborative decision making process.
- Conduct a comprehensive internal and external scoping process to:
  - Refine project purpose and need.
  - Delineate and map the environmental context.
  - Obtain agency and public input.
  - Establish transportation and environmental performance measures that will support environmental streamlining and stewardship.
- Develop/analyze alternatives that meet the project purpose and need while meeting 1) State and Federal transportation and environmental performance measures, and 2) the needs of the regulatory agencies and the public.
- Develop mitigation measures for unavoidable environmental impacts.
- Document the project development process:
  - Comprehensive project files.
  - NEPA document.
  - Categorical Exclusion or Environmental Assessment.
- Strive to satisfy as many of the regulatory permit requirements as possible as part of the project development process.
- Address project environmental issues:
  - Surface water quality and storm water management.
  - Traffic and construction noise.
  - Air toxins and equipment emissions.
  - Blackstone River Heritage corridor preservation.
  - Historic sites and districts.
  - Contaminated soils and groundwater.
  - Environmental justice.
  - Visual quality and aesthetics.
  - Riverine vegetation and habitat connectivity.
  - Construction waste management.
  - Detours through residential and business communities.
  - Nighttime construction lighting and noise pollution.

Context Sensitive Solutions (CSS)

- Use a project design team approach that includes the following:
  - Project team leader.
  - Engineering group.
  - Environmental group.
  - Public involvement group.

Conclusions

All proposed work should not only address the environmental regulatory requirements, but should also ensure that all parties involved (public agencies, contractors and citizenry) work together to complete as much of the permitting as possible in the early phases of the project. All work should address regulatory requirements. Limiting the environmental impacts, i.e., avoiding work in the river or placing new construction outside the 100-year flood plain, will help accelerate the project by avoiding possible permitting delays and unanticipated environmental issues.

4.1. Next Steps

Most of the participants had not been introduced to the limitations of the project prior to arriving in Providence and had only a short time to brainstorm and develop innovative solutions for the unique constraints of the Pawtucket Bridge No. 550 project. The Accelerated Construction Technology Transfer workshop provided an impartial examination of the project by experts from other areas of the country, each proffering their own ideas, expertise and insights for achieving the project goals. The solutions presented during the workshop reinforced some of the original design concepts and provided new direction for other aspects of the project.

RIDOT is evaluating the recommendations from all the skill sets and will determine which ideas or suggestions should be adopted for use. Some of the key ideas that RIDOT is investigating further include the following:

- Complete replacement of Pawtucket Bridge No. 559.
- Horizontal skidding as part of the superstructure replacement method.
- Permanent closure of the George Street/I-95 northbound on-ramp.
- Restructuring of local traffic patterns to eliminate the need for a C-D road alongside I-95 northbound.
- Reducing the construction timeframe by one-third to one-half.

APPENDIX A

WORKSHOP ATTENDEES

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APPENDIX B

SKILL SET REPORTING FORMS

Structures

Construction

Geotechnical/Materials

Traffic/Safety/ITS/PR

Roadway/Geometric Design

Environment

IDEA (Short Name)	IDEA (Detailed Description)	IMPLEMENTATION DETAILS (Barriers, Skill Set Coordination, etc.)
Replacement of Bridge No. 550	With this alternative: a) A more efficient structure type will be implemented to meet current standards. b) Concerns about seismic criteria could be eliminated. c) Implementation of maintenance and protection of traffic during construction would be easier. d) Cost of retrofitting and steel painting would be eliminated.	
Structure types	Superstructure: • Multi span jointless girder bridge, either continuous girder or continuous for live load. Steel plates or bulk tee could be used.	• Possible to adjust span lengths to reuse existing piers. • Realigning or permanently closing Pleasant Street is recommended.
	Substructure: • Precast elements: abutments, pier columns and caps, footings and walls.	• Thorough inspection of existing piers should be carried out to determine if they could be reused.
	• Build abutment or pier closer to river to minimize span length.	• Construction of new substructure as well as repair of existing should be done under the existing bridge, as much as possible, to keep traffic disruption to a minimum during construction.
	• Modify existing pier three to be reused as an abutment.	
	• Eliminate variable space by implementing constant depth beams.	
	• Consider the use of integral abutments.	

SUPERSTRUCTURE CONSTRUCTION ALTERNATIVES Ê

1. Horizontal skidding	a) Eliminate skew at abutment. b) Build new or widen existing piers. c) Build jacking towers on both sides. d) Construct new three-lane bridge superstructure south of existing structure. e) Jack old and new superstructure.	

