Utah Department of Transportation Accelerated Bridge Construction Standards Workshop

January 28-29, 2008
Salt Lake City, Utah

Workshop Report

Acknowledgements

The Utah Department of Transportation (UDOT) thanks the Federal Highway Administration (FHWA) for co-sponsoring this workshop and for its many activities to advance accelerated bridge construction technology. UDOT also thanks the national experts who volunteered their time and shared their expertise during the workshop and afterwards with their offers of assistance. Local industry and internal UDOT partnerships make accomplishments possible. UDOT expresses appreciation to its employees and local industry partners for their sustained efforts to advance accelerated bridge construction in the State of Utah. Carmen Swanwick with HDR Salt Lake City and her staff and consultants are thanked for coordinating this workshop. Appreciation is also expressed to Breakout Team leaders Mike Culmo, William Nickas, Carin Roberts-Wollmann, and Ray Wolfe for their assistance in accomplishing the goals of the workshop.

About the Workshop

A group of national experts, local industry partners, and UDOT employees gathered for an invitation-only day-and-a-half workshop held January 28-29, 2008, in Salt Lake City, Utah. See Appendices A, B, and C of this report for workshop agenda and participants. The purpose of the workshop, sponsored by UDOT and FHWA, was to obtain recommended actions for UDOT to consider in its transition to accelerated bridge construction as standard practice by 2010. This report documents the activities and products of the workshop.

Mary Lou Ralls, Workshop Moderator/Facilitator and author of Workshop Report

Executive Summary

The Utah Department of Transportation (UDOT) Accelerated Bridge Construction (ABC) Standards Workshop was convened to bring together bridge experts from Departments of Transportation (DOTs), the design and construction industry, and academia from across the country and locally to assist UDOT in transitioning to ABC as standard practice by 2010. The invitation-only day-and-a-half workshop was co-sponsored by the Federal Highway Administration (FHWA) Office of Bridge Technology and Highways for LIFE Program (HfL).

To set the stage for the workshop discussions, on the morning of the first day participants were offered several presentations, beginning with welcoming remarks from UDOT and FHWA executives, followed by presentations from several of the national experts. UDOT then presented design and construction aspects of its ABC projects to date, followed by a presentation on ABC projects planned for the next three to five years; these presentations gave the national experts and local partners an understanding of UDOT's current ABC experience and upcoming needs. A presentation was then given on UDOT's first ABC draft standards – full-depth precast concrete bridge deck panels – followed by participant discussions on this initial effort. Discussions were also held on how best to proceed in UDOT's effort to develop products for the use of self-propelled modular transporters (SPMTs) to remove and install bridges, with these discussions centered on several questions related to development of standards and specifications. During the working lunch a presentation was given on seismic ABC considerations from the state DOT perspective, with comments included from the American Association of State Highway and Transportation Officials (AASHTO) Highway Subcommittee on Bridges and Structures (SCOBS) Technical Committee on Seismic Design, T-3.

The afternoon of the first day began with an academic panel discussing research on various aspects of ABC. The participants were then divided into four teams for the breakout sessions. In the first breakout session the participants were asked to identify opportunities and obstacles to UDOT ABC standard practice by 2010. The participants then came together to discuss, consolidate and prioritize the identified opportunities and obstacles. In the second breakout session the participants provided recommendations to implement the top identified opportunities and address the top identified obstacles, again followed by a feedback session to consolidate and get group consensus.

The second day began with the third and final breakout session to develop proposed action plans for 2008-2010 for UDOT consideration to achieve ABC standard practice by 2010, building on the recommendations from the previous day. The action plans included the proposed activity, by whom, for whom, by when, resources needed, and estimated budget. The participants came together one last time to discuss, consolidate, and prioritize the proposed action plans. Recommendations by workshop participants included using prefabricated components for the entire bridge, using complete bridge move-ins, standardizing a model for quantifying user costs, improving public relations and public involvement, and various recommendations related to developing standards. Next steps were then discussed by FHWA and UDOT, and the participants were thanked for their contributions. The meeting was adjourned at noon. UDOT is considering the participants' recommendations as they continue their initiative to make ABC standard practice by 2010.

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Background

Much has changed since the 1950s and 1960s when many of the bridges in Utah were built. At that time alignments were often new, and congestion was relatively small. Today is different, with vast sections of the transportation system congested, in some cases 24 hours a day. It is no longer acceptable in Utah to take months and in some cases years to build our structures. Finding ways to accelerate that process has become paramount and essential for the Utah Department of Transportation (UDOT) to be successful. Reducing bridge construction time from months to days and sometimes hours is critical to that success. Comments by John Njord, Executive Director, UDOT

In the initial planning of each bridge project, UDOT first uses its ABC Decision Chart, which builds on the FHWA Decision-Making Framework for prefabricated bridge elements and systems (PBES), to determine whether ABC with PBES provides benefit. (See Appendix D of this report for the UDOT ABC Decision Chart.) Project documents are then developed accordingly. By 2010 UDOT envisions that it will be able to quickly assemble project plans and specifications for cost-effective long-lasting bridges that are built rapidly to minimize traffic disruption and congestion and improve safety. This workshop is a step toward that vision.

Workshop Objective

The objective of this invitation-only day-and-a-half workshop was to assist UDOT in making accelerated bridge construction (ABC) standard practice by 2010. See Appendices A, B, and C of this report for the workshop agenda and participants. Discussed during the workshop were the process for moving forward and the type and priority of ABC products and activities, for example UDOT bridge manual text (design aids), standard drawings, construction specifications, and implementation activities such as feedback methods, training, and industry rollout meetings. Also discussed were UDOT's first two planned ABC standard products: go-by drawings and performance specifications for full-depth precast concrete bridge deck panels and the use of self-propelled modular transporters (SPMTs) to remove and install bridges.

Presentations by Sponsors

(Note: See Appendix B for presenter bios.)

John Njord, the Executive Director of UDOT, welcomed participants to the workshop. He stated that an important part of his job as UDOT Director is finding resources to replace almost 600 bridges in the next 10 years, or about 60 bridge replacements per year. That number is much higher than the number being replaced today in Utah, and consequently more resources will be required to be successful in completing those replacements. He commented that the Utah Governor and legislature have provided good support in obtaining funding, and UDOT's job collectively is to ensure that when those jobs are delivered, the public is not punished with traffic disruption and congestion for months or years on end. Mr. Njord said that he believes UDOT will be able to accomplish this goal of building bridges for the next generation, bridges that will last much longer than previous bridges. While working in an accelerated fashion UDOT can achieve higher quality with greater durability and with less impact to UDOT's customers. An example was last year's experience of completing the 4500 South Bridge replacement over I-215E during a

weekend using SPMTs. Hundreds of people watched throughout the weekend as the old bridge was moved out and the new one moved in, with applause erupting at the completion. This is one example of the right way to do business, and one example of the ways hundreds of bridges will be replaced in Utah over the next decade. Mr. Njord thanked the participants for attending the workshop and sharing their time and expertise from many parts of the country. He said he is looking forward to participants helping UDOT shape the future of ABC in the State of Utah.

Jim McMinimee, Director of UDOT Project Development, also welcomed participants. He said it was exciting to see the collection of 115 participants who accepted UDOT's invitation to be part of the workshop. He thanked both those from Utah attending in support of the workshop goals and the national talent offering their services to UDOT. He said he looked forward to reviewing the outcomes of the workshop as UDOT continues its initiative to provide ABC in Utah.

Vasant Mistry with FHWA in Washington, D.C., gave the FHWA Office of Bridge Technology welcoming comments. He expressed FHWA's appreciation to UDOT for taking leadership in promoting ABC. Mr. Mistry congratulated UDOT and stated that UDOT is providing an excellent example for the rest of the nation. FHWA is looking for other states to likewise take leadership in the use of ABC in their states. He stated that this leadership is critical as the increased traffic volumes across the country combined with the nation's aging infrastructure have intensified construction activities in the last two decades. FHWA's priorities are to stem the yearly loss of an average 40,000 lives to accidents and $78B due to congestion. Congestion robs the nation of productivity and quality of life, on the order of 4.2 billion hours per year time delay and 2.9 billion gallons of wasted gas per year (2005 data). Although highway construction cannot be avoided, the extended onsite time for construction with its additional safety concerns and cost can be reduced. In order to reduce these impacts, UDOT is promoting and implementing ABC and thereby reducing onsite construction time while improving quality of life, reducing the impact on traffic and improving the longevity of its bridges. Mr. Mistry challenged the workshop participants to assist UDOT in its commitment to provide the traveling public with rapidly constructed, high quality, long-lasting, and safe highway bridges.

