

ACTT WORKSHOP

Tennessee



April 6-8, 2004 | Knoxville, Tennessee



U.S. Department of Transportation
Federal Highway Administration

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Executive Summary

Accelerated Construction Technology Transfer (ACTT) is a strategic process that uses innovative techniques and technologies to reduce construction time on major highway projects while enhancing safety and improving quality. The process is implemented by conducting 2-day workshops for State Departments of Transportation (DOT). The American Association of State Highway and Transportation Officials (AASHTO) and the Federal Highway Administration (FHWA) jointly fund ACTT workshops.

On April 6-8, 2004, The Tennessee Department of Transportation (TDOT) hosted an ACTT workshop that brought together 82 transportation professionals from 19 States, including Washington, DC. The main objective of the workshop was to draw on the expertise of the participants to help TDOT achieve its primary goal of minimizing construction time for its Interstate 40 (I-40) widening project through downtown Knoxville.

The project focuses on a 2-mile stretch of I-40 between Interstate 275 (I-275) and Cherry Street in downtown Knoxville. The project involves the widening of I-40 and the reconstruction of several associated interchanges in Knoxville, Tennessee. The project limits extend from the Cherry Street interchange east of the central business district to the interchange with I-275 in downtown Knoxville. Built in the early 1960s, the existing facility includes substandard features like short weaving sections, left-hand entrance ramps with short acceleration lanes, and inadequate shoulders. While I-40 has a minimum of six through lanes east and west of downtown Knoxville, the section within project limits is a “bottleneck” with only four through lanes. The \$160 million project is to upgrade this stretch of I-40 to today’s standards and add capacity. Also, as part of this project, James White Parkway/SR-158 (JWP) will undergo some improvements. A combination of additional lanes and geometric improvements at the I-40/SR-158 interchange is expected to help address the capacity issue of the project. The primary project challenge is to minimize construction time while minimizing right-of-way requirements and adverse environmental and socioeconomic impacts to the community, which include several historical districts adjacent to the highway.

At the opening session, Weston Gaffron, TDOT Assistant Chief Engineer, and Bobby Blackmon, FHWA Division Administrator, expressed support for the workshop as they welcomed the participants. Dr. Donn Hancher, Assistant Dean of the College of Engineering, the University of Kentucky, gave the keynote address on “Why ACTT? Why Now?” which included an overview of several projects accelerated across the nation and their success stories. The opening day concluded with a project overview by the project management team and a bus tour of the project site.

The following day, attendees broke into six predetermined skill set teams as follows:

- Structures.
- Construction/Materials/Accelerated Testing/Constructibility.
- Geotechnical.
- Innovative Contracting/Worker Health/Warranties.
- Traffic/Safety/ITS.
- Environment/PR/Aesthetics.

The skill set teams examined different aspects of the project and assessed the potential for accelerating various phases of the project. Each team focused on applying the ACTT process to the specific concerns of their expertise while the teams collectively searched for methods and measures to help TDOT achieve its primary project goal of a 4-year construction time through a 14-month mainline closure.

Workshop participants remained focused throughout the workshop and made numerous recommendations, many of which were deemed viable and will be pursued, according to TDOT. As the host agency, TDOT will examine the recommendations and determine which will be implemented on this or other projects.

CHAPTER 1

*Accelerated Construction
Technology Transfer*

Highway construction continues to produce significant disruptions in communities across the nation as DOTs work to update an aging infrastructure system. While highway construction is unavoidable, excessive construction time is unnecessary and often can be dangerous. It is costly, prolongs workers' exposure to traffic, and subjects travelers to substandard conditions. The ACTT initiative aims to minimize travel delays and community disruptions by reducing cost and construction time and improving quality, traffic control, and safety.

1.1 BACKGROUND

ACTT is a process that encourages the use of innovative technologies and methods to accelerate the construction of major highway projects to reduce user delay and community disruption. A complete accelerated construction approach involves evaluating the planning, design, and construction activities within a highway corridor using multiple strategies and technologies. Successful ACTT deployment requires a thorough examination of all facets of a highway corridor with the objective of improving safety and optimizing cost effectiveness while minimizing adverse impacts for the benefit of the traveling public.

Recommendations by Transportation Research Board (TRB) Special Report 249 called for creating a strategic forum to promote accelerated construction in the highway infrastructure. TRB Task Force A5T60 was formed with the objectives of:

- Facilitating the removal of barriers to innovation.
- Advocating continuous quality improvement and positive change.
- Enhancing safety and mobility.
- Encouraging the development of strategies that generate beneficial change.
- Creating a framework for informed consideration of innovation.

Fully supporting the task force's mission and objectives, the FHWA and the Technology Implementation Group (TIG) of AASHTO joined the task force in an outreach effort. The result was the formation of a national resource pool known as the "National Skill Sets Council" and completion of two ACTT pilot workshops (one in Indiana and one in Pennsylvania). Following the pilot workshops, TRB Task Force A5T60 transferred the concept to FHWA and AASHTO to continue the effort by conducting future workshops.

CHAPTER 2

Project Details

2.1 BACKGROUND

The project selected for the Tennessee ACTT workshop involves the widening of Interstate 40 (I-40) and the reconstruction of several associated interchanges in Knoxville, Tennessee. The project limits extend from the Cherry Street interchange east of the central business district to the interchange with I-275 in downtown Knoxville. The existing facility was built in the early 1960s, and is now obsolete. While I-40 has a minimum of six through lanes east and west of downtown Knoxville, the section proposed for reconstruction is a “bottle neck” having but four through lanes. I-40 is a major east-west route, with a daily traffic of some 103,000 vehicles within the project limits. The traffic volume includes a substantial number of trucks. The current cross section is simply inadequate to carry this traffic volume.

The portion of I-40 within the project boundaries has other deficiencies. Some elevated portions have no shoulders. There is a left hand exit ramp to the JWP and a very dangerous left hand entrance ramp with a very short acceleration lane from the JWP to westbound I-40. Local traffic between north Knoxville and downtown enters from the Broadway interchange, weaves across the I-40 mainline within a short distance, and exits left to JWP. This movement causes major operational problems, including frequent accidents.

This project has been discussed since the early 1980s and TDOT has held numerous public meetings since that time. Many alternates have been studied and presented at the public meetings. The alternates have been narrowed down to two: Alternate “K,” TDOT’s current design, and Alternate “L,” a depressed freeway alternate. Public hearings on these alternate designs were held in June 2003 and August 2003. In conjunction with the Knoxville City Mayor and Knox County Mayor, TDOT Commissioner Gerald Nicely made the decision to go forward with the current design.

2.2 PROJECT DESIGN DETAILS

In addition to creating six through lanes (up from four), the project includes extending Hall of Fame Drive north to Broadway (US-441), the reconstruction of an interchange between I-40 and Hall of Fame Drive, the redesign of the JWP interchange, and improvements to the Cherry Street interchange. The following describes several current deficiencies and the proposed changes to be made:

Current: Ramps from Western Avenue, Henley Street, and I-275 all merge into two lanes of eastbound traffic on I-40.

Proposed: I-40 viaduct widening – New lanes creating a total of five lanes of eastbound traffic.

Current: The entrance ramp from northbound JWP currently merges into the left-hand lane of westbound I-40.

Proposed: Northbound traffic from JWP merges into a new right-hand auxiliary lane onto westbound I-40.

Current: Southbound traffic from Broadway must cross two lanes of westbound I-40 to exit onto JWP and reach downtown.

Proposed: Southbound traffic from Broadway will use Hall of Fame Drive to reach downtown. Traffic entering the freeway system from southbound Broadway will stay on I-40 westbound; the left-hand exit is eliminated.

Current: North Fifth Avenue is a four-lane city street that provides a half interchange with I-40.

Proposed: North Fifth Avenue becomes part of the new Hall of Fame Drive to connect Broadway to downtown Knoxville. The interchange between Hall of Fame Drive and I-40 is modified to serve fully directional movements.

Current: Traffic from Summit Hill Drive must merge with JWP before exiting onto Magnolia Avenue, thus creating a short weaving condition that causes operational problems.

Proposed: Hall of Fame Drive connects Summit Hill Drive to Magnolia Avenue and Broadway. The ramps to and from Magnolia Avenue (and the short weaving condition) are eliminated.

Current: Fifth Avenue and Magnolia Avenue are parallel streets and Magnolia Avenue splits into a pair of one-way streets under I-40 ending at Broadway.

Proposed: Magnolia Avenue through traffic will be relocated to West Fifth Avenue. This will eliminate neighborhood cut-through traffic on East Fifth Avenue and provide a continuous east-west movement beyond Broadway. Old Magnolia Avenue becomes a two-way street on the south side of I-40 to better serve business access along this street.

Current: Fourth Avenue passes under I-40 and JWP to intersect Gill Avenue.

Proposed: I-40 is located further from the Fourth and Gill Neighborhood and the Fourth Avenue underpass is eliminated. Fourth Avenue is relocated to the west side of I-40 along the old interstate right-of-way and is incorporated into the neighborhood street grid.

2.3 COMMUNITY CONCERNS AND IMPACTS

The project faces numerous challenges. There are several historical districts adjacent to the project and it is close to the downtown area. This project will affect the local street system and traffic. TDOT and the project contractor(s) must work with the City of Knoxville and neighborhood groups to maximize the flow of traffic on detour routes while minimizing the disruption to area residents and businesses. Changes to the design of structures and roadway geometry should be considered where there are opportunities to simplify the construction process and increase motorist safety during and after the project. The project team must work with state and local law enforcement to ensure that incidents on detour routes are cleared quickly. Finally, the project team needs to remain open to change throughout the process so that new opportunities for streamlining and safety can be realized as they arise.