IDEA (Short Name)	IDEA (Detailed Description)	IMPLEMENTATION DETAILS (Barriers, Skill Set Coordination, etc.)
2. Longitudinal launching	a) Use staged construction similar to preliminary proposal. b) Construct launching pit at east end. c) Launch beams from east to west. d) Repeat for each stage.	Eliminates the use of cranes for erection of the new structure. (Cranes may still be needed for demolition of existing bridge; location of these cranes is a concern.)
3. Conventional construction	a) Use staged construction similar to preliminary proposal. b) Use prefabricated substructure. c) Use prefabricated slabs. d) Provide contractor incentives/ disincentives.	Crane picks and location of cranes is a concern. Recommendations for staging: • Closing of George Street. • Building three lanes on each stage to minimize number of phases. • Adding longitudinal joints between northbound and southbound.

IDEA (Short Name)	IDEA (Detailed Description)	IMPLEMENTATION DETAILS (Barriers, Skill Set Coordination, etc.)
Area traffic improvements	• As part of phase I construction, have improved traffic flow/ intersection improvements.	• Determine how to handle on/off-ramp and local area traffic flow. Traffic types (i.e., emergency vehicles).
Substructure under existing bridge – phase I	• Build new substructure underneath existing bridge utilizing pre-cast elements.	1. Build up foundations, proposed piers. 2. Construct northbound additional lanes. 3. Utilize northbound lanes for northbound traffic. 4. Demo northbound bridge. Construct pier caps, steel, deck. 5. Reroute traffic onto northbound side. 6. Remove southbound bridge. Construct new southbound bridge.
Temp hwy closure	• Close northbound or southbound I-95 for short term (less than three months) and reroute traffic to RTE 6/I-295.	• Close I-95 northbound or southbound/detour traffic/short duration/reduce total project time – "short-term – high impact closure."
Superstructure placement	• Consider placement of superstructure from several areas (options).	• Crane placement (lifting concerns) – using Taft Street or by barge. • Lifts (work) to be performed at night.
Riverwalk	• Use context sensitive design – riverwalk improvements.	• Coordinate with phase I area traffic improvements. The final improvements will be completed after new superstructure is open to traffic.
A-plus-B bidding No fault incentives	• Select contractor based on price and construction time.	• Enforcement is critical. • Phased construction issues - utilizing intermediate milestones a must.
Design build		
School Street ramp	• Replace School Street ramp with a new traffic pattern.	• Existing signals at several intersections. • Alignment issues. • Emergency vehicle response times.
The horizontal slide	• Build new structure to one side of existing bridge. • Use lateral jacking to slide bridge in place of existing structure.	• Traffic issues – temporary highway/secondary roadway closures. • Constructability issues.

SKILL SET Geotechnical/Materials

IDEA (Short Name)	IDEA (Detailed Description)	IMPLEMENTATION DETAILS (Barriers, Skill Set Coordination, etc.)
Replacement of structure	• Prudent to use replacement rather than rehabilitation, considering variables.	
Foundation options	Various options available such as: • Spread footings on rock. • Spread footings on MSE. • Micropiles. • Drilled shafts.	• Dependent on loading conditions. • Problematic with boulders.
Embankment options	• Use of MSE wall structures.	• Must analyze impacts of fill on existing structure.
MSE walls	• Use in applicable areas (embankment options).	• Unlimited aesthetic options.
Lightweight fills	• Use of geofoam or other lightweight fills for fill areas under existing structure.	