Christine Johnson represented the FHWA Highways for LIFE Program (HfL) in welcoming participants to the workshop and to Utah. She congratulated Utah and UDOT for the decision to make ABC a policy when conditions warrant in the State of Utah. She said Utah stands out in its aggressive management approach to staying on top of costs, materials, labor, and the whole production process. She applauded UDOT for its willingness to try new policies and technologies, and to rapidly adopt them if they improve one of those variables. The nation's transportation infrastructure is congested and in need of rehabilitation, and yet to rehabilitate will temporarily make the situation worse. The nation has a history of innovation and a culture of "can do" that has made the U.S. a leading nation. Points of crises tend to propel the U.S. to new developments, adaptations, technologies, and sometimes whole new ways of thinking. That is the idea behind HfL, asking the question, "Can we build highways and bridges in weeks instead of years, with minimal traffic backups, with higher quality and lower cost?" Ms. Johnson said the answer is yes; indeed, the LIFE in HfL stands for long-lasting, innovative, fast construction, and efficient. Through HfL, FHWA is playing the role that FHWA has traditionally played in the industry, of putting a spotlight on a group of policies and technologies that have the potential for releasing the vise-like grip of traditional solutions bringing on more congestion

at prohibitive costs with prohibitive consequences to local businesses and to road users. The development of ABC standards is needed and will have an impact on the bridge builders of tomorrow. Ms. Johnson said the nation congratulates UDOT, and the citizens of Utah thank UDOT for its initiative to make ABC standard practice.

Presentations by National Experts

(Note: See Appendix B for presenter bios and Appendix E for link to view and download the presentations.)

Vasant Mistry with the FHWA Office of Bridge Technology presented the national vision for making ABC standard practice. FHWA has been promoting ABC in partnership with AASHTO since 2001, and has co-sponsored a number of ABC workshops, seminars, and conferences throughout the nation to improve mobility and safety. For the last few years FHWA has been surveying ABC practice across the country. The survey found that only 21 states use a systematic economic process to evaluate alternate materials, contracting, and construction approaches to determine the cost effectiveness in building new and rehabilitated bridges. The majority of states are using ABC for less than 10 percent of their new and rehabilitation bridge construction. This percentage will increase as other states follow UDOT's lead in making ABC standard practice. FHWA would like to expand the use of ABC standards to all bridge components of a bridge. The national vision is to include standardized abutments, piers, precast decks on precast concrete girders, precast decks on steel framing, and total bridge systems complete with substructures. Standardizing more bridge components and processes for bridge building will reduce onsite construction time, reduce traffic and environmental impact, lower first and life-cycle costs, and improve safety and quality. Now is the time to identify implementable ABC methods and details that will lead to successful projects. As progress is made toward this national vision, Mr. Mistry said the public procurement system must promote fair and open competition and avoid product names and proprietary systems. He thanked the participants and UDOT for attending the workshop and setting the UDOT ABC standards initiative into motion.

Lieutenant Colonel Joe Hanus with the Civil and Mechanical Engineering Department at the U.S. Military Academy in West Point prepared a presentation on developing a doctrine for ABC but was unexpectedly unable to attend the workshop. His presentation was given by **William Nickas** with Corven Engineering, Inc. Mr. Nickas compared U.S. military bridging doctrine with ABC doctrine. He explained that a doctrine is needed because materials and needs change, and construction practices must change with them. U.S. military bridging types are assault bridging, support bridging, and line of communications bridging. Each type has a different purpose, onsite construction time, and service life. Similarly, ABC bridging types could be defined as emergency bridging, public safety bridging, economic bridging, and project savings bridging. Again, each of these bridging types has a different purpose, onsite construction time, and service life. Fundamentals of military bridging include surprise, extensive preparation, flexible plan, traffic control, organization, and speed. Similarly, ABC fundamentals can be identified. Wargaming used for military operations could similarly be used for ABC to ensure successful projects. Finally, after-action reviews of military operations could be done for ABC projects to continually improve the process. Mr. Nickas summarized the recommended elements of an ABC doctrine as type, fundamentals, war-gaming, and after-action reviews.

Mike Culmo with CME Engineering, Inc. gave a presentation on a manual sponsored by FHWA and currently under development. The manual will provide a catalog of

prefabricated bridge connection details that have been used around the country, including their durability history and design and construction methodologies. Included are connections between prefabricated foundations, footings, abutments, piers, girders, decks, and total systems. To be in the manual, the detail must have resulted in rapid construction and have performed well under traffic and in an exposed environment. The details were compiled from state DOTs across the country. The manual will be posted on the FHWA website.

Ray Wolfe with the California Department of Transportation gave a presentation on seismic ABC considerations during the working lunch. Mr. Wolfe discussed the national initiative to develop research priorities for connection details in moderate to high seismic regions, the focus in California, and the priorities of the AASHTO Highway Subcommittee on Bridges and Structures (SCOBS) Technical Committee on Seismic Design, T-3. He stated ABC is critical to meeting the AASHTO SCOBS Strategic Plan for Bridge Engineering Grand Challenge #3, "Accelerated Bridge Construction." More research and development are needed to advance ABC techniques in moderate-to-high seismic regions, and national and regional coordination is essential. Needed is the implementation of design standardization, contracting vehicles, and construction techniques that minimize delivery schedules. The common goal is to improve mobility and reduce traveler delays.

Presentations on ABC Research by Academic Panel

(Note: See Appendix B for presenter bios and Appendix E for link to view and download the presentations.)

Sameh Badie with George Washington University and Principal Investigator (PI) for NCHRP 12-65, "Full-Depth Precast-Concrete Bridge Deck Panel Systems," gave an overview of the objectives and products from NCHRP 12-65.

Ian Buckle with the University of Nevada at Reno discussed seismic ABC research. He listed research needs that include full and partial isolation and discussed the option of having all ABC elements with isolators at all supports versus all ABC elements with isolators at the abutments only.

George Lee with the University of Buffalo/MCEER discussed ongoing seismic ABC research at MCEER. Included are FHWA-sponsored research on precast, segmental bridges in seismic regions and use of seismic isolation bearings in substructures.

Jose Restrepo with UCSD and PI for NCHRP 12-74, "Development of Precast Bent Cap Systems for Seismic Regions," gave an overview of the objectives and products under development in the NCHRP 12-74 project.

Carin Roberts-Wollmann with Virginia Tech discussed the various full-depth precast concrete deck panel research projects at Virginia Tech. Included are haunch and pocket grout specifications, horizontal shear connectors on precast girders, time-dependent behavior, and panel-to-panel joint behavior in negative moment regions.

Terry Wipf with Iowa State University and Co-PI for NCHRP Synthesis 327, "Cost-Effective Practices for Off-System and Local Interest Bridges," gave an overview of the findings from Synthesis 327 and also ABC research done by Iowa State for the Iowa DOT.

Presentations by UDOT on ABC Projects

(Note: See Appendix B for presenter bios and Appendix E for link to view and download the presentations.)

UDOT ABC projects completed to date were presented by **Hugh Boyle** with Michael J. Baker Engineering, UDOT consultant. He first briefly described nine past ABC projects, and then discussed various design and construction considerations.

UDOT ABC projects planned for the next 3-5 years were presented by **Richard Miller** with UDOT. ABC projects planned through 2011 include 30 new bridges or complete bridge replacements, 11 deck replacements, 8 bridge widenings, and 8 new box culverts or culvert replacements. Most of these projects are already designed or in design, or they will be design-build projects to be awarded soon. He commented that the state legislature has provided additional funds to help reduce the structurally deficient list. These upcoming projects make clear the need for standard details for connections whether on steel or precast concrete girders.

First Draft UDOT ABC Standard Products

Full-Depth Precast Concrete Bridge Deck Panels:

A presentation on UDOT's initial draft standard (go-by) drawings for full-depth precast concrete bridge deck panels was given by **Carmen Swanwick** with HDR. Ms. Swanwick said that design and detailing language for the UDOT manual and construction specifications would also be developed for full-depth deck panels. In this development past and upcoming UDOT projects were investigated, and past and ongoing research and practices in other states were reviewed. They narrowed parameters and developed three types of panels: panels adjacent to abutments, interior panels, and panels adjacent to bents. The panel-to-panel shear keyway connection detail from NCHRP 12-65 was added, and the maximum 2-ft shear stud blockout spacing from AASHTO LRFD was followed. Ms. Swanwick emphasized that these products are "go-by" drawings, and that the designer must provide calculations and verifications and must address specific project details related to panel layouts, dimensions, orientations, shear stud blockouts, surface elevations, closure pour details, lifting devices, and panel connections. Existing structure capacities must be checked on rehab projects. The goal is to standardize full-depth deck panel details and address constructability issues to provide consistency in panels across upcoming projects so that contractors and designers can be more efficient and projects more cost effective.

A participant discussion followed Ms. Swanwick's presentation. Discussion topics included shear stud blockout spacing and configuration, panel-to-panel connection details, diaphragm effects in seismic loading, negative moment regions, size and weight of prefabricated components, longitudinal post-tensioning, fabrication issues, cracking potential and solutions, vertical adjustment and lifting details, and potential for leakage around pockets. See Appendix F for notes from the participant discussion.