During 2004, TDOT has continued to hold numerous meetings with city officials and representatives of community groups. At the request of these community groups, TDOT has made a number of design changes. They include:

- Realign Fourth Avenue to the west side of I-40.
- Provide parking along relocated Fourth Avenue for a neighborhood park.
- Erect noise barriers along the interstate adjacent to the Fourth and Gill community.
- Extend First Creek Greenway under the interstate.
- Decrease the turning radii onto Gill Avenue to discourage large trucks.
- Keep on-street parking on Gill Avenue.
- Realign Magnolia/Fifth Avenue to increase traffic through the business district on Magnolia Avenue.
- Make Old Magnolia Avenue a two-way street.
- Reopen Fifth Avenue under the railroad tracks.
- Reconnect Williams Street under the interstate.

The department unveiled a revised design plan on March 8, 2004, at a joint City of Knoxville/TDOT public question and answer session. At that meeting, the public was advised of community inspired changes. This

meeting was a great success. Issues still on the table for community input include: (1) aesthetics of noise walls and retaining walls, (2) landscaping, (3) treatment of areas under bridges, (4) lighting, and (5) permanent and detour signage.

2.4 PROJECT IMPLEMENTATION

The total estimated project cost is \$160 million, making it the largest in TDOT history. The construction as presently planned will be performed in two phases:

- Phase 1: Hall of Fame Drive will connect Summit Hill Drive and Broadway (SR-33). The interchange between Hall of Fame Drive and I-40 will be constructed and the exit ramp from I-40 eastbound to JWP will be built.
- Phase 2: I-40 will be widened to three lanes in each direction from I-275 to Cherry Street. The interchange with JWP (SR-158) will be completed and the interchange with Cherry Street will be improved.

By completing the work on Hall of Fame Drive first, continuous downtown access will be maintained during reconstruction of the interstate. In order to minimize construction time and increase safety during Phase 2, the plan calls for complete closure of I-40 to through traffic for 14 months. During this closure, through interstate traffic will be diverted to I-640, and the local street network is expected to see an increased traffic burden. These traffic impacts, however, are expected to be much less than would be experienced were the interstate to be kept in service during construction.

CHAPTER 3

Workshop Details

With support from the FHWA and AASHTO, TDOT hosted an ACTT workshop in Knoxville on April 6-8, 2004. Eighty-two people from 19 states were in attendance. These included representatives of TDOT, Knoxville/Knox County government, FHWA, other state highway agencies, and the public. The project focus of the workshop was the proposed I-40 widening in Knoxville.

The workshop began with opening remarks from the officials from TDOT and FHWA. Mr. Glen Malone (TDOT) and Mr. Jeff Mize (Wilbur Smith Associates) gave a presentation of the project. Dr. Donn Hancher from the University of Kentucky followed with his presentation on “Why ACTT? Why Now?” The ACTT management team moderated the workshop. Attendees were then taken on a bus tour through the proposed construction site. Tour guides described the key elements of the project to the attendees.

3.1 SKILL SET FOCUS

In a pre-workshop meeting with the ACTT Management Team, TDOT officials identified six skill set areas to focus on various aspects of the project and methods for accelerating project implementation. The six areas are:

- Structures.
- Construction/Materials/Accelerated Testing/Constructibility.
- Geotechnical.
- Innovative Contracting/Worker Health/Warranties.
- Traffic/Safety/Intelligent Transportation Systems (ITS).
- Environment/Public Relations/Aesthetics (landscaping, treatment of areas under bridges, noise wall aesthetics, etc.) .

Each workshop attendee was assigned to a skill set team based upon his/her background and responsibility. FHWA made provisions for each team to have one or more designated leaders with expertise in the focus area and experience with the ACTT process. The leaders helped the local team members to examine how accelerated construction methods could be implemented in the project. During the workshop, skill set teams met in breakout session to consider concepts that could result in expedited construction and to identify issues that could delay construction. Members of different skill set teams then worked together to ensure ideas were addressed in a coordinated fashion. In the closing session, each skill set presented its list of five to seven “priority” recommendations to the workshop attendees.

CHAPTER 4

*Skill Set Groups and
Recommendations*

The skill set teams met to discuss aspects of the project and methods for accelerating project implementation. Each skill set team focused on how the ACTT process applied to the specific concerns of their areas of expertise while collectively, the teams searched for methods/measures to help TDOT achieve its goal of closing I-40 to through traffic for 14 months to allow work crews to complete construction in 4 years.

Each skill set team completed the reporting forms, which are included in this report as Appendix B. The teams were also asked to rank five to seven ideas in order of top priority, and to make a presentation on these to the workshop attendees.

A brief summary of each skill set description (italicized) is listed as guidelines for the skill set team members. The five to seven “priority” recommendations are also listed below each description.

4.1 STRUCTURES (BRIDGES, RETAINING WALLS, CULVERTS, MISCELLANEOUS)

Accelerating the construction of structures will require deviation from standard practices for design and construction and include early coordination between designers and contractors. A systems approach from the “ground up” will be necessary instead of emphasis on individual components. Prefabrication, preassembly, incremental launching, life-in, roll-in, etc., are systems or concepts that have a proven contribution to accelerating construction and should be understood and receive priority consideration. Designers have several options in structure types and materials to meet design requirements, but identifying the most accommodating system while minimizing adverse project impacts should be the objective.

The initial brainstorming by the structures skill set resulted in 29 separate ideas for accelerating construction within the project corridor. The ideas were grouped into foundations, substructures, superstructure, and other issues. These topics included questions or issues, findings, and initial recommendations as follows:

Foundations

- Use steel piles.
- Use drilled shafts.
- Use spread footings on rock.
- Excavate fills and use spread footings.
- Advance foundation piling construction where possible.
- Use mono drilled shafts under each column.
- Fix the elevation of the footing/column construction joint.

Substructure

- Use precast columns and caps.
- Use cast-in-place columns with precast caps.
- Use lightweight concrete in precast caps.
- Use maturity meters to monitor concrete strengths and control the construction stages.
- Consider the feasibility of precast abutments.
- Minimize substructure units.
- Consider aesthetic effects with options.
- Coordinate with other skill sets.

Superstructure

- Use continuous precast beams.
- Prefabricate superstructure units.
- Consider the benefits of spliced girders.
- Use full depth precast deck slabs.
- Use lightweight concrete to reduce the weight of prefabricated components.
- Minimize skews.
- Minimize flares on roadways and bridges.

Other Issues

- Advance embankment construction (end fill at bridge abutments).
- Consider Expanded Polystyrene (EPS) for fill material.
- Precast fascia panels for retaining walls.
- Require early submittals for Value Engineering (VE) cost reduction submittals.
- Use full span bridge erection.
- Develop staging areas.
- Do initial screening of VE proposals.

Following continued consideration and intermingling with other skill sets, the Structures skill set organized its final recommendations into seven areas: Contracting, Precasting/Prefabricated Technology, Materials, Embankment, Geometry, Foundations, and Retaining Walls. The Structures skill set did not consider the noise walls. These areas and subsequent recommendations for accelerating the construction follow:

Contracting

- Use a single contract (final design contract #1 plus preliminary design contract #2).
- Preprocure materials that are on the critical path:
 - Bridge girders.
 - Manholes.
 - Retaining wall panels.
 - Noise walls.
- Use advanced contract for:
 - Utility relocation work.
 - Building demolition.
 - Clean and paint existing steel girders to remain.
 - Early selected substructure units.
- Value engineering (VE) Proposals:
 - Provide for early screening (within 30 days).
 - Early VE submissions (within 90 days).
 - Consider user cost/other benefits in VE proposal evaluation.
- Set realistic schedule with incentives.
- Advance the fill construction under I-40 bridges.

Precasting/Prefabricated Technology

- Use precast pier caps.
- Use precast columns (if feasible, details for seismic connections needed).

- Girders:
 - Spliced girders for longer spans.
 - Replace with steel for longer spans.
 - Consider segmental concrete construction.
- Use full depth precast deck slabs (bridge over I-40).
- Consider prefabricated units (girder with deck).
- Consider full span prefabrication and erection.

Materials

- Use self consolidating concrete.
- Use maturity meters for concrete strength determination.
- Use lightweight concrete.
- Use high performance concrete and steel.
- Consider onsite concrete batch plant.
- Consider advanced concrete mix design.

Embankment

- Construct abutment fills early.
- Consider EPS for the fill material.
- Consider graded rock fill (to avoid possible inclement weather delays).

Geometry

- Minimize the skews on bridges.
- Minimize flares on roadways and bridges.
- Maximize span lengths (minimize substructure units).

Foundations

- Detail three alternative foundation types for piers:
 - Drilled shafts (mono shafts).
 - Steel piles.
 - Spread footings.
- Advance construction wherever possible.
- Fix footing elevation for precast columns.

Retaining Walls

- Use only prequalified (TDOT) products (No VE proposals; require other walls systems to be submitted and approved prior to letting).
- Consider prepurchase of wall system components.
- Require early submission for tied back walls proposed.
- Verify right-of-way (ROW) easements provide for all wall types.
- Precast fascia panels.
- Consider EPS fill behind walls.