IDEA (Short Name)	IDEA (Detailed Description)	IMPLEMENTATION DETAILS (Barriers, Skill Set Coordination, etc.)
Movable traffic barriers	• Use for temporary lane closures during construction.	• Coordination with: construction, structures, geometrics, traffic, public relations. • Barriers include: weather conditions, installation costs, the fact that the same can be achieved with barrels and jersey barriers.
ITS devices (cameras, DMS, etc.)	• Expand the existing network for the project work area. • Will provide real time information on traffic conditions to road users. • Provide for incident detection and work zone monitoring. • Use Smart Zone, DMS, portable trailblazer and overhead message signs, cameras, HAR (Highway Advisory Radio).	• Coordination with: construction, structures, geometrics, traffic, public relations, ITS. • Barriers include: finding sites and locations for installation of devices, finding sight line visibility barriers, avoiding utility conflicts, keeping information up to date.
Signal coordination	• Upgrade local system so it is State controlled to mitigate concerns of traffic flow and concerns of the motoring public (i.e., hospital access).	• Coordination with: construction, structures, geometrics, traffic, public relations, ITS. • Barriers include: cost and city approval.
Speed control	• Implement dynamic speed display signs before work zone to notify motorists ahead of reduced speed work zone due to traffic congestion. • Will coordinate with DMS signs.	• Coordination with: construction, traffic, ITS. • Barriers include: cost, coordination.
Enhanced work zone delineation	• Provide reflective devices on barriers, reflective pavement markings, increased lighting of construction work zone area. • Will provide a safer work zone area for motorists.	• Coordination with: construction, traffic. • Barriers include: maintenance, weather limitations on installation and life span of reflective materials.
Lane rentals Contractor incentives/ disincentives	• Will get contractor to work more efficiently and keep project on schedule, possibly even ahead of schedule.	• Coordination with: construction. • Barriers include: increased construction cost and enforcement.
Closure of George Street on-ramp and temporary closure of School Street off-ramp	• Will reduce crashes and eliminate conflicts. • Will eliminate merging on bridge and facilitate construction.	• Coordination with: structures, construction, geometrics, traffic, public relations, ITS. • Barriers include: inconvenience to motorists and local residents. May have to upgrade local streets due to increased traffic; would require a well-coordinated public relations campaign.

IDEA (Short Name)	IDEA (Detailed Description)	IMPLEMENTATION DETAILS (Barriers, Skill Set Coordination, etc.)
Incident management	• Hold bi-weekly meetings. • Have on call tow truck in work zone 24/7. • Use work zone safety campaign. • Have alternate routes available. • Obtain accident data before construction begins to have a base line for accident monitoring throughout construction.	• Coordination with: construction, public relations, ITS, traffic. • Barriers include: cost and coordination.
Public relations	• Identify the target audience. • Identify a point of contact. • Utilize the media, DOT web site, TV, radio. • Put out an RFP for a public awareness program. • Develop a project video for the public. • Work with public transportation for alternate routes and means of alternative transportation for public. • Get public involved – name the bridge contest (creates positive feeling and identity toward project and increased public acceptance). • Celebrate project milestones – keeps public notified on progress of project, get local businesses involved in the celebrations. Keeps project acceptance positive. • KEEP PUBLIC INFORMED!!	• Coordination with: construction and public relations • Barriers include: cost, maintenance, politics and coordination with local businesses, public officials and public transportation.

IDEA (Short Name)	IDEA (Detailed Description)	IMPLEMENTATION DETAILS (Barriers, Skill Set Coordination, etc.)
Eliminate George Street on-ramp	Reason: 1. George Street on-ramp has proximity interaction with School Street off-ramp. 2. George Street on-ramp merges into the interstate on a curve. 3. Less construction impact to I-95 (George Street overpass widening needed). Advantages: 1. On-ramp weaves eliminated. • School Street off-ramp, Vernon Street on-ramp and I-95 will operate better. 2. Roadwork advanced. • Construction will already require work. 3. No need to modify George Street overpass. 4. Less traffic control impact on I-95. • There's no need to accommodate on-ramp traffic. 5. Bridge 550 additional width not needed to control weaving. 6. Improves access to hospital and along Division Street.	Alternative: 1. Make Division Street Bridge one-way going east. • Local traffic going westbound will go through Main Street. 2. Reconfigure George Street and service road. • Make Grace Street eastbound and Marion Street westbound. • Add new road connecting Marion Street to Pleasant Street. 3. Make School Street area improvements. • Build roundabout connecting Division Street, Prospect Street and School Street. • Straighten out School Street by the Apex parking lot. Issues/Barriers: 1. Keeping Pleasant Street open to local circulation. • Construction suggests placing CONSPAN to cover Pleasant Street as part of advance work. 2. Acquiring potential property. 3. Achieving buy-in by stakeholders.