Use of Self-Propelled Modular Transporters (SPMTs) to Remove and Install Bridges:

Four questions structured the participant discussion on standard (go-by) drawings and specifications for the use of SPMTs to move bridges.
1. What technical assistance does the SPMT mover provide during the design process for a project?
2. What duties related to the SPMT move should be delineated in the contract documents, including SPMT mover submittal requirements?
3. What should be monitored in the bridge during lifting and transporting, and should this monitoring be continuous during the move?
4. Who should provide monitoring and inspection of the bridge during lifting and transporting, and how should those responsibilities be delineated in the contract documents?

In responding to the above questions, discussion topics included different requirements for D-B, D-B-B, and CMGC projects; defining responsibilities; pre-bid communications; simple-span versus multi-span monitoring; and monitoring with a purpose. See Appendix G for notes from the participant discussion.

Charge to Breakout Teams

Workshop participants were given their charge prior to assembling into four teams. Participants were told the products from the three consecutive breakout sessions were intended to assist UDOT in making ABC standard practice by 2010, with the topics of each of the three breakout sessions working sequentially toward achieving that goal.

In Session A, the teams were to identify opportunities and obstacles to UDOT achieving ABC as standard practice by 2010. In the follow-up feedback session of all participants, these identified opportunities and obstacles were then to be consolidated and prioritized. In Session B, the teams would take the top prioritized opportunities and obstacles and develop recommendations to implement the opportunities and address the obstacles to achieving ABC as standard practice by 2010. In the follow-up feedback session of all participants, these recommendations were to be consolidated and prioritized as needed. In Session C, each team would develop proposed UDOT action plans for 2008, 2009, and 2010 based on the recommendations developed in Session B. The proposed action plans were to identify the activities, by whom, for whom, by when, needed resources, and estimated budget. In the closeout session, all participants were to consolidate and prioritize the proposed actions.

The Session A breakout session began with a brief presentation on an upcoming example UDOT ABC project to each of the four teams. The breakout sessions were not value engineering activities to develop specific recommendations for the example projects. The intent of the project presentations was to provide enough details to help the teams generate ideas about likely opportunities and obstacles to UDOT achieving ABC as standard practice by 2010.

Breakout Session Project Presentations

Breakout Team 1:

Danny Page with UDOT gave a presentation on the I-70, Eagle Canyon project. The 2C-495 bridge project involves replacing the deteriorated deck and approach slabs of the 485-ft long, 34-ft wide three-hinged steel arch built in 1965. The decision to replace the cast-in-place concrete deck with precast deck panels was primarily due to issues related to maintenance of traffic and the fact that the nearest concrete plant is over an hour from the bridge site. This project will be designed soon.

Breakout Team 2:

Thad Pinkerton with UDOT gave a presentation on the I-15, Utah County reconstruction project. The project includes total reconstruction of 15 major interchanges, modifications to seven interchanges, and construction of two proposed new interchanges. The project includes many similar structures that will incorporate standardized components.

Breakout Team 3:

Jason Richins with UDOT gave a presentation on the I-15, North of Beaver project. This project involves the replacement of two deteriorated cast-in-place concrete bridges on I-15 that cross a county road. The use of ABC was largely to minimize I-15 traffic disruption and limit maintenance of traffic costs. The county road traffic is low and mainly farm equipment.

Breakout Team 4:

Gang Guo with UDOT gave a presentation on the US-89, Pleasant Grove project. Originally when constructed, US-89 was constructed in a depressed section under the existing railroad line. The current plan is to fill the depressed section and construct a widened US-89 over the railroad track. The railroad track will be the main line for the UTA commuter rail. ABC is used on this project to reduce user impacts. The in-house design is approximately 30 percent complete.

Breakout Session A

The purpose of Breakout Session A was to identify opportunities and obstacles to UDOT ABC standard practice by 2010. Breakout Session A notes from each of the four breakout teams are included in Appendices H - K.

Feedback Session A

In the Feedback Session A each of the four breakout teams presented to all participants the opportunities and obstacles their team prioritized, as shown in Table 1. Participants as a group consolidated the identified opportunities and obstacles, and were then each given five votes on their priorities (see “Group Votes” and “Group Rank” in Table 1). The four teams were then each assigned two prioritized opportunities/obstacles on which to develop recommendations to implement the opportunities and address the obstacles (see “Team Assignment” in Table 1).

Table 1. Prioritized Opportunities and Obstacles from Feedback Session A

Team Priority	Opportunities Identified by Teams	Group Votes	Group Rank	Team Assignment
T4-1*	Use of prefabricated components for entire bridge	53	OP1	T4
T2-1, T3-2	Complete bridge move-in	43	OP2	T2
T2-2/3, T 4-2	Successful UDOT standard details, including seismic	26	OP3	T4
T1-2	Innovative ways to remove decks and install deck panels	22	OP4	T1
T1-1	Use of CMGC	13	OP5	T1
T1-3	Use of lightweight deck panels	6		
T3-3	Use voided slab for short spans	5		
T4-3	Eliminate construction staging	2		
T3-1	Use precast box culvert as alternative to short-span bridge	1		

* Key: T4-1 = Team #4's priority #1.

Team Priority	Obstacles Identified by Teams	Group Votes	Group Rank	Team Assignment
T2-1*	Process for accelerating decision making	26	OB1	T2
T2-2, T4-1	Programmatic conversion, including stakeholder buy-in	19	OB2	T3
T4-3	Public buy-in to short closures	14	OB3	T3
T1-2	Construction staging	6		
T3-2	Aesthetics	5		
T4-2	Coordination with railroads and utilities	5		
T1-3	Understanding sheared bolts	3		
T2-3	Maintenance of traffic	3		
T1-1	Validating construction loads on structure	2		
T3-1	Maintaining adequate vertical clearance	1		

* Key: T2-1 = Team #2's priority #1.

Breakout Session B

The purpose of Breakout Session B was to develop recommendations to UDOT to help them to achieve ABC standard practice by 2010. Recommendations were made on the eight opportunities and obstacles that received the most votes in Feedback Session A, as shown in Table 1. Accordingly, recommendations were made to implement the top five prioritized opportunities and to address the top three prioritized obstacles. Breakout Session B notes from each of the four breakout teams are included in Appendices H - K.

Feedback Session B

In Feedback Session B each of the four breakout teams presented to all participants their team prioritized recommendations for their two assigned opportunities and obstacles. Participants discussed and updated the recommendations per group consensus. The consensus recommendations are listed in Table 2. The four teams were each asked to

take the recommendations for their two prioritized opportunities/obstacles to Breakout Session C and develop action plans to implement the recommendations.

Table 2. Consensus Recommendations from Feedback Session B

OP_ / OB_	Recommendations Consolidated and Prioritized by Participants
Opportunity OP1: Use of prefabricated components for entire bridge	
OP1-1	Look at details around the world and other industries (e.g., FHWA & PCI documents), Visit other DOTs to look prefabricated foundations, investigate technology transfer, coordinate with the National Seismic ABC Initiative (Ray Wolfe) on seismic details
OP1-2	Obtain contractor & supplier input
OP1-3	Develop a pilot project
OP1-4	Research gaps in knowledge (including seismic)
Opportunity OP2: Complete bridge move-in	
OP2-1	Define roles and responsibilities for the EOR, specialty engineer, heavy lifter, and geotechnical engineer
OP2-2	Develop a plan for expanding the awareness of the heavy move capabilities
OP2-3	Develop a methodology for early involvement for the heavy movers
OP2-4	Standardize deflections, loads, and load factors for allowable and monitoring and also what tolerances are allowed
OP2-5	Develop methodology for communicating boundary conditions between the contractor and heavy mover such as site, Digital Terrain Model and geometry
OP2-6	Develop a methods to promote specialized bridge movers/heavy move use in DBB
Opportunity OP3: Successful UDOT standard details, including seismic	
OP3-1	Need dedicated staff to develop details and acceptance protocol
OP3-2	Develop go by drawings including methods to facilitate easy removal and future widenings
OP3-3	Staff training
Opportunity OP4: Innovative ways to remove decks and install deck panels	
OP4-1	Look at light weight deck panels
OP4-2	Develop a better spec to address damage to the existing girders
OpportunityOP5: Use of CMGC	
OP5-1	Refine the CMGC process
Obstacle OB1: Process for Accelerating Decision-Making	
OB1-1	Qualified people (empowering, training, and recruiting talent to Utah)
OB1-2	Develop a formal partnering process weekly involving subs, suppliers and the department
OB1-3	Clearly define roles and responsibilities at the construction job site
OB1-4	Timelines (accountability for submittals and decisions between contractor and owner)
Obstacle OB2: Programmatic conversion including stakeholders buy-in	
OB2-1	Standardize a model for quantifying user costs
OB2-2	Have designers work with contractors early in the design process to perform constructibility reviews
OB2-3	Include contingencies in the conceptual estimates
OB2-4	Coordinate with University's to include ABC in curriculum
Obstacle OB3: Public buy-in to short closures	
OB3-1	Improve PR/PI - Make sure successful projects are in the news - Broadcast the economic benefits - Emphasize aesthetics - Better utilize the media -1% of the project costs should be set aside for PR

Breakout Session C

The purpose of Breakout Session C was to develop proposed UDOT action plans for 2008-2010 to achieve ABC standard practice by 2010. The action plans were to include the activity, by whom, for whom, by when, needed resources, and estimated budget. Breakout Session C notes from each of the four breakout teams are included in Appendices H - K.