More detailed information relative to the Structures skill set initial can be found in Appendix B.

4.2 CONSTRUCTION/MATERIALS/ACCELERATED TESTING/CONSTRUCTIBILITY

Accelerated construction may press the contractor to deliver a quality product in confined time frames and areas, while maintaining traffic. Completion milestones and maintenance and protection of traffic are key elements visible to the traveling public. Allowing contractors to have input on design elements that would affect time or quality during construction can improve the effectiveness and efficiency of the overall project completion. The use of automation to enhance construction equipment performance; construction engineering and surveying; data collection and documentation; and contract administration should be explored and implemented. Pursue options to expedite and facilitate turnaround times in material testing for material acceptance and contractor payment. The use of innovative materials should be explored and encouraged on projects to maximize the creative characteristics of the designer and contractor. By identifying project performance goals and objective(s), the designer and contractor have the maximum freedom to determine the appropriate methodology for constructing the project. Right-of-way considerations include state laws and procedures covering acquisition and relocation, numbers and types of businesses and residences that may be affected, ready availability of additional ROW, and sometimes, the number of outdoor advertising structures in the project area. Other items to consider are industry responsiveness, incentive-based utility agreements, corridor approaches to utility agreements, contracting for utility work, and non-destructive methods of utility relocation. When applicable, close railroad coordination is essential for a project for construction access or work affecting the railroad lines.

The construction skill set brainstorming sessions produced a number of ideas for incorporation into the project. These ideas were generally divided into Preconstruction, Materials, Bridges, Pavement, and Contract Administration activities that should be incorporated into the project. All of the ideas developed during the sessions can be effective in accelerating this project. However, the following key elements of the recommendations should be emphasized:

- Authorize utility relocation in advance of construction. Start the railroad permitting process at the earliest point in the design process. Work with railroads to obtain early scheduling of track closures to speed construction within the railroad ROW.
- Adjust span lengths to avoid existing foundations, and install the foundation before the demolition of the existing bridge. The time to construct spread footings, pile foundations, and drilled shafts is a controlling factor in completing the project on time or ahead of schedule. The use of pin piles installed beneath an existing bridge would reduce construction time by allowing new bridge foundations to be constructed before the old bridge is demolished.
- Use precast bridge elements. This construction technique would result in the elimination of in-place formwork, the need to install rebar cages in-place, time consuming in-place incremental concrete pours, in-place form stripping, in-place concrete finishing and in-place concrete curing time, all of which is sequential and on the critical path. The use of precast pier caps, bent caps, and post-tensioned/precast columns is suggested, all of which could be prefabricated before needed.
- Use preassembled structural steel in sections. The preassembled steel sections could be erected on the ground and lifted in place by cranes. This will reduce the number of temporary supports needed to stabilize the steel girders during erection, reduce time needed to bolt members together in-place, and significantly reduce crane operation time.

- Develop an overall Certified Project Management (CPM) schedule that includes all commitments for the improvement, not just the job schedule.
- Let project to contract in advance of the I-40 closure to allow for preparatory work.
- Use the A + B bidding technique to provide incentive for the contractor to speed construction to open the facility to traffic at the earliest time.
- Complete or defer all roadway work on I-640 during the closure of I-40. The only exception would be emergency repairs. The intent was to ensure no reduction in capacity on I-640 during the I-40 closure period.

Below is a listing of the ideas developed during the session:

Pre-Construction

- Accelerate utility relocation.
- Accelerate the permit process.
- Recognize railroads use double shifts.
- Consider a partial opening of I-40.
- Co-locate offices for field inspection coordination.
- Suggest material storage near railroad and port.
- Use alternative pavement in the bidding process.

Materials

- Use high early strength concrete.
- Use VECP.
- Use nondestructive testing.

Bridges

- Adjust span lengths and install the foundation under the JWP before demolition.
- Use precast pier caps, bent caps, and post-tensioned/precast columns.
- Use continuous pours for deck slabs on prestressed beams.
- Provide greater cover in lieu of epoxy coated rebars.
- Use high early strength concrete for deck slabs.
- Preassemble structural steel in sections and launch or lift into place.
- Coordinate the movement of cranes and overweight specialty equipment within the project.

Pavement

- Use the same structure for the shoulder and pavement.
- Use alternative pavement in the bidding process.

Contract Administration

- Let the contract before the I-40 closure.
- Specify shop draw approval time limitations.
- Use one contract.

- Work multiple shifts.
- Develop an overall CPM schedule.
- Use innovative techniques.
- Coordinate all contracts.
- Use Contractor Quality Control process.
- Establish Dispute Review Board.
- Include a price adjustment clause.

4.3 GEOTECHNICAL

Subsurface conditions and issues should be explored to assess their impacts on the project. Based on the geography of the project, subsurface investigation may be complicated by traffic volume, environmental hazards, utilities, railroad property, and ROW.

The skill set team members made recommendations on Bridges 19, 4, and 5, specifically:

Bridges-General Issues

- Lengthen spans (reduces the number of substructures).
- Provide three design alternates: drilled shafts, driven piles, and spread footing where appropriate.
- Consider the use of styrofoam blocks (EPS) at abutments, and protect them from hydrocarbons.

Specific Bridge Issues: Bridge 19

- Consider 2-span design:
 - Eliminates foundations, decreases construction time.
 - Reduces potential interference with the drainage pipe.
- Provide a detailed design and construction sequence for local drainage.
- Consider “top down” construction in cut area:
 - Potential benefits:
 - Assist with construction drainage.
 - Reduced impact on adjacent structure (shoring).
 - Reduction of construction time.
- Consider spread footings, pin piles, and permitting construction of foundations before demolition of the existing bridge.

Specific Bridge Issue: Bridges 4 and 5

- Consider single span bridges to eliminate piers and speed construction.

Improve Subgrade Throughout Corridor

- Extend pavement life.
- Improve mobility of construction equipment.
- Benefits future maintenance.

Provide contractual mechanism to expedite changes due to unanticipated subsurface or other conditions.

Provide training on inspection of MSE walls and drilled shafts for field staff prior to construction.

4.4 INNOVATIVE CONTRACTING/WORKER HEALTH/WARRANTIES

Explore the state-of-the-art in contracting practices and obtain a better knowledge of how these techniques could be selected, organized, and assembled to match the specific situations needed on this project. Techniques to be considered include performance related specifications, warranties, design/build (D/B), maintain, operate, cost + time, partnering escalation agreements, lane rental, incentives/disincentives, value engineering, and any other innovative contracting techniques that would apply to the project. It is feasible to acquire pavement designs approaching 50 to 60 years by telling the contractor what was wanted, rather than how to build the pavement. By identifying and communicating the pavement performance goals and objectives for the pavement, the designer and contractor have the maximum freedom to determine the appropriate methodology.

The skill set team members divided their recommendations into four areas:

- Pre-Bid Planning.
- Delivery Methods.
- Procurement/Bidding Methods.
- Contract Management During Construction.

Pre-Bid Planning

- Identify staging areas.
- Mandatory pre-bid meeting:
 - DBE Notification.
- Special Contractor Pre-Qualification.
- Lengthen time period (advertisement to letting).
- CPM Master Schedule (internal to owner).

Delivery Methods

- Design-Bid-Build (D/B/B).
- Early Sub-Structure Contracts:
 - One contract vs. two contracts.
 - If one contract, D/B the structures.
 - If two contracts, allow bidder to bid one or both (let both contracts at the same time).

Procurement Option

- A + B (cost + time).
- Can apply to road closure (define interim completion date).

Contract Management During Construction

- Incentive Strategies
 - I/D for time (final and interim milestones).
 - No excuse bonus.
 - Lane rental.
 - Performance:
 - Safety.
 - Consultant Mgt.

- Maintaining TCP
 - Adherence to context sensitive issues.
- CPM Scheduling:
 - Contractor requirement.
 - Updates required for progress payment.
- Expedited Decisionmaking:
 - Submittals.
 - Change orders.
 - VE.
- Partnering/escalation agreements.
- Submit worker health/safety plan.
- Maintain an onsite safety officer:
 - Maintain work zone TCP
 - Ensure worker personal protective equipment (PPE).
 - Monitor work hours.
- Warranties:
 - ITS.
 - Plants/landscaping.
 - Pavement surfaces.
 - Signage/pavement markings.
 - Structures.
- Alternate contractor TCP's meeting internal TMP requirements.
- Escrow bid documents.
- Alternate Dispute Resolution (ADR):
 - Dispute Review Board (DRB).

4.5 TRAFFIC ENGINEERING/SAFETY/ITS

Enhanced safety and improved traffic management by corridor contracting should be considered. Developing and evaluating contract models may illustrate the best use of incentives to enhance safety and improve traffic flow during and after construction. Evaluating both the construction and maintenance work may help assess traffic and safety issues more fully than the conventional project-by-project approach. Provide better information to the traveling public and politicians on the relationships among crashes, delays, mobility, total traffic volume, truck traffic volumes, and the need for lane closures during construction. Implement integrated ITS systems to communicate construction information to motorists via radio, Internet, wireless alerts, along with incident management systems/services.

The Traffic Engineering/Safety/ITS skill set team's five recommendations were:

- Contract Incentives and Disincentives.
- Incident Management.
- Maintenance of Traffic Flow.
- Public Awareness.
- Hall of Fame Drive.