IDEA (Short Name)	IDEA (Detailed Description)	IMPLEMENTATION DETAILS (Barriers, Skill Set Coordination, etc.)
Seek context sensitive solutions	• Establish a project development process that integrates engineering, environmental analysis, agency coordination and public involvement into a collaborative decision-making process.	• Form a multi-disciplinary project design team with membership from engineering, environmental, the public and agency representatives to fully flush out regulatory and community concerns.
Perform comprehensive internal and external scoping process	• Refine project purpose and need. • Delineate and map the environmental context. • Obtain agency and public input. • Establish transportation and environmental performance measures to support environmental streamlining and stewardship initiatives for the project.	• Strive to satisfy as many of the regulatory permit requirements and public concerns as possible in a proactive project development process to avoid potential delays during project development, construction and maintenance.
Develop and analyze project alternatives	• Meet the purpose and need for the project while obtaining the transportation goals for the project and environmental performance measures in cooperation with the regulatory agencies and the public.	• Document the project development process in a comprehensive project file and summarize the process findings in environmental documents to comply with NEPA (Categorical Exclusion or Environmental Assessment).
Proactively address project area environmental issues, including those identified through scoping	• Surface water quality and storm water management. • Traffic and construction noise. • Air toxins and construction equipment air emissions. • Blackstone River Heritage Corridor preservation. • Historic sites and districts. • Contaminated soils and groundwater. • Environmental justice. • Visual quality and aesthetics. • Accessibility to businesses, community facilities and emergency services. • Riverine vegetation and habitat connectivity. • Construction waste management and recycling. • Maintenance and protection of traffic detours through residential and business communities. • Nighttime construction light and noise pollution. • Indirect and cumulative impacts.	• Strive to satisfy as many of the regulatory requirements as possible by developing a comprehensive and continuous agency and public involvement plan that concentrates on innovative techniques to reach out to stakeholders in the project area. • Develop mitigation measures for unavoidable environmental impacts in cooperation with the regulatory agencies and the public. Implement commitments by developing a project-monitoring plan that ensures commitment implementation through project construction.

Innovative Financing. The team's primary goals are to align potential financing options with project goals; match anticipated cash flow with project management; and provide options for managing competing priorities for existing resources.

ROW/Utilities/Railroad Coordination. The ROW group's primary role is to ensure that ROW, utilities and railroad work comply with state laws and procedures. They must also consider the numbers and types of businesses and residences impacted by a project and evaluate the ready availability of additional right-of-way.

Geotechnical/Materials/Accelerated Testing. The geotechnical team explores subsurface conditions to determine their impact on the project; pursues options for expediting materials acceptance and contractor payment; and evaluates the use of innovative materials in accordance with project performance goals and objectives.

Traffic Engineering/Safety/ITS. The traffic engineering team strives to enhance safety; improve traffic management; and explore technologies, including ITS systems, that will communicate real-time construction information to the public.

Structures (Bridges, Retaining Walls, Culverts, Miscellaneous). The structures skill set focuses on accelerating the construction of structures. Their task is to identify the most accommodating types of structures and materials that will meet design requirements and minimize adverse project impacts.

Innovative Contracting. The innovative contracting group explores state-of-the art contracting practices and strives to match them with the specific needs of the project.

Roadway/Geometric Design. The roadway team evaluates proposed geometrics and identifies the most accommodating product with the minimum number of adverse impacts.

Long Life Pavements/Maintenance. The maintenance skill set identifies pavement performance goals and objectives and explores future maintenance issues for the project corridor, including winter service, traffic operations and preventative maintenance.

Construction (Techniques, Automation and Constructability). The construction crew explores techniques that will encourage the contractor to deliver a quality product within a specific timeframe while maintaining traffic.

Environment. The environment team ensures that the scope of work and construction activities reflect local environmental concerns. Their goal is to provide the most accommodating and cost effective product while minimizing natural and socio-economic impacts.

Public Relations. The public relations skill set discusses ways to partner with local entities and effectively inform both local communities and the traveling public about the project before, during and after construction. Their role is to put a positive spin on the project.

Background of ACTT

ACTT is a process that brings together public- and private-sector experts from across the country in a setting that encourages flexibility and innovation. The goal is to recommend technologies that will accelerate construction time while reducing user delay and community disruption. This necessitates a thorough examination of all facets of a highway corridor with the objective of improving safety and cost effectiveness while minimizing adverse impacts to the traveling public.

The ACTT concept was originated by the Transportation Research Board (TRB) in conjunction with FHWA and the Technology Implementation Group (TIG) of the American Association of State Highway and Transportation Officials (AASHTO). Following the completion of two pilot workshops, one in Indiana and one in Pennsylvania, the originating task force, A5T60, passed the concept off to FHWA and TIG to continue the effort. They have done so by coordinating a series of ACTT workshops around the country, with several more pending in 2005 and 2006.

More information on the ACTT program is available online at:

http://www.FHWA.dot.gov/construction/accelerated/index.htm.