Closeout Session C

In the Closeout Session C, each of the four breakout teams presented to all participants their team proposed action plans. Participants then consolidated and updated the action plans per group consensus, and voted on their priorities.

Participants were given five votes on their priorities. Instructions for voting on their priorities were as follows:

- Vote for an individual proposed activity if they felt the individual activity could be completed independently.
- If they felt that all proposed activities for a recommendation must be completed as a unit, they were to vote for that recommendation.
- If they felt that all proposed recommendations to implement an opportunity or address an obstacle must be done, they were to vote to implement that opportunity or to address that obstacle.

The proposed action plans from the four breakout teams are consolidated in Appendix L, with number of votes shown.

Table 3 lists the priorities by number of votes received. Opportunity OP1, “Use of prefabricated components for entire bridge,” was the top priority. Opportunity OP2, “Complete bridge move-in,” and Recommendation OP3-1, “Need dedicated staff to develop details and acceptance protocol,” were tied at a close second place. Recommendation OB2-1, “Standardize a model for quantifying user costs,” Recommendation OB1-1, “Qualified people (empowering, training, and recruiting talent to Utah),” and Recommendation OP4-1, “Look at lightweight deck panels,” received the third, fourth, and fifth place priorities, respectively. As shown in Table 3, an additional eight Recommendations also received votes. Note that a few participants voted for five of the individual Activities that they believed could be completed independently; those Activities are also listed in Table 3 under the corresponding Opportunities and Recommendations.

Table 3. Prioritized Action Plans from Closeout Session C

Action Plans Consolidated and Prioritized by Participants	Group Votes
Opportunity OP1: Use of prefabricated components for entire bridge Recommendation OP1-1: Look at details around the world and other industries (e.g., FHWA & PCI documents), visit other DOTs to look at prefabricated foundations, investigate technology transfer, coordinate with the National Seismic ABC Initiative (Ray Wolfe) on seismic details	53

Recommendation OP1-2: Obtain contractor & supplier input Recommendation OP1-3: Develop a pilot Project Recommendation OP1-4: Research gaps in knowledge (including seismic) Activity OP1B: Evaluate seismic connections: 12-74 details, grouted couplers, MCEER, U of Washington *[rec'd. additional 7 votes]* Activity OP1C: Implement seismic isolation *[rec'd. additional 2 votes]*	
Opportunity OP2: Complete bridge move-in Recommendation OP2-1: Define roles and responsibilities for the EOR, specialty engineer, heavy lifter, and geotechnical engineer Recommendation OP2-2: Develop a plan for expanding the awareness of the heavy move capabilities Recommendation OP2-3: Develop a methodology for early involvement for the heavy movers Recommendation OP2-4: Standardize deflections, loads, and load factors for allowable and monitoring and also what tolerances are allowed Recommendation OP2-5: Develop methodology for communicating boundary conditions between the contractor and heavy mover such as site, Digital Terrain Model and geometry Recommendation OP2-6: Develop a methods to promote specialized bridge movers/heavy move use in DBB	50
Opportunity OP3: Successful UDOT standard details, including seismic Recommendation OP3-1: Need dedicated staff to develop details and acceptance protocol	50
Obstacle OB2: Programmatic conversion including stakeholders buy-in Recommendation OB2-1: Standardize a model for quantifying user costs	37
Obstacle OB1: Process for Accelerating Decision-Making Recommendation OB1-1: Qualified people (empowering, training, and recruiting talent to Utah)	31
Opportunity OP4: Innovative ways to remove decks and install deck panels Recommendation OP4-1: Look at lightweight deck panels Activity OP4-1A: Lightweight concrete deck panels *[rec'd. 5 additional votes]* Activity OP4-1B: Composite deck panels (FRP, etc.) *[rec'd. 5 additional votes]*	27
Obstacle OB3: Public buy-in to short closures Recommendation OB3-1: Improve public relations/public involvement - Make sure successful projects are in the news - Broadcast the economic benefits - Emphasize aesthetics - Better utilize the media -1% of the project costs should be set aside for public relations	18

Opportunity OP4: Innovative ways to remove decks and install deck panels Recommendation OP4-2: Develop a better spec to address damage to the existing girders during removal process	15
Opportunity OP3: Successful UDOT standard details, including seismic Recommendation OP3-2: Develop go-by drawings including methods to facilitate easy removal and future widening	12
Opportunity OP5: Use of CMGC Recommendation OP5-1: Refine the CMGC process Activity OP5-1C: Improving the negotiation process (public perception) *[rec'd. additional 2 votes]*	10
Obstacle OB2: Programmatic conversion including stakeholders buy-in Recommendation OB2-3: Include contingencies in the conceptual estimates	10
Obstacle OB2: Programmatic conversion including stakeholders buy-in Recommendation OB2-4: Coordinate with Universities to include ABC in curriculum	10
Obstacle OB2: Programmatic conversion including stakeholders buy-in Recommendation OB2-2: Have designers work with contractors early in the design process to perform constructability reviews	7
Opportunity OP3: Successful UDOT standard details, including seismic Recommendation OP3-3: Staff/Consultant training	2

Note: See Appendix L for proposed activities not shown.

Summary

Mary Lou Ralls summarized the activities of the past day and a half and thanked the participants for achieving the workshop goals of providing recommendations and proposed activities for UDOT to achieve ABC standard practice by 2010. Products of the workshop are the identified opportunities and obstacles (Table 1 and Appendices H – K, Breakout Session A), recommendations to implement the opportunities or address the obstacles (Table 2 and Appendices H – K, Breakout Session B), and proposed action plans for 2008-2010 (Table 3, Appendix L and Appendices H – K, Breakout Session C).

Next Steps

Vasant Mistry provided closing comments. He said the workshop was well organized, and he thanked UDOT for hosting it and the participants for sharing their time and effort to assist UDOT. He said he anticipates UDOT's next steps to include establishing realistic

milestones, designating champions, conducting the local industry feedback meeting on the first two draft standards, making presentations at AASHTO meetings, and continuing to work with local industry to implement ABC as standard practice. He said FHWA is available to continue its support to UDOT in making ABC standard practice.

Jim McMinimee closed out the workshop with his comments on next steps. He said UDOT will evaluate the ideas developed in the workshop, train and educate UDOT staff, involve the community further, evaluate ABC implementation, and publish results. He thanked the participants and adjourned the workshop.

APPENDIX A

UDOT Accelerated Bridge Construction Standards Workshop Agenda

Radisson Hotel, 215 West South Temple
Salt Lake City, Utah
January 28-29, 2008
(Dress Code: Business Casual)

Moderator and Facilitator: Mary Lou Ralls of Ralls Newman, LLC

Monday, January 28, 2008

8:00-8:30 a.m.	UDOT Opening Remarks (John Njord, Jim McMinimee) FHWA Office of Bridge Technology Welcome (Vasant Mistry) FHWA Highways for LIFE Welcome (Christine Johnson) Workshop Objective (Mary Lou Ralls)
8:30-8:45 a.m.	National Vision: Making ABC Standard Practice (Vasant Mistry)
8:45-9:00 a.m.	Developing a Doctrine for ABC (Joe Hanus, U.S. Military Academy)
9:00-9:15 a.m.	Connection Details Manual (Mike Culmo, CME Engineering, Inc.)
9:15-9:30 a.m.	UDOT ABC Projects to Date: Design Aspects (Hugh Boyle, Baker)
9:30-9:45 a.m.	UDOT ABC Projects to Date: Construction Aspects (Hugh Boyle, Baker)
9:45-10:00 a.m.	UDOT Upcoming ABC Projects in Next 3-5 Years (Richard Miller)
10:00-10:15 a.m.	*Break*
10:15-10:40 a.m.	Detailed Presentation of Draft UDOT Full-Depth Precast Concrete Bridge Deck Panel Standard (Go-By) Drawings and Specification (Carmen Swanwick, HDR)
10:40-11:05 a.m.	Brainstorming and Recommendations on Full-Depth Precast Concrete Bridge Deck Panel Standard (Go-By) Drawings and Specification (Workshop Participants)
11:05-12:00 noon	Brainstorming and Recommendations on Standard (Go-By) Drawings and Performance Specifications for the Use of SPMTs to Remove and Install Bridges (Workshop Participants)