Contract Incentives and Disincentives

- Use A + B bidding – project duration + construction costs. Consider the use of A + B + C bidding (C = special contractor prequalification).
- Establish traffic operation standards, e.g., maximum delay, maximum travel time, minimum number of lanes, etc. Use these standards in combination with contract incentives/disincentives.
- Use liquidated damages to encourage the contractor to meet performance and schedule goals.
- Hall of Fame Drive, I-40 closure/reconstruction may be split into separate contracts – use performance incentives in both phases to ensure the overall project timeline.
- Contract(s) should include incentives and disincentives for major intermediate phases to keep the project moving and keep the public happy.

Incident Management

- ITS (operational in early 2005) will only cover I-40 and I-640 – no surface streets outside of camera range. TDOT traffic management center should offer assistance to city whenever possible to ease surface congestion.
- HELP trucks typically cover interstates – can more trucks be used, or can the contractor provide a similar service? Other Tennessee cities don't have excess HELP capacity to give to Knoxville. A line item in the contract for on-call towing could help to ease congestion.
- The contract may need to include a line item amount for increased local law enforcement coverage. If trucks are diverted to I-640 before the full closure, GHSO funds could be used to provide additional state enforcement, especially Commercial Vehicle Enforcement.

Maintenance of Traffic Flow

- Preplanning is crucial – anticipate problems on alternate routes before they occur. Identify potential bottlenecks on alternate routes, take steps to eliminate or mitigate these problem spots.
- Look for ways to alleviate bottlenecks on I- 640 – ramp metering could be one such way to address capacity problems.
- QuickZone analysis of the proposed traffic control plan will prove helpful. Use other available traffic modeling and analysis tools to examine the potential impacts of proposed work.
- Use critical path scheduling techniques, consider this when developing the TCP.
- Park and Ride lots could offer some reduction in traffic demand. Identify areas where lots are needed before major work begins.
- Reduce work on other area routes while work is underway on I-40.
- The contractor should designate a traffic control coordinator.

Public Awareness

- A steady flow of accurate information to the public will create a favorable reception for TDOT and contractors.
- Suggest alternate routes, encourage transit use, carpooling, park and ride, and others to reduce demand on affected roadways.
- Additional attention should be given to changes brought about by the project – new lane closures, lane shifts, addition of ramp metering or other new traffic control techniques.
- Consider a public information officer (PIO) dedicated to this project. The PIO could be an existing TDOT staff member or could be an outside person or firm brought in to support this project.
- The public face of the project team should come from within TDOT, regardless of who is working behind the scenes.

- The PIO should be involved from the earliest (planning) stages of the project to avoid later confusion.
- The PIO should maintain regular contact with downtown business owners and homeowners directly affected by the project.
- The Internet can be a valuable tool to inform the public. If used, the information on the site must be kept accurate and timely or the effort will be wasted.
- 511 and Highway Advisory Radio will be online by the start of work on I-40. Information provided by these resources must also be accurate and up-to-date.
- Truck traffic will greatly affect the performance of detours and alternate routes. Work with the trucking community early and often to encourage the use of low-impact alternate routes and shift traffic to avoid peak hours.
- Make an effort to reach out-of-town motorists before they reach Knoxville. Provide information in Tennessee Interstate rest areas. Provide materials and information to DOTs in bordering states for distribution in their rest areas.

Hall of Fame Drive (HOFD)

- Hall of Fame Drive should be fully functional and properly maintained before the closure of I-40. Use incentives in the contract to ensure completion is on schedule.
- Interagency agreement between the city and the state would allow the city to maintain signals before the project's final acceptance. Contractor maintenance is not preferable when time is of the essence.
- Local monitoring of operations on HOFD would improve performance. Traffic cameras along the corridor would allow the city to react in real time. Video traffic detectors could serve a dual purpose.
- Remote connectivity to the system would allow the city to change signal timing in response to incidents and fluctuating demand.

4.6 ENVIRONMENT/PR/AESTHETICS

Scope-of-work and construction activities need to reflect environmental concerns to ensure the most accommodating and cost effective product while minimizing natural and socioeconomic impacts. Although designers may have several options in meeting design standard requirements, identifying the most efficient and aesthetically pleasing alternative and minimizing adverse impacts should be the objective.

The Environmental/PR/Aesthetics Team's recommendations were:

- Public Relations.
- Structures.
- Environment/Contracts.
- Signature Statement.

Public Relations

- Brand the project ASAP.
- Determine/select a dedicated PIO.
- Develop a chart of communication flow.
- Develop/establish credibility.
- Develop a Public Information Plan:
 - Maintain onsite presence throughout life of project (TDOT, contractors, PIO with public access).
 - Collaborate with partners, including local government, agencies, and community groups.
 - ID stakeholder groups.
 - Determine dissemination methods.

Dissemination methods include:

- Web site.
- Email distributions.
- Newsletters.
- PSAs, press releases, etc.
- Door-to-door contacts as needed.
- HAR/DMS I-40 JCTs with I-81 and I-75.
- Welcome centers/others as appropriate.

Hold Special Events:

- Construction information meeting.
- Kickoff event.
- Milestone celebrations.
- Regular updates at community meetings.

Outreach

- Reach beyond areas adjacent to project.
- Include regional areas/I-640 corridor.

Structures

- Include retaining/noise walls.
- Design clear span bridges where feasible:
 - To improve safety.
 - To increase useable space under bridges.
- Improve lighting under bridges:
 - Incorporate natural lighting as appropriate.
 - Add 24-hour where necessary.

Use innovative materials/design techniques on noise walls:

- Incorporate aesthetically pleasing designs/textures on both sides of noise walls.
- Consider anti-graffiti coatings.
- Consider beneficial landscaping.
- Consider murals.

Environmental/Contracts

- Minimize dust/debris during demolition/construction (contracting/special provisions).
- Provide corridor lighting rather than area lighting flooding neighborhoods.
- Include construction noise limit performance standards in the contract.
- ROD approved – follow through with environmental commitments – storm water management.
- Require contractor to provide:
 - Construction schedules in advance (weekly).
 - Schedule changes with sufficient notice.

Create a signature statement that defines downtown Knoxville, TDOT, and the community through both the structures and aesthetics.

CHAPTER 5

Next Steps

TDOT will evaluate the recommendations from each of the skill sets to determine which ideas or suggestions should be adopted during the remainder of the planning, design, and construction phases of the project.

APPENDIX A

Workshop Attendees

Beth Anne Atkins
North Carolina DOT
1543 Mail Service Center
Raleigh, NC 27699-1543
Tel: 919.733.2210
baatkins@dot.state.nc.us

Frank Bale
Wilbur Smith Associates
1100 Marion Street, Suite 200
Knoxville, TN 37921
Tel: 865.963.4300
Fax: 865.963.4301
fbale@wilbursmith.com

Clint Bane
TDOT
7345 Region Lane
Knoxville, TN 37914
Tel: 865.594.2408
Fax: 865.594.2642
Clint.Bane@state.tn.us

Victor Barbour
North Carolina DOT
1591 Mail Service Center
Raleigh, NC 27699-1591
Tel: 919.250.4128
vbarbour@dot.state.nc.us

Ralph Barnes
TDOT
Suite 600, JK Polk Bldg.
Nashville, TN 37243
Tel: 615.253.1387
Fax: 615.741.9673
Ralph.Barnes@state.tn.us

James P. (Jim) Barta, Jr.
Texas DOT
125 E. 11th Street
Austin, TX 78701
Tel: 512.416.3008
Fax: 512.416.2319
JBarta@dot.state.tx.us

Brian R. Barth
Texas DOT, Dallas District
P.O. Box 133067
Dallas, TX 75313-3067
Tel: 214.320.6189
Fax: 214.320.6625
bbarth@dot.state.tx.us

Mark Best
TDOT
7345 Region Lane
Knoxville, TN 37914
Tel: 865.594.2456
Fax: 865.594.2642
Mark.Best@state.tn.us

Bobby Blackmon
FHWA-TN
640 Grassmere Rd Pk, Ste 112
Nashville, TN 37211-3678
Tel: 615.781.5770
Fax: 615.781.5773
Bobby.Blackmon@fhwa.dot.gov

Monty Boone
City Police Dept.
P. O. Box 3610
Knoxville, TN 37927
Tel: 865.215.7311
Fax: 865.215.7412
mboone@cityofknoxville.org

Bob Bowers
Wilbur Smith Associates
1100 Marion Street, Suite 200
Knoxville, TN 37921
Tel: 865.963.4300
Fax: 865.963.4301
rbowers@wilbursmith.com

Frank Brewer
U of Tennessee
Center for Transportation Research
Suite 309, Conference Center Bldg.
Knoxville, TN 37996-4133
Tel: 865.974.5255
Fax: 865.974.3889
fbrewer1@utk.edu

Travis Brickey
TDOT
7345 Region Lane
Knoxville, TN 37914
Tel: 865.594.0161
Fax: 265.534.2642
Travis.Brickey@state.tn.us

Gordon Catlett
City Police Dept.
P.O. Box 3610
Knoxville, TN 37927
Tel: 865.215.7423
Fax: 865.215.7412
gcatlett@cityofknoxville.org

Bryan Chamberlain
Utah DOT
2060 South 2760 West
Salt Lake City, UT 84104
Tel: 801.887.3723
bchamberlain@utah.gov

Vijay Chandra
Parsons Brinckerhoff
250 W. 34th Street
New York, NY 10119
Tel: 212.465.5377
Fax: 212.631.3787
ChandraV@pbworld.com

Tom Clabo
City of Knoxville
1400 Loraine Street
Knoxville, TN 37921
Tel: 865.215.6100
Fax: 865.215.6109
tclabo@cityofknoxville.org

David Clarke
U of Tennessee
Center for Transportation Research
Suite 309, Conference Center Bldg.
Knoxville, TN 37996-4133
Tel: 865.974.5255
Fax: 865.974.3889
dbclarke@utk.edu

Ralph Comer
TDOT
Suite 900, JK Polk Bldg.
Nashville, TN 37243
Tel: 615.741.3421
Fax: 615.532.8451
Ralph.Comer@state.tn.us

Mike Conger
Knoxville TPO
Suite 403, City/County Bldg, 400 Main St.
Knoxville, TN 37902
Tel: 865.215.3813
Fax: 865.215.2068
mike.conger@knoxtrans.org

Tom Cooling
URS
1001 Highlands Plaza Dr. West, Suite 300
St. Louis, MO 63110
Tel: 314.743.4148
Fax: 314.429.0462
tom_cooling@urscorp.com

Fred Corum
TDOT
7345 Region Lane
Knoxville, TN 37914
Tel: 865.594.2400
Fax: 865.594.2642
Fred.Corum@state.tn.us

Gary Crawford
FHWA-HQ
400 7th Street SW, Room 3118
Washington, DC 20590
Tel: 202.366.1286
Gary.Crawford@fhwa.dot.gov

Don Dahlinger
TDOT
Suite 1000, JK Polk Bldg.
Nashville, TN 37243
Tel: 615.741.3033
Fax: 615.741.6408
Donald.Dahlinger@state.tn.us

George Danker
TDOT
7345 Region Lane
Knoxville, TN 37914
Tel: 865.594.2706
Fax: 865.594.2677
George.Danker@state.tn.us

Cabrina Dieters
TDOT
Suite 1300, JK Polk Bldg.
Nashville, TN 37243
Tel: 615.741.0834
Fax: 615.532.7745
Cabrina.Dieters@state.tn.us

David Donoho
TDOT
Suite 700, JK Polk Bldg.
Nashville, TN 37243
Tel: 615.741.2414
Fax: 615.741.0782
David.C.Donoho@state.tn.us

Brian Egan
TDOT
6601 Centennial Blvd.
Nashville, TN 37243-0360
Tel: 615.350.4104
Fax: 615.350.4128
Brian.Egan@state.tn.us

Tucker Ferguson
PennDOT
400 North Street, 7th floor
Harrisburg, PA 17120
Tel: 717.787.7894
hferguson@state.pa.us

Kelsey Finch
TDOT
7345 Region Lane
Knoxville, TN 37914
Tel: 865.594.4531
Kelsey.Finch@state.tn.us

Brian Fouch
FHWA-TN
640 Grassmere Rd Pk, Suite 112
Nashville, TN 37211-3678
Tel: 615.781.5765
Fax: 615.781.5773
Brian.Fouch@fhwa.dot.gov

Winston Gaffron
TDOT
Suite 700, JK Polk Bldg.
Nashville, TN 37243
Tel: 615.741.2342
Fax: 615.741.0865
Winston.Gaffron@state.tn.us

John Gould
Wilbur Smith Associates
1100 Marion Street, Suite 200
Knoxville, TN 37921
Tel: 615.963.4300
Fax: 615.963.4301
jgould@wilbursmith.com

Mary Ann Gregory
TDOT
Suite 1800, JK Polk Bldg.
Nashville, TN 37243
Tel: 615.253.1069
Mary.Gregory@state.tn.us

Terry Grubb
Wilbur Smith Associates
1100 Marion Street, Suite 200
Knoxville, TN 37921
Tel: 865.963.4300
Fax: 865.963.4301
tgrubb@wilbursmith.com

Dr. Donn Hancher
University of Kentucky
371 Ralph Anderson Building
University of Kentucky
Lexington, KY 40506-0503
Tel: 859.257.1864
hancher@engr.uky.edu

Stephany Hanshaw
Virginia DOT
970 Reon Drive
Virginia Beach, VA 23464
Tel: 757.424.9903
Fax: 757.424.9911
s.hanshaw@virginiadot.org

Jerry Hatcher
TDOT
Suite 700, JK Polk Bldg.
Nashville, TN 37243
Tel: 615.741.7976
Fax: 615.741.0782
Jerry.Hatcher@state.tn.us

Gary Head
TDOT
6601 Centennial Blvd.
Nashville, TN 37243-0360
Tel: 615.350.4101
Fax: 615.350.4128
Gary.Head@state.tn.us

Mark Helinski
Wilbur Smith Associates
6709 Centurion Drive, Suite 220
Lansing, MI 48917
Tel: 517.323.0500
Fax: 517.323.9200
mhelinski@wilbursmith.com

Joe Huerta
FHWA
10 South Howard St., Suite 4000
Baltimore, MD 21201
Tel: 410.962.2298
Fax: 410.962.4586
joseph.huerta@fhwa.dot.gov

Becky Jaramilla
FHWA-TN
640 Grassmere Rd Pk, Ste 112
Nashville, TN 37211-3678
Tel: 615.781.5758
Fax: 615.781.5773
Rebecca.Jaramilla@fhwa.dot.gov

Gil Jones
TDOT
Suite 400, JK Polk Bldg.
Nashville, TN 37243
Tel: 615.741.3565
Gilbert.Jones@state.tn.us

Jeff Jones
TDOT
1300 James K. Polk Bldg.
Nashville, TN 37243-0348
Tel: 615.741.2221
Fax: 615.532.2799
Jeff.C.Jones@state.tn.us

Jerry Jones
FHWA-RC
61 Forsyth St. SW Suite 17T26
Atlanta, GA 30303
Tel: 817.978.4358
Jerry.Jones@fhwa.dot.gov

Brace Lemon
Wilbur Smith Associates
Port City Center, 701 East Bay Street, Suite 516
Charleston, SC 29403-5033
Tel: 843.958.1500
Fax: 843.958.1502
blemon@wilbursmith.com

Tom Love
TDOT
Suite 900, JK Polk Bldg.
Nashville, TN 37243
Tel: 615.741.5364
Tom.Love@state.tn.us

Margaret Mahler
TDOT
Suite 400, JK Polk Bldg.
Nashville, TN 37243
Tel: 615.741.4984
Fax: 615.532.5988
Margaret.Z.Mahler@state.tn.us

Glenn Malone
TDOT
7345 Region Lane
Knoxville, TN 37914
Tel: 865.594.2405
Fax: 865.594.2495
Glenn.Malone@state.tn.us

Duane Manning
TDOT
7345 Region Lane
Knoxville, TN 37914
Tel: 865.594.2408
Fax: 865.594.2642
Duane.Manning@state.tn.us

Raymond McCabe
HNTB Corporation
352 7th Avenue
New York, NY 10001
Tel: 212.594.9717
Fax: 212.594.9638
RMcCabe@hntb.com

Scott M. McCanna
Oregon DOT
355 Capitol St. NE, Room 222
Salem, OR 97301-3871
Tel: 503.986.3788
Fax: 503.986.3749
Scott.M.McCanna@odot.state.or.us

Scott McGuire
FHWA-TN
640 Grassmere Rd Pk, Suite 112
Nashville, TN 37211-3678
Tel: 615.781.5774
Fax: 615.781.5773
Scott.McGuire@fhwa.dot.gov

Jeff Mize
Wilbur Smith Associates
1100 Marion Street, Suite 200
Knoxville, TN 37921
Tel: 865.963.4300
Fax: 865.963.4301
jmize@wilbursmith.com

Dan Montag
FHWA
300 South New St., Suite 2101
Dover, DE 19904
Tel: 302.734.1719
Fax: 302.734.3066
Daniel.Montag@fhwa.dot.gov

Mike Montgomery
Wilbur Smith Associates
2920 Brandywine Road, Suite 220
Atlanta, GA 30341-5539
Tel: 770.936.8650
Fax: 770.936.8656
mmontgomery@wilbursmith.com

Harry Moore
TDOT
7345 Region Lane
Knoxville, TN 37914
Tel: 865.594.2701
Fax: 865.594.2495
Harry.Moore@state.tn.us

Len Oliver
TDOT
6601 Centennial Blvd.
Nashville, TN 37243-0360
Tel: 615.350.4130
Fax: 615.350.4128
Len.Oliver@state.tn.us

Henry Pate
TDOT
Suite 1300, JK Polk Bldg.
Nashville, TN 37243
Tel: 615.741.8295
Fax: 615.532.7745
Henry.Pate@state.tn.us

Ernie Pierce
City of Knoxville
1400 Loraine Street
Knoxville, TN 37921
Tel: 865-215-6731
Fax: 865-215-6109
epierce@cityofknoxville.org

Don Poche
TDOT
7345 Region Lane
Knoxville, TN 37914
Tel: 865.594.4530
Fax: 865-594-2642
Donald.Poche@state.tn.us

Jerry Potter
FHWA-HQ
400 7th Street SW, Room 3203
Washington, DC 20590
Tel: 202.366.4596
Jerry.Potter@fhwa.dot.gov

Jeffrey A. Pouliotte
Florida DOT
605 Suwannee Street, Mail Station 31
Tallahassee, FL 32399-0450
Tel: 850.414.4146
Fax: 850.412.8021
jeffrey.pouliotte@dot.state.fl.us