12:00-1:00 p.m.	*Working Lunch (provided)* Lunch Presentation: Seismic ABC Considerations (Ray Wolfe, Caltrans), including comments from Chair of AASHTO T-3 Technical Committee for Seismic Design
1:00-1:30 p.m.	Academic Panel on ABC Research – Completed, Ongoing & Needed (Sameh Badie, George Washington University) (Ian Buckle, University of Nevada at Reno) (George Lee, University of Buffalo/MCEER) (Jose Restrepo, UCSD) (Carin Roberts-Wollmann, Virginia Tech) (Terry Wipf, Iowa State University)
1:30-2:15 p.m.	Charge to Breakout Teams (Mary Lou Ralls) Breakout Session A: Identify Opportunities and Obstacles to UDOT ABC Standard Practice by 2010 (Breakout Sessions 1-4, each using an upcoming UDOT project as an example and starting with 10-minute presentation by UDOT project engineer on the upcoming project)
2:15-3:00 p.m.	Feedback Session A: Report out Opportunities and Obstacles, then Consolidate and Prioritize
3:00-3:15 p.m.	*Break*
3:15-4:15 p.m.	Breakout Session B: Develop Recommendations for UDOT ABC Standard Practice by 2010, including type and priority of subsequent standard drawings/specifications development and other needed activities to implement the identified Opportunities and address the identified Obstacles (Breakout Sessions 1-4)
4:15-5:30 p.m.	Feedback Session B: Report out Recommendations, then Consolidate and Prioritize
5:30 p.m.	Adjourn for the day

Tuesday, January 29, 2008

8:00-9:30 a.m.	Breakout C: Based on the prioritized Recommendations, develop Proposed UDOT Action Plans for 2008, 2009 and 2010, including estimated budgets, for ABC Standard Practice by 2010 (Breakout Sessions 1-4)
9:30-10:00 a.m.	*Break*

10:00-11:45 a.m.	Closeout Session C: Report out Proposed UDOT Action Plans for 2008, 2009 and 2010, including estimated budgets, for ABC Standard Practice by 2010, then Consolidate and Prioritize
11:45 a.m.	Summary (Mary Lou Ralls) Next Steps (Jim McMinimee, Vasant Mistry)
12:00 noon	Adjourn *(box lunch provided)*

APPENDIX B

Presenter Bios

John R. Njord has served as UDOT Executive Director since May 2001. UDOT is an agency of 1,800 employees with responsibility for the design, construction, maintenance, and operation of the 6,000-mile state system of roads and highways. Mr. Njord joined the Department in 1988, where he has served as the Deputy Director, Chief Engineer, Urban Planning Engineer, and other engineering positions. He also served as the UDOT Director of Transportation Planning with the Salt Lake Organizing Committee, where he was responsible for transportation planning for the 2002 Olympic Winter Games. Mr. Njord is the past President of the American Association of State Highway and Transportation Officials (AASHTO), and is a member of the American Society of Civil Engineers. The Public Relations Society of America named Mr. Njord the "Utah Communicator of the Year" in November 2002. Mr. Njord graduated from the University of Utah with a bachelor's degree in Civil Engineering and is a registered professional engineer.

Jim McMinimee is the Director of UDOT Project Development. Jim has been with UDOT for 22 years. Since 2002 UDOT has implemented Design-Build and Construction Manager/General Contractor (CM/GC) contracting, Accelerated Bridge Construction, implementation of the Transportation Technician program and implementation of the GPS Network. The Project Development Division is also responsible for engineering policy and business strategy for the Department. Before coming to Project Development in 2001, Jim served as the Region Two Director in Salt Lake City for six years. Additionally, Jim has over 10 years combined experience in Materials and Central Maintenance Operations at UDOT. During his career Jim and his teams have received numerous awards. Jim received his BS in Civil Engineering from the University of Utah and is a licensed PE with the State of Utah.

Richard L. Miller – Structures Design Manager, Utah Department of Transportation, (801)957-8556, richardmiller@utah.gov

Hugh Boyle – Contract Employee for Utah Department of Transportation, Michael J. Baker Engineering, (801)352-5992, hboyle@mbakercorp.com

Gang Guo – Structures Design Engineer, Utah Department of Transportation, (801)964-4465, gguo@utah.gov

Daniel Page – Structures Design Project Manager, Utah Department of Transportation, (801)965-4693, dpage@utah.gov

Thad Pinkerton – Structures Rotational Engineer, Utah Department of Transportation, (801)965-4369, tpinkerton@utah.gov

Jason Richins – Structures Design Squad Leader, Utah Department of Transportation, (801)964-4470, jtrichins@utah.gov

Sameh S. Badie is an associate professor at the Civil and Environmental Engineering Department, The George Washington University, Washington DC. He received his PhD degree in structural engineering in 1997 from the University of Nebraska. His research interests include design and analysis of prestressed and reinforced concrete structures and development of precast deck concrete systems for highway bridges. He is the principal investigator of the NCHRP 12-65, a co-principal investigator of the NCHRP 18-14 and co-author of the PCI Bridge Design Manual. He is licensed professional engineer in Maryland, Nebraska and Virginia.

Ian Buckle is the director of the Center for Civil Engineering Earthquake Research and professor of civil engineering at the University of Nevada, Reno. He has previously served as Deputy Director of the National Center for Earthquake Engineering Research, University at Buffalo, New York (now the Multidisciplinary Center for Extreme Events Research). The author of more than 200 publications in bridge and earthquake engineering, Dr Buckle is known for his contributions to the seismic provisions in the AASHTO *LRFD Comprehensive Bridge Specifications* (1998) and (2007), the AASHTO Standard Specifications *Division I-A: Seismic Design* (2002), and the Federal Highway Administration *Seismic Retrofitting Manual for Highway Structures: Part 1- Bridges* (2006). Dr Buckle is currently the chair of TRB Committee AFF50 on Seismic Design and Performance of Bridges, vice-chair of the Caltrans Seismic Advisory Board, immediate past president Board of Directors NEES Consortium, and past chair ASCE Technical Council on Lifeline Earthquake Engineering.

Michael Culmo is Vice President of Transportation and Structures for CME Associates, Inc., of East Hartford, Connecticut, his employer for the past 11 years. He earned a B.S. in civil engineering in 1983 and a master's degree in structural engineering in 1986, both from the University of Connecticut. Previously he was a supervisor in a bridge design unit for the Connecticut Department of Transportation, where he worked for 13 years. He is a member of the TRB Concrete Bridges Committee and Steel Bridges Committee, and has been a member of the PCI North East Technical Committee for Bridges for the past 15 years.

Joseph P. Hanus is a Lieutenant Colonel in the US Army, and is the Structures Group Director in the Civil and Mechanical Engineering Department at the United States Military Academy, West Point, New York. He has served over 20 years in the US Army in various combat and construction engineering units, with multiple overseas deployments. He received his PhD in civil engineering from the University of Wisconsin at Madison. His research interests include accelerated bridge construction, the use fiber-reinforced-polymers in construction, and engineering education. He is a licensed professional engineer in Wisconsin.

Christine Johnson is Director of Field Services West for FHWA. In that position she has supervisory responsibilities for 16 Western FHWA Division offices and the FHWA in-house consulting group – known as the National Resource Center. Prior to assuming this position in 2002 she served as the Associate Administrator for Operations and the head of the Joint Program Office for Operations Christine has also held executive positions in the New Jersey DOT, Parsons Brinkerhoff Consulting firm, and the Port Authority of New York and New Jersey. She has a Masters Degree in Planning and a PhD in Public Policy analysis from the University of Illinois – both focusing on transportation.

George C. Lee is SUNY Distinguished Professor and Samuel P. Capen Professor of Engineering for the Department of Civil, Structural and Environmental Engineering at the University at Buffalo, State University of New York (UB). Previously, he had served as chair of the Department of Civil Engineering and Dean of the School of Engineering and Applied Sciences at UB, and Director of the Multidisciplinary Center for Earthquake Engineering Research (MCEER). He earned both his PhD and MS degrees at Lehigh University and his undergraduate degree from the National Taiwan University. His currently funded research projects (supported by U.S. National Science Foundation and Federal Highway Administration) include the seismic design of structures with added response modification and isolation systems, decision-support systems for managing utility systems for critical facilities, seismic design of segmental piers for accelerated bridge construction, multi-hazard design principles for highway bridges and bridge damage monitoring system. He is the recipient of numerous awards and citations including the Newmark Medal of the American Society of Civil Engineers. Most recently, he received a 2006 Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring (PAESMEM).

Vasant Mistry is the Senior Bridge Engineer, U.S. Department of Transportation, Federal Highway Administration (FHWA), office of Bridge Technology, Washington D.C. He serves as the national

technical expert and review authority for all steel bridge and structural matters for the FHWA bridge program. He is responsible for drafting Federal polices and regulations as well as championing the use of innovative bridge technologies and materials, including accelerated bridge construction. He is a member of the AASHTO Technical Committee for Steel Designs (T-14). He also serves as a technical committee member for six national committees. He is a Professional Engineer and has a degree of Master of Science in Structural Engineering and has over 35 years of experience in bridge design and review. He has written several papers and made over 90 presentations related to steel bridges and accelerated bridge construction.