Robert Pressley
City Fire Dept
900 Hill Ave., Suite 430
Knoxville, TN 37915
Tel: 865.595.4471
Fax: 865.595.4482
rpressley@cityofknoxville.org

Dan Sanayi
FHWA-HQ
400 7th Street SW, Room 3211
Washington, DC 20590
Tel: 202.493.0551
Dan.Sanayi@fhwa.dot.gov

Sidney Scott
Trauner Consulting
One Penn Center, Suite 600
1617 JFK Boulevard
Philadelphia, PA 19103
Tel: 215.814.6400
Fax: 215.814.6440
Sid.Scott@traunerconsulting.com

Wayne Seger
TDOT
Suite 1300, JK Polk Bldg.
Nashville, TN 37243
Tel: 615.741.4044
Wayne.Seger@state.tn.us

Paul Sharp
FHWA-TN
640 Grassmere Rd Pk, Suite 112
Nashville, TN 37211-3678
Tel: 615.781.5762
Fax: 615.781.5773
Paul.Sharp@fhwa.dot.gov

Mike Smart
FHWA-TN
640 Grassmere Rd Pk, Suite 112
Nashville, TN 37211-3678
Tel: 615.781.5775
Michael.Smart@fhwa.dot.gov

Jim Sorenson
FHWA-Office of Asset Mgmt.
400 7th Street SW
Washington, DC 20590
Tel: 202.366.1333
Fax: 202.366.9981
james.sorenson@fhwa.dot.gov

John Steele
FHWA-TN
640 Grassmere Rd Pk, Suite 112
Nashville, TN 37211-3678
Tel: 615.781.5777
Fax: 615.781.5773
JohnH.Steele@fhwa.dot.gov

Cliff Stewart
TDOT
Suite 1300, JK Polk Bldg.
Nashville, TN 37243
Tel: 615.741.4726
Fax: 615.532.2799
Cliff.Stewart@state.tn.us

Jack Stout
TDOT
7345 Region Lane
Knoxville, TN 37914
Tel: 865.594.2655
Fax: 865-594-2642
Jack.Stout@state.tn.us

Del Truitt
TDOT
Suite 700, JK Polk Bldg.
Nashville, TN 37243
Tel: 615.741.2567
Fax: 615-741-2508
Del.Truitt@state.tn.us

Jim Ullrich
Citizen
1003 Luttrell Street
Knoxville, TN 37917
Tel: 865-637-8340
Fax: none
ullrichjim@ntown.com

Chuck Van Deusen
Charles H. Van Deusen, Inc.
21160 Eastfarm Lane
Northville, MI 48167
Tel: 248.474.4417
Fax: 248.442.2456
chuckvan@mich.com

Lisa Vander Heiden
Montana DOT
P.O. Box 201001
Helena, MT 59620-1001
Tel: 406.444.7205
lvanderheiden@state.mt.us

Ralph Volpe
FHWA-TN
640 Grassmere Rd Pk, Suite 112
Nashville, TN 37211-3678
Tel: 615.781.5764
Fax: 615.781.5773
Ralph.Volpe@fhwa.dot.gov

Ed Wasserman
TDOT
Suite 1100, JK Polk Bldg.
Nashville, TN 37243-0339
Tel: 615.741.3351
Fax: 615.532.7745
Ed.Wasserman@state.tn.us

Jim Watson
TDOT
7345 Region Lane
Knoxville, TN 37914
Tel: 865.594.2484
Fax: 865.594.2495
Jim.Watson@state.tn.us

Jeff Welch
Knoxville TPO
Suite 403, City/County Bldg, 400 Main St.
Knoxville, TN 37902
Tel: 865.215.3790
Fax: 865.215.2068
jeff.welch@knoxtrans.org

Terry Zoller
Minnesota DOT
2055 North Lilac Drive
Golden Valley, MN 55422
Tel: 763.797.3091
Fax: 763.797.3181
terry.zoller@dot.state.mn.us

APPENDIX B

Skill Set Reporting Forms

STRUCTURES		
IDEA (Short Name)	IDEA (Detailed Description)	Implementation Details (Barriers, Skill Set Coordination, etc.)
Contracting	<p>Single Contract Preprocurement of Materials Advanced Contracting Value Engineering (VE) Set Realistic Schedule with Incentives Advanced Fill Under I-40 Bridge</p>	<ol style="list-style-type: none"> 1. Final Design (contract #1) + Preliminary Design (contract #2) 2. Bridge Girders 3. Manholes 4. Retaining Wall Panels 5. Noise Walls 6. Utility Relocation 7. Building Demolition 8. Clean and Paint Existing Steel Girders 9. Early Selected Substructure Construction 10. Initial Screening (within 30 days) 11. Submission (within 90 Days)
Precasting/ Prefabricated Technology	<p>Columns Caps Girders Full Depth Slabs Prefabricated Units (girder and slabs) Full Span Prefabrication and Erection</p>	<ol style="list-style-type: none"> 1. Splice Girder (longer spans) 2. Replace with Steel (longer spans) 3. Segmental Concrete
Staged R/W acquisition like design-build (D/B) projects	<p>Self Consolidating Concrete Maturity Meters for Concrete Strength Light Weight Concrete High Performance Concrete and High Strength Steel Onsite Batch Plant Advanced Mix Design</p>	
Embankment	<p>Early Construction of Abutments EPS (Expanded Polystyrene Fill) Graded Rock Fill</p>	

STRUCTURES		
IDEA (Short Name)	IDEA (Detailed Description)	Implementation Details (Barriers, Skill Set Coordination, etc.)
Geometry	<p>Minimize Skews Minimize Flares Maximize Span Lengths (minimize substructure units)</p>	
Foundations	<p>Detail Three Alternate Foundation Types for Piers</p>	<p>1. Drilled Shaft (mono shaft) 2. Steel Piles 3. Spread Footings</p>
Retaining Walls	<p>Only Prequalified (TDOT) Products (No VE) Candidate for Prepurchase Early Submission for Tie-Back Walls Verify ROW Easement for All Types Precast Fascia Panels (EPS Fill)</p>	
Construction	<p>Miss Existing Foundation Jet Grouting Bent Caps, Use Precast Cap Precast Columns (Seismic Connections May Be a Problem) Continuous Placement of Deck on Prestressed Beams High Early Strength Concrete -No Aluminum -No Shrinkage -Need a Mix Design Consider Black Steel and Latex Concrete Overlay Stainless Clad or Epoxy Bars OK Preassemble Steel and Set in Place</p>	

CONSTRUCTION, MATERIALS, ACCELERATED TESTING, CONSTRUCTIBILITY

IDEA (Short Name)	IDEA (Detailed Description)	Implementation Details (Barriers, Skill Set Coordination, etc.)
Preconstruction and Utilities	<ol style="list-style-type: none"> 1. Accelerate utility relocation by authorizing in advance of construction * 2. Accelerate permit process 3. Railroads double shifts 4. Partial opening of I-40 5. Co-location of offices for field inspection coordination 6. Coordinate construction of other facilities 7. Suggest (not mandatory) material storage near railroad and port 8. Identify all work on the critical path that can be done in advance of closing I-40 (i.e., ramps, foundations) 	<ol style="list-style-type: none"> 1. Usage of SUE procedures to minimize delays. 2. Coordination time and in-house resources are barriers. 3. Coordination with railroads to prevent delay is a barrier. 4. Assumption that I-640 can handle the deferred traffic is a barrier. Worker safety is another barrier. 5. No barriers. 6. This needs to be coordinated with traffic. 7. No barriers. 8. Develop critical path.
Materials	<ol style="list-style-type: none"> 1. Use of high early strength concrete 2. VECP 3. Non-destructive testing (maturity meters) 	<ol style="list-style-type: none"> 1. Need to make sure that it is necessary (justify the additional cost). 2. No barriers because this is a standard special provision of the contract. 3. Specification change and (for maturity meter, increased production monitoring) are barriers.
Bridges	<ol style="list-style-type: none"> 1. Adjust span lengths to avoid existing foundations, and install spread footings and/or pin pile foundation under the JWP before demolition* 2. Use of precast pier caps, bent caps, and post tensioned/precast columns 3. Use of continuous pours for deck slabs on prestressed beams 4. Greater cover in lieu of epoxy coated rebars to avoid painting holidays and speed construction 	<ol style="list-style-type: none"> 1. Confirm that foundations will be spread footings and/or piles. 2. Needs to be investigated and developed if approved. 3. No barriers. 4. Philosophy changes. 5. Philosophy changes. 6. No barriers. 7. Coordinate and approve.