William N. Nickas joined Corven Engineering, Inc. as a Principal Engineer in January 2007 and works to strengthen personnel development, project management, quality control and quality assurance, with a focus on accelerated bridge construction. Previously as the FDOT Chief Structures Engineer, William led the agency in challenges that began with findings of post-tensioned tendon corrosion in Niles Channel, Mid-Bay Bridge and Sunshine Skyway Bridge. In August of 2004, he directed the recovery efforts of the I-10 bridge over Escambia Bay which resulted in two lanes of traffic being opened in 17 days. He then took a team to aid in post Katrina recovery efforts for Mississippi and Louisiana. His position at FDOT also made him the state's representative on the AASHTO Subcommittee on Bridges and Structures, where he served six years as chairman of the AASHTO T-10 Concrete Bridge Technical Committee.

Richard A. Pratt is the Chief Bridge Engineer for the Alaska DOT&PF. He has worked in bridge engineering for his entire 25-year career. Rich is recognized for his experience in seismic analysis, design, and retrofitting of highway bridges. He currently chairs the AASHTO Technical Committee for Seismic Design (T-3). Rich lives in Juneau, Alaska, where he's an avid cross country skier.

Mary Lou Ralls is an engineering consultant and principal of Ralls Newman, LLC in Austin, Texas. She earned BSCE and MSE degrees from the University of Texas at Austin in 1981 and 1984, respectively, before joining the Texas Department of Transportation (TxDOT). At TxDOT she worked in various engineering positions before being appointed the state bridge engineer and director of the Bridge Division in 1999. Ralls retired from TxDOT in September 2004 after 20 years of service. She is a registered professional engineer in Texas and continues work to advance innovative bridge technologies.

José I. Restrepo is a Professor in Structural Engineering at the University of California, San Diego and Director of Operations of the Charles Lee Powell Structural Research Laboratories and Director of the Robert and Natalie Englekirk Structural Research Center. Dr. Restrepo's expertise is in the seismic design of bridges and buildings, and on development of innovative structural systems, including precast concrete. He is a past recipient of the *Chester Paul Siess Award* of the American Concrete Institute and of the *Charles C. Zollman Award* of the Precast/Prestressed Concrete Institute. Dr. Restrepo holds an adjunct faculty position at the International School for the Reduction of Seismic Risk at the University of Pavia, Italy.

Carin L. Roberts-Wollmann is an Associate Professor of Civil and Environmental Engineering at Virginia Tech. Her areas of interest are reinforced and prestressed concrete structures and bridge design and construction. She earned her BSCE from the University of Nebraska-Lincoln in 1983 and her MS and PhD in Civil Engineering from the University of Texas at Austin in 1990 and 1993, respectively. Carin is a registered professional engineer in North Carolina.

Carmen Swanwick leads HDR's Salt Lake City Structures Group. Carmen is a graduate of the University of Utah where she earned a Master of Science and Bachelor of Science degrees in Civil Engineering. She is a licensed Professional Engineer in Utah, Idaho, New Mexico, and Minnesota with over 10 years of engineering experience. Locally, Carmen has been managing a rapid deck-replacement project for UDOT Research and supporting UDOT's desire for implementing prefabricated bridge systems and accelerated bridge construction in the state. As part of the rapid deck-replacement project, Carmen has organized scanning tours to expose UDOT officials, local

contractors, and consultants to the use of PBC and ABC. She has been involved with several UDOT projects using pre-fabricated elements and accelerated bridge construction.

Terry Wipf is the Pitt-Des Moines Professor in Civil Engineering within the Civil, Construction and Environmental Engineering Department at Iowa State University (ISU). He also serves as the Director of the Bridge Engineering Center at ISU. Prior to joining ISU, he had worked four years as a bridge engineer with HNTB in Kansas City, Mo., and he is a registered professional engineer. During his career he has directed more than 100 bridge related research projects funded by state, federal and industrial sponsors. His research specialty areas include bridge engineering, structural health monitoring, and bridge testing and evaluation, and he has conducted several recent research projects focusing on accelerated bridge construction topics. The projects have included laboratory and field demonstration testing and evaluation of precast concrete substructure and superstructure elements. Dr. Wipf is currently a member of the Transportation Research Board Committee, Dynamics and Field Testing of Bridges.

Raymond W. Wolfe graduated from the University of Southern California with a B.S. in Aerospace Engineering in 1988, then from the California State Polytechnic University Pomona with a M.S. in Structural Engineering in 1995. He received his Ph.D. in Civil Engineering from the University of Southern California in 2002 with an emphasis in system identification and health monitoring. He is registered as a Civil Engineer and as a Mechanical Engineer in California. After a brief stint in the defense industry, Ray joined the California Department of Transportation (Caltrans) in 1991 as an entry level engineer working in Structure Construction. His subsequent career has included experience in Structure Design, Structural Materials, and Structures Maintenance and Investigations. He currently manages a Bridge Design office located in Southern California, and is active with FHWA in developing standards for ABC implementation in regions subjected to moderate-to-high seismic activity.

APPENDIX C

Participant Lists

Out-of-State Participants

#	Participant	Affiliation	Email	Expertise
1	Andres, Tom	Florida DOT	Thomas.Andres@dot.state.fl.us	State DOT; Chair, AASHTO TIG SPMT LST
2	Armeni, John	Armeni Consulting Services, Inc.	john.armeni@armeniconsulting.com	Construction Contractor perspective
3	Badie, Sameh S.	George Washington Univ.	badies@gwu.edu	PI, NCHRP 12-65, "Full-Depth, Precast-Concrete Bridge Deck Panel Systems"; ABC Researcher
4	Barnhart, Eric	Barnhart Crane & Rigging	ebarnhart@barnhartcrane.com	SPMT & other heavy move equipment company
5	Bilow, Dave	NCBC	dbilow@cement.org	Precast Concrete Bridge Industry
6	Buckle, Ian	University of Nevada, Reno	igbuckle@unr.edu	Chair, TRB AFF50 Seismic Design & Performance; Seismic ABC researcher
7	Calvert, Eugene	Collier County, Florida	EugeneCalvert@colliergov.net	Local government (county) perspective
8	Capers, Harry	Arora & Assoc.	hcapers@arorapc.com	Chair, TRB AFF10 General Structures
9	Culmo, Mike	CME Associates, Inc.	Culmo@cmeengineering.com	FHWA Connections Manual; PCINE
10	Gribble, Kurt	Missouri DOT	Kurt.Gribble@modot.mo.gov	State DOT; large upcoming bridge program
11	Halsband, Bill	Mammoet	halsband@Mammoet.com	SPMT & other heavy move equipment company
12	Hanus, Joe *	U.S. Military Academy	Joseph.Hanus@usma.edu	Doctrine for ABC / Military Bridges
13	Hoyne, David	Vermont DOT	David.Hoyne@state.vt.us	State DOT; Member, AASHTO Construction Subcommittee
14	Hyzak, Mike	Texas DOT	MHYZAK@dot.state.tx.us	State DOT; bridge standards
15	Johnson, Christine	FHWA Director of Field Services – West	christine.johnson@fhwa.dot.gov	FHWA Co-Sponsor; national ABC perspective
16	Kapur, Jugesh	Washington State DOT	KapurJu@wsdot.wa.gov	State DOT; Member, AASHTO TIG SPMT LST
17	Lee, George	University of Buffalo/MCEER	gclee@buffalo.edu	PI, FHWA Seismic ABC Research
18	Liles, Paul	Georgia DOT	pliles@dot.ga.gov	State DOT; AASHTO T-4 Construction Vice-Chair

#	Participant	Affiliation	Email	Expertise
19	Messam, Marlene	Collier County, Florida	MarleneMessam@colliergov.net	Local government (county) perspective
20	Mistry, Vasant	FHWA Office of Bridge Technology	vasant.mistry@dot.gov	FHWA Co-Sponsor; national ABC perspective
21	Nickas, William	Corven Engineering	wnickas@corveneng.com	ABC Engineering Consultant Contractor to UDOT
22	Nooren, Piet	Mammoet	piet.nooren@mammoet.com	SPMT & other heavy move equipment company
23	Nordholm, Greg *	Sarens Group	greg.nordholm@norsarllc.com	SPMT & other heavy move equipment company
24	Pratt, Rich *	Alaska DOT	richard.pratt@alaska.gov	State DOT; AASHTO T-3 Seismic Design Chair
25	Ralls, Mary Lou	Ralls Newman, LLC	ralls-newman@sbcglobal.net	ABC Engineering Consultant Contractor to UDOT
26	Restrepo, Jose	University of California at San Diego	jrestrepo@soe.ucsd.edu	PI, NCHRP 12-74, “Development of Precast Concrete Bent Cap Systems for Seismic Regions”; Seismic ABC Researcher
27	Roberts-Wollmann, Carin	Virginia Tech	wollmann@vt.edu	Full-Depth Precast Concrete Deck Panel Research
28	Russell, Henry G.	Henry G. Russell, Inc.	henry@hgrconcrete.com	Bridge Engineering Consultant; Specifications
29	Russo, Frank	HNTB	FRusso@HNTB.com	PI, SHRP2 R04, “Innovative Bridge Designs for Rapid Renewal”
30	Sarens, Steven	Sarens Group	steven.sarens@sarens.com	SPMT & other heavy move equipment company
31	Schrage, Calvin *	NSBA	Schrage@nsbaweb.org	Steel Bridge Industry
32	Smith, Will	Barnhart Crane & Rigging	wsmith@barnhartcrane.com	SPMT & other heavy move equipment company
33	Tang, Benjamin	Oregon DOT	Benjamin.M.Tang@odot.state.or.us	State DOT; large upcoming bridge program
34	Waugh, Keith	Leware Constr., FL	kwaugh@lewarecc.com	Bridge Construction Contractor for FDOT SPMT project
35	Wipf, Terry J.	Iowa State University	tjwipf@iastate.edu	PI, NCHRP Synthesis 327, “Cost-Effective Practices for Off-System and Local Interest Bridges”; ABC Researcher
36	Wolfe, Ray	Caltrans	ray_w_wolfe@dot.ca.gov	State DOT; National Seismic ABC Initiative

* Did not attend workshop due to last-minute scheduling problem.

Local Industry Participants

#	Participant	Affiliation	Email	Expertise
1	Arens, Mike	Baker	marens@mbakercorp.com	Local Consultant
2	Ball, Austin	JUB	aball@jub.com	Local Consultant
3	Birdsall, Adam	Parsons Brinkerhoff	birdsalla@pbworld.com	Local Consultant
4	Blackham, Paul	Stanley	blackhampaul@stanleygroup.com	Local Consultant
5	Bolling, Doyt	LTAP, Utah	doyt@cc.usu.edu	Technology Transfer to local city/county engineers
6	Boyle, Hugh	Baker	HBoyle@mbakercorp.com	Local Consultant
7	Bryne, Brian	Lochner	bbyrne@hwlochner.com	Local Consultant
8	Deslis, Amalia	URS	Amalia_Deslis@URSCorp.com	Local Consultant
9	Eixenberger, David	URS	David_Eixenberger@URSCorp.com	Local Consultant
10	Ferris, Dan	WW Clyde	cglasser@wwclyde.net	Local Contractor
11	Hendershot, Robert	R2H	rch@r2h.com	Local Consultant
12	Holmes, Dana	HDR	Dana.holmes@hdrinc.com	Local Consultant
13	Isom, Christine	Hatch Mott MacDonald	Christine.isom@hatchmott.com	Local Consultant
14	King, Vance	CIVCO	vanceking@civcoengineering.com	Local Consultant
15	Kozhikote, Ramkumar	PBSJ	mktadros@pbsj.com	Local Consultant
16	Lehman, Dave	U of U	David.Lehman@utah.edu	U of U Research
17	Mulia, Handi	PTG	Handi.mulia@parsons.com	Local Consultant
18	Olsen, Clark	Utah Pacific Steel	clark@utahpacificbridge.com	Steel Fabricator
19	Pantelides, Chris	U of U	chris@civil.utah.edu	U of U Research
20	Reasch, Larry	Horrocks	larry@horrocks.com	Local Consultant
21	Reeves, Will	Tubular Steel Design	willstowellreeves@msn.com	Local Consultant
22	Richins, Jeremy	Flare	Jeremy@flareconstruction.com	Local Contractor
23	Robertson, Russ	FHWA, Utah	Russell.robertson@dot.gov	Local FHWA support
24	Romero, Mike	PEC	pec@pecutah.com	Local Consultant
25	Sarhan, Anthony	FHWA, Utah	Anthony.sarhan@fhwa.dot.gov	Local FHWA support
26	Scoles, Jim	Morrison Maierle	jscoles@m-m.net	Local Consultant
27	Sletten, Joshua	HNTB	jsletten@HNTB.com	Local Consultant
28	Swanwick, Carmen	HDR	Carmen.swanwick@hdrinc.com	Local Consultant
29	Volz, Jerry	Ames	jtripi@amesco.com	Local Contractor
30	Wadsworth, Kip L.	Ralph L. Wadsworth	kip@wadsco.com	Local Contractor

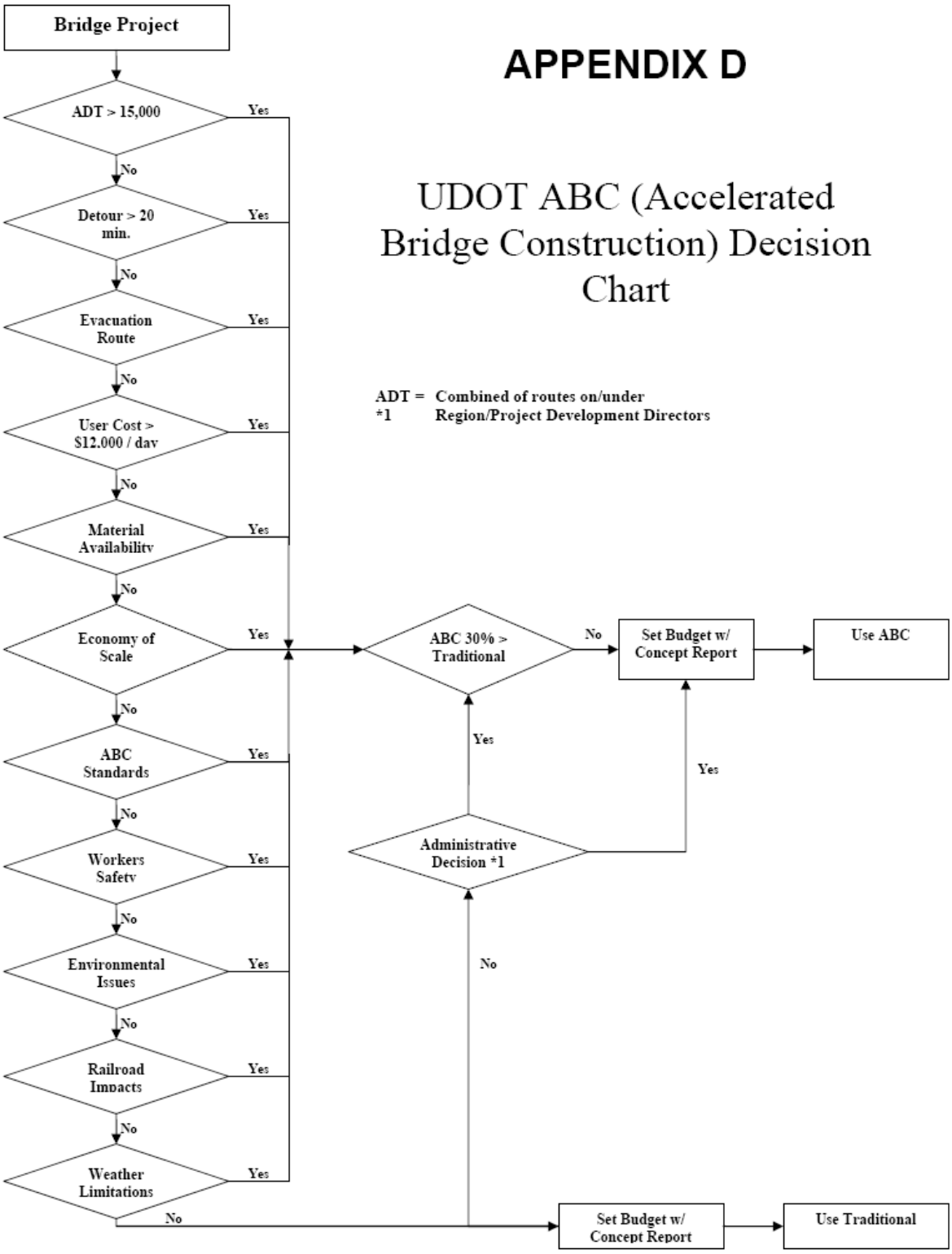
#	Participant	Affiliation	Email	Expertise
31	Wells, Eric	Granite Construction	Eric.wells@gcinc.com	Local Contractor
32	Wolf, Erik	Wadsworth Brothers	erik@wadsbro.com	Local Contractor
33	Wynn, Susan	Carter Burgess	susan.wynn@c-b.com	Local Consultant