* = items of increased emphasis areas

CONSTRUCTION, MATERIALS, ACCELERATED TESTING, CONSTRUCTIBILITY		
IDEA (Short Name)	IDEA (Detailed Description)	Implementation Details (Barriers, Skill Set Coordination, etc.)
	<ol style="list-style-type: none"> 5. Use of high early strength concrete, particularly for deck slabs 6. Preassemble structural steel in sections and launch or lift into place 7. What needs to be done to coordinate the movement of cranes and overweight specialty equipment across pavement and bridges during construction 	
Pavement	<ol style="list-style-type: none"> 1. Alternative Pavement: <ul style="list-style-type: none"> • Usage of long-life pavement • Noise reduction • Service life 2. Use same structure for shoulder and pavement 3. Use of alternative pavement in the bidding process 	<ol style="list-style-type: none"> 1. Cost factor would be a barrier on using pavement with longer life. How much pavement can be stacked on top of other pavement is another issue. 2. Cost is only barrier. 3. Establishing the contract document in bidding is the barrier.
Contract Administration	<ol style="list-style-type: none"> 1. Let contract early before I-40 closure for prep time <ul style="list-style-type: none"> • Specify shop draw approval time limitation 2. Use of one contract instead of breaking down 3. Work multiple shifts 4. Develop overall schedule (CPM) for all included commitments, not just job schedule * 5. Use of incentives/disincentives, A + B,* warranty 6. Construction management coordination of all contracts <ul style="list-style-type: none"> • Issues resolution 7. Contractor quality control process <ul style="list-style-type: none"> • Rating contractor performance 8. Establish dispute resolution board 9. Include price adjustment clause 	<ol style="list-style-type: none"> 1. Paying of a premium and stockpile payment are barriers. <ul style="list-style-type: none"> • Specification of development is another barrier. 2. The barriers are funding, project delivery, and time. 3. Local ordinances (noise restrictions, etc.) need to be checked. Coordinate with city and county. 4. In-house resources are needed. 5. Bonding companies for the warranty can be a barrier. 6. Coordination is needed. 7. Establishment of a new process is the barrier. Change partnering specification is another barrier. 8. New process that has to be developed and established. 9. Establish indexes for steel and write specification.

GEOTECHNICAL		
IDEA (Short Name)	IDEA (Detailed Description)	Implementation Details (Barriers, Skill Set Coordination, etc.)
Lengthen bridge spans	In order to reduce the number of bridge piers and potentially the critical path construction time, eliminate bridge piers where feasible.	This may involve use of drilled shaft foundations to permit high column loads; Structures group coordination required.
Consider alternatives to driven piling	Provide multiple foundation alternatives where practical and allow contractor to select option that is best suited to project goals. Also provides backup if originally designed foundation is not feasible at a particular pier location.	Need to prepare design alternatives, which likely would include driven piles, drilled shafts, and spread footings; Structures group coordination required; Additional design time and lack of experience with alternatives are possible barriers.
EPS at abutments	Structural group suggests use of EPS foam at abutments to expedite construction.	This options appears feasible, however, EPS foam must be protected from hydrocarbons to prevent collapse.
Two spans at Bridge 19	Reduce number of spans to two spans to reduce number of piers and potentially shorten schedule reduce and conflict with 54-inch pipe. Improve safety by eliminating pier construction in median of I-40 while under traffic.	Coordinate with structural group. Barrier—longer spans may not be typical design for overpass type structure.
Use top-down construction at Bridge 19	North end of bridge is in cut section. By using top-down method, it may be possible to shorten the schedule since excavation can occur after bridge is built. May enhance construction drainage, and eliminate much of the temporary shoring for the adjacent bridge.	Coordinate with structural. Barrier—not a common technique. Contractor may not be familiar.
Footings, pin piles at Bridge 21	Rock is shallow at Bridge 21 such that footings can be constructed before the existing bridge is razed. This should save time. Where footings are not feasible, consider pin piles, which can be installed under low headroom.	Coordinate with structural. Pin piles may not be common foundation for agency.

GEOTECHNICAL		
IDEA (Short Name)	IDEA (Detailed Description)	Implementation Details (Barriers, Skill Set Coordination, etc.)
Single span at Bridges 4 and 5	Eliminate center pier to reduce construction time. Improve safety by eliminating center pier.	Longer span than typically used. Coordinate with structural.
Improve subgrade throughout corridor	Poor soils exist in portions of the corridor that will need to be improved by removal and replacement or insitu treatment to provide a suitable pavement subgrade. Other areas also likely will require improvement. Instead of doing this piecemeal, improve the entire corridor. This will improve mobility during construction, and increase pavement life.	Coordinate with materials (pavement design). Barriers - typically subgrade improvement is done locally depending on conditions exposed in the field.
Detailed design of drainage at Bridge 19	The piping in this area is deep (50 ft) and if not properly done may significantly affect construction. Instead of leaving this totally to the contractor's means and methods, provide a detailed design and construction sequence.	Construction coordination. Barrier, may not be typical practice.
Train inspectors on MSE walls and drilled shafts	Since designs may include these elements, inspection staff should be knowledgeable prior to construction.	Construction coordination. Barriers, funding and time for training.

INNOVATIVE CONTRACTING/WORKER HEALTH/WARRANTIES

IDEA (Short Name)	IDEA (Detailed Description)	Implementation Details (Barriers, Skill Set Coordination, etc.)
Goals/Drivers	<ol style="list-style-type: none"> 1. Time Savings 2. Quality 3. Safety 4. PR 5. Build in Budget 6. Context Sensitive Const. 	<ol style="list-style-type: none"> 6. a) Environment b) Noise c) Dirt
	<ol style="list-style-type: none"> 1. Design, Bid, Build 2. Design, Build 3. CM @ Risk or Agency CM (construction mgr) 	<ol style="list-style-type: none"> 1. Clustered Construction {one contract or two (bidder has option to bid both)} (bid second at 30 percent) 2. Combined Contracts
Procurement/Bidding Methods	<ol style="list-style-type: none"> 1. A + B (A+C) Bidding A = Cost, B = Time 2. A + B - Q = Warranty 3. Bid Alternates/Design Alternates, VE 4. Best Value 	<ol style="list-style-type: none"> 1. Time 2. Time/Quality 3. Additive Alternates 4. a) Items Other Than Price (prequalification) (can be a post-project or post-selection process) b) Quality/Time c) Safety d) Context Sensitive Issues e) Special Prequalification
Contract Mgmt Methods	<ol style="list-style-type: none"> 1. Incentive Contracting 2. Performance Incentives 3. Insurance 4. Lane Rental 	<ol style="list-style-type: none"> 1. a) I/D Time No Excuse Bonus b) Define I/D Completion 2. a) Safety (number of incidents) b) Quality c) Time d) Prequalify e) CEI 3. Owner Controlled Policy 4. Daily/Hourly (traffic)

INNOVATIVE CONTRACTING/WORKER HEALTH/WARRANTIES		
IDEA (Short Name)	IDEA (Detailed Description)	Implementation Details (Barriers, Skill Set Coordination, etc.)
Advanced Construction Early Action	<ol style="list-style-type: none"> 1. Utility Work 2. Mainline Phase 1 3. ROW/Permits 4. Lead Time Activities 5. Owner Furnished Materials 6. Geotech Investigation 7. Local Street Enhancements 8. Identify Borrow/Waste/Staging Sites 	<ol style="list-style-type: none"> 1. Agreements 4. a) Flexible Start Dates b) A+B to reduce closure times c) Lengthen Prebid Time (between advertise and award) (mandatory prebid meeting) 6. Drilled Shafts
Contract Management During Construction	<ol style="list-style-type: none"> 1. CPM Scheduling Specification 2. Change Order Process 3. Partnering Agreements 4. Escalation 5. Warranties 6. Performance Specifications 7. Worker Safety/Health 	<ol style="list-style-type: none"> 1. a) CPM Master Schedule (internal to owner) b) Baseline c) Monthly Updates d) Bid Item e) Payment Contingent On Getting Updates f) Special Restrictions g) Non-work Periods 2. a) Change Review Team b) Delegation of Authority 5. a) Plants b) Landscape c) Asphalt 6. a) Contractor TCM/TCP's State Approved (Internal TMP) b) Noise c) Performance-Related Spec For Concrete d) No Excuse Clause e) Bid Escrow f) Alternative Dispute Resolution (ADR) / Dispute Review Board
Group visit; Traffic Construction Warranty		

TRAFFIC/ITS/WORKER SAFETY		
IDEA (Short Name)	IDEA (Detailed Description)	Implementation Details (Barriers, Skill Set Coordination, etc.)
1. Incentives and Disincentives	Use contract clauses to encourage the contractor to reduce travel delay and project duration.	Use A + B bidding - Time + Money. Consider A + B + C where C is contractor prequalification. Goal is to accelerate construction and reduce traffic delay. Consider having the contractor develop a traffic management plan. Develop traffic management criteria as part of the initial construction contract bidding process - establish maximum delays, minimum capacities, etc. Link these measures to contract incentives. Use offsite preparation, staging areas to reduce impact on Interstate 40 and primary surface streets. Use liquidated damages for noncompliance with traffic standards, lane closures, etc. May want to consider intermediate points for incentive/disincentive, e.g., opening of Hall of Fame Drive, in addition to overall project completion. If Hall of Fame Drive and Interstate 40 are separated, both contracts should include incentives/disincentives for major phases. While Interstate 40 will be completely closed initially, an early opening of one direction of travel would be well received by the public. Contract could include incentives to achieve this goal.
2. Incident Management	Incident management will be key to maintaining traffic flow during the construction phase of this project. ITS, HELP trucks, and emergency services are all vital to traffic operations in the project area.	ITS system monitors interstate only - no surface street coverage outside the view of cameras (ITS system will be operational in Knoxville in early 2005). Traffic Management Center should offer as much help as possible to City of Knoxville. Surface streets will be greatly affected by this project. Can TDOT divert HELP trucks to city streets, or should part of the contract include a service truck to patrol the area? HELP trucks are stretched thin as is - adding coverage to surface streets could cause problems elsewhere on the system. Safety issues - shoulders are not full-width on many city streets. Can additional HELP trucks be brought in from other cities to assist in times of peak impact? Oregon DOT provided a temporary fire station when a project cut off a fire station from part of its service area.

TRAFFIC/ITS/WORKER SAFETY		
IDEA (Short Name)	IDEA (Detailed Description)	Implementation Details (Barriers, Skill Set Coordination, etc.)
		<p>Include a contract line item for local law enforcement along Interstate 640 during the I-40 closure. Also consider funds for onsite or oncall towing services to protect operations on I-640. If trucks are diverted to I-640 prior to the I-40 closure, use Governor's Highway Safety Office funding for state law enforcement, including commercial vehicle enforcement. Encourage participation and coordination with local law enforcement and incident management officials during planning and construction meetings.</p> <p>Consider having the contractor develop a traffic management plan. Develop traffic management criteria as part of the initial construction contract bidding process - establish maximum delays, minimum capacities, etc. Link these measures to contract incentives.</p>
3. Maintenance of Traffic Flow	Steps can be taken to anticipate problems on alternate routes to prevent incidents and congestion on these roadways.	<p>Take an early look (preplanning as opposed to crisis management) at surface streets in the area, which will serve as a detour. Identify potential bottlenecks along detour routes. Look at revised signal timing, increased turn storage lengths, etc. Upgrades to signal systems on surface streets would be helpful both for detour traffic and incident management capability. Signal coordination and communication with central control could help to manage incidents.</p> <p>Identify potential bottlenecks on Interstate 640 where non-traditional techniques could be applied. Ramp metering, though controversial, could be used to alleviate some congestion, especially along I-640 during the I-40 closure.</p> <p>Post an advisory urging trucks to use the I-640 route before the project begins in earnest.</p> <p>Use of QuickZone could be very beneficial. Use other forms of traffic analysis and modeling in development and implementation of traffic control plan.</p> <p>Use Critical Path scheduling techniques, integrate into traffic</p>

TRAFFIC/ITS/WORKER SAFETY		
IDEA (Short Name)	IDEA (Detailed Description)	Implementation Details (Barriers, Skill Set Coordination, etc.)
		<p>management. Park and Ride, Carpool lots could be added to reduce congestion. Identify needed lots before the project starts. Ensure that other interstate routes are not affected by additional construction. Designate responsibility for traffic maintenance to the construction contractor - designate a traffic control and management supervisor. Contract should stipulate that this individual have ATSSA or equivalent certification. Alternate certification is subject to TDOT approval.</p>
4. Public Awareness	The use of extensive public education and relations campaigns to inform the public of project details, delays, and alternatives can greatly reduce traffic demand in the project area.	<p>By informing the public of project details and offering alternatives to usual traffic patterns, a much more attractive situation can be created for both the contractor and the traveling public. DOT can provide alternate route suggestions, fund increased transit runs, encourage the adoption of shifted work schedules, etc. Work with major employers such as UT and TVA to encourage ride sharing, transit, and off-peak travel. Focus on new traffic control devices and techniques, such as ramp metering, if appropriate. Consider use of Internet site to inform the public. Ensure that someone has responsibility for keeping information fresh. Consider the use of a public information officer (PIO) (in addition to TDOT's regional PIO) devoted to this project to reduce confusion and misinformation in the media. PIO will maintain a working relationship with downtown businesses and homeowners directly affected by the project. PIO should work closely with all local media. TDOT could utilize the services of a PR firm, but it is important that the public face for this project is someone with TDOT. Bring the PIO onboard early (during the planning phase) to keep the public up to speed from the start - this could mean that the PR services should be separated from the construction contract. Traffic management</p>

TRAFFIC/ITS/WORKER SAFETY		
IDEA (Short Name)	IDEA (Detailed Description)	Implementation Details (Barriers, Skill Set Coordination, etc.)
5. Hall of Fame Drive	Hall of Fame Drive should be completely functional and properly maintained before Interstate 40 is closed.	center will automatically provide up-to-date information regarding freeway status (camera images, average speeds, travel times, etc.). 511 will be up and running by the time this project comes on line. HAR will also be in place for general information. Encourage use of park and ride. Make sure that information is timely or it is useless. Working with motor carriers may offer relief—Interstate 640 currently offers no incentive to truckers—encourage its use early either through CVE efforts or through mandatory truck routes. Spread information to out-of-area motorists by providing information and materials at interstate rest areas. Should also provide information to bordering states—GA, KY, NC, VA—to inform drivers of potential delays and encourage alternate routes where appropriate.
		Hall of Fame Drive is an essential alternate route during the Interstate 40 closure. HOF should be open to traffic before the closure. Incentives/Disincentives should be utilized to protect the completion date of HOF. In order to ensure that traffic signals and controls are properly maintained, interagency agreements should be formed between the city and the state. Contractor maintenance is not an attractive option because of the potentially long response times from out of town personnel. Local monitoring of the HOF signal system would improve operations. It would be preferable for the city engineering department to have remote connectivity to the signal system on HOF. Any incident management capability in the signal system would be helpful. Use of video traffic detection (as opposed to loop detection) would help to make the system fully functional at an earlier date. Consider surveillance cameras as part of the HOF system.

ENVIRONMENTAL/PR/AESTHETICS

IDEA (Short Name)	IDEA (Detailed Description)	Implementation Details (Barriers, Skill Set Coordination, etc.)
Sound Walls	Aesthetics, materials, graffiti, plantings, color/texture, whisper walls, spray anti-graffiti material, neighborhood vs. historical	(open question - not in const. plans) (location and ht.?) - designs are far enough along to see where the grades will be - retaining wall on the sides of the Gill St. Bridge (Whisper Wall technology) (precast concrete that looks like stone used out west and is aesthetically easy on the eye (planting vines may damage the structure of the wall - some parts on Papermill project that has cypress trees going along the edge of the wall on state right-of-way) (mural or painting to discourage graffiti - can you spray for anti-graffiti and anti-noise at same time) (in TX they've been putting in terraced sound walls but more expensive to build and maintain) (cost on sound walls - sm. Compared to a 160 m project - vision)
Lighting	Corridor only, not flooding neighborhood, 24 hr. under bridge	(localized to the corridor - not flooding the neighborhood) (mercury or sodium vapor) (orange light has more contrast as opposed to stark white) Ullrich says shadows are "no good and people feel unsafe." Needs to have lighting underneath the structures - 24 hr. lighting - Gill St. Bridge wouldn't have the problem of darkness as much as Central or Broadway - lighting for security issues -
Bridges	Clear spanning (no pillars), homeless issues	(structures need to be designed where homeless people (1,000 - 1,500 per month - Travis: one of the highest in the south because Knoxville is very generous to the homeless - better solution than chain link fences? - in Calif. they use "razor grid" to keep the homeless away - design period? 20 yr. Design period will always be in reconstruction - needs to go 100 yr. design period, Fed Hwy. encourages longer design period - clear span a bridge with high-strength concrete you minimize the cost - look at future cost - recommend clear span bridges - clear spanning makes it easier for future reconstruction because of no pillars - clear spanning may provide more visibility - also provides savings in geo support - mirrors used for visual inspection to look for the homeless? - 24 hr.

ENVIRONMENTAL/PR/AESTHETICS		
IDEA (Short Name)	IDEA (Detailed Description)	Implementation Details (Barriers, Skill Set Coordination, etc.)
Creek	Flood Control	Upstream and downstream flood control - City of Knoxville issues
PR	Thru traffic vs. local, discuss how to handle local, signs for local area, signs for detour route	<ul style="list-style-type: none"> - Put out press releases for info. Detour rts. (putting up proper signage for detours) and traffic flow to other areas (immediate) - putting out the proper signage for local of interest - needs name for project, Smart Fix - a plan in place, a central contact to deal with the public, a dedicated PIO to get announcements out and inform the public as to project issues, would Travis have time for big a project or bring in a contract person (an intern could/would work for free), pr firm?, ways to inform the public about construction - e-mail list serves, city council members, information dissemination methods discussed, keep flow of info. clear that flows between information people (no miscommunication possibilities) the key is to have one person who makes the decisions as to information flow, (should be a TDOT person to make info. is clear and what you want the info. to reflect) two-way communication is necessary between the residents and the PIO. The PIO should be familiar and accessible to the public. - Closer to the construction date, have a public meeting with a sign-up sheet for information releases. Before construction starts: have a preconstruction meeting with the public and put the info. in simple terms, phasing maps, have q and a, send out announcement about 2 weeks before on a postcard with an artist rendering of what the finished project would look like. - Get the names and addresses of stakeholder groups up to 1/2 mile outside the parameters of the project area and the project area itself. Can get this through KUB.the. Other concerns will be the college, emergency medical personnel, etc., credibility is very important with communication issues. Use the Chamber of Commerce as a communication resource for

ENVIRONMENTAL/PR/AESTHETICS

IDEA (Short Name)	IDEA (Detailed Description)	Implementation Details (Barriers, Skill Set Coordination, etc.)
		<p>information dissemination. The contractor should always attend public meetings</p> <ul style="list-style-type: none"> - Have TDOT lease a bldg. In the area for a project presence with maps, drawings, etc., and staffed certain hours each day so it's easily accessible to stakeholders. A presence there would make a big difference in PR. - The PIO is officed with the construction engineer to ensure communication. - Let the CEI group have a designated person to disseminate info. An information flow chart should be implemented. - Media events (like Hall of Fame Kick-Off) - Designated radio station to inform the public of project closures, alternate routes, including rehab on detour routes and tourism issues. - Telephone line set up with daily reports recordings