UDOT Participants

#	Participant	Affiliation	Email	Expertise
1	Burns, Stan	UDOT	sburns@utah.gov	Director of Engineering Services
2	Cook, Ray	UDOT	raycook@utah.gov	HQ-Structural Designer
3	Guo, Gang	UDOT	gguo@utah.gov	HQ-Structural Designer
4	Henrie, Jason	UDOT	jhenrie@utah.gov	UDOT Project Manager (Contract Employee)
5	Jar, Justin	UDOT-HQ	jjar@utah.gov	HQ-Planning/Programming
6	Knaus, Rebecca	UDOT	rknaus@utah.gov	HQ-Structural Designer
7	Lindsey, Shana	UDOT	rlindsey@utah.gov	HQ-Director of Research
8	McMinimee, Jim	UDOT	jmcminimee@utah.gov	HQ-Director of Project Development
9	Miller, Richard	UDOT	richardmiller@utah.gov	Deputy Bridge Engineer
10	Page, Daniel	UDOT	dpage@utah.gov	HQ-Structural Contracting
11	Pinkerton, Thad	UDOT	tpinkerton@utah.gov	HQ-Structural Designer
12	Pope, Cory	UDOT-District	corypope@utah.gov	Region 1-Director
13	Richins, Jason	UDOT-HQ	jtrichins@utah.gov	HQ-Structural Design

APPENDIX D

UDOT ABC (Accelerated Bridge Construction) Decision Chart



ADT = Combined of routes on/under
*1 Region/Project Development Directors

APPENDIX E

ABC-Related Websites and References

Websites

http://www.udot.utah.gov/
(for additional information and updates on UDOT Accelerated Bridge Construction, visit: http://www.udot.utah.gov/main/f?p=100:pg:1126907402770386460:::1:T,V:1991,)

http://www.fhwa.dot.gov/bridge/

http://www.fhwa.dot.gov/bridge/prefab/

Projects constructed to date: http://www.fhwa.dot.gov/bridge/prefab/projects.htm

Publications: http://www.fhwa.dot.gov/bridge/prefab/pubs.htm

Research: http://www.fhwa.dot.gov/bridge/prefab/research.htm

http://www.fhwa.dot.gov/bridge/conferen.cfm (calendar of upcoming bridge events)

http://www.fhwa.dot.gov/construction/accelerated/ (ACTT workshops)

http://www.fhwa.dot.gov/hfl/ (Highways for LIFE)

http://www.aashtotig.org/ (AASHTO Technology Implementation Group)

http://www.trb.org/shrp2/ (TRB Strategic Highway Research Program 2)

Renewal Projects (ABC): http://www.trb.org/shrp2/ProjectDescriptions.asp?AID=78

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"Framework for Prefabricated Bridge Elements and Systems (PBES) Decision-Making," Federal Highway Administration (FHWA), Publication Number FHWA-IF-06-30, http://www.fhwa.dot.gov/bridge/prefab/framework.cfm

"Prefabricated Bridge Elements and Systems in Japan and Europe Summary Report," FHWA International Technology Exchange Programs, May 2004, http://www.fhwa.dot.gov/bridge/prefab/pbesscan.htm

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APPENDIX F

Discussion Notes on Full-Depth Precast Concrete Deck Panels

Sameh Badie, PI for NCHRP 12-65, made the following comments:

- Their research showed the shear pocket spacing could be extended to 4 ft with minimal penalty. Consider increasing the stud size to 1¼-inch diameter to reduce the number of studs required for the larger spacing; Nebraska and possibly Missouri and Iowa are starting to use the larger studs. (Note: UDOT commented that they could use the 4-ft shear pocket spacing with a design exception.)
- Their shear pockets were hidden inside the panels, with just a small hole in each shear pocket for grouting. This was done to eliminate the open cast-in-place closure pour, thereby eliminating durability concerns at this location.
- For the panel-to-panel connection details, where top slots are cut in the structural hollow tube, it may be a good idea to move the cut out into the concrete by the tube rather than cutting the top side of the tube to lower the fabrication cost. In discussing costs with contractors, the cut in the top of the tube could cost about $1 per tube.

Need to look at diaphragm effects in seismic loading. The deck becomes a diaphragm, and the forces need to be transferred from the deck to the substructure to ensure no premature damage due to an earthquake.

In positive moment areas, the panels are always in compression. But what about in negative moment areas, where deck joints have a tendency to open up? Have the panels been considered over continuous spans or just simple spans?
Response: Have considered over continuous spans. UDOT has been closing their joints on rehabilitation projects, and now looking at how those joints have performed on past projects.

When sizing prefabricated pieces such as precast panels and precast caps, make the weight of the panels similar to the weight of the caps, for example so that the crane doesn't have to pick up a cap that weighs three times the size of a panel. It's preferable to have similar weights. Texas, North Carolina and South Carolina have spliced their caps to size the pieces for the cranes.

Has UDOT looked at details for edge panels where a lip is used to slipform the barrier rail? Some projects have used the lip mainly as a side form for the overlay, with a cast-in-place joint across the cap to make continuous spans.
Response: UDOT is looking at lifting panels with the parapets on them to reduce time and schedule. It was found that when doing this on these size panels there's so much reinforcement in the parapets because you're really looking at an end section for each section. We're now looking at doing some post-tensioning along the parapet as well to close that joint. Utah has used an overlay on every panel project.

In terms of the panel-to-panel connection, is UDOT leaning away from longitudinal post-tensioning?
Response: UDOT is not leaning away from it. As development continues on the panel standards, details will also include post-tensioning.

On the draft panel sheets, the horizontal shear connector blockouts are shown full depth of the panel. Is there concern about the shrinkage cracks that will form along the perimeter of these blockouts? Some projects are using partial-depth blockouts so that, for durability, complete concrete placement above the shear connectors allows no conduit for moisture and deicing salts to get to the horizontal shear connectors.
Response: UDOT has seen cracking around the shear stud blockouts. That's why an overlay has been used on every project.

Texas is building a project now with NCHRP 12-65 details. Some issues:

- Fabrication cost. Steel in a panel is about $5/sq ft to fabricate. The panels alone were $40/sq ft, relatively large for the $70/sq ft bridge costs in Texas. Could look at ways to reduce the steel cost. For example, using poor-boy splice sleeve couplers with metal ducts as a confinement may reduce the costs of a passively reinforced joint connection between the panels; Texas may run tests on that type detail to reduce costs.
- Alignment of the couplers during fabrication. A fabrication plant is casting the panels. The NCHRP 12-65 research used a piece of wood that sticks up for the vertical blockout for the panel-to-panel connection. In a production environment with a 400-ft long bed, the fabricator runs a vibrating screed along the full length. For this project the top blockouts tend to get rotated over or pushed around. Some of this has to do with quality control in holding the blockout forms down. It's still a concern.
- TxDOT minimized the cold joints at the top surface by casting partial-depth blockouts. Minimizing the cold joints can eliminate the need for an overlay, and this would also enhance time.
- TxDOT uses a passive panel-to-panel connection (no longitudinal post-tensioning). Post-tensioning requires a two-stage grouting process where the panel-to-panel joints are grouted prior to post-tensioning, the panels are allowed to slide during post-tensioning to get the post-tensioning into the system, and the haunch interface is grouted after post-tensioning. This requires additional time and a specialty subcontractor to do the work. Texas has a durability environment different than UDOT and other states with their more severe corrosion environments. Texas can live with a passive connection that doesn't necessarily work in other states.

Response: Good comments. Note also that UDOT hasn't used the NCHRP 12-65 details yet; they are proposed for future projects.

One of the post-tensioning concerns is having good long-term maintenance. Otherwise, the post-tensioning can become ineffective, corroded, and not do what it was intended to do.

A past contractor's perspective: no problem with transverse post-tensioning, especially with a bar. A specialty contractor is not needed. The contractor sometimes casts the panels instead of a fabrication plant. Problems can be addressed with good quality control in the yard. Get benefit by transverse post-tensioning. Good corrosion protection on the anchor head is needed, and the grouting must be done properly. Corrosion concerns due to salt water in coastal regions must also be addressed.

On past UDOT projects, the panels were sometimes done by fabricators and sometimes site cast by contractors.

In the Texas environment, panel details that work with prestressed concrete rather than steel girders could be far more cost effective because of the price of steel. Geometry control is easier for a steel girder bridge because prestressed concrete girders have inherent camber variation. The UDOT draft details have a headed stud at fixed height. On its recent project TxDOT estimated the camber, varied the projection of those elements according to the estimated camber, detailed a threaded headed element with a nub top that allowed grinding to reduce the projection, and worked dynamically with the fabricator to adjust as needed.

Local fabricator: Has there been any attempt to use prestressing to reduce the cracking around the blockout?
Response: New Hampshire DOT built one and had some cracking. Deck cracking is relatively easy to repair using methacrylate or epoxy injection. A little shrinkage at the blockout might occur, and this can also be repaired easily. Post-tensioning can minimize cracking.

The vertical adjust detail is important to keep because it also provides dead load distribution across the girders; it's important to get uniform distribution of dead load across the girders.

It was suggested that the lifting detail be taken off the plans. That's dependent on the contractor's means and methods. The contractor should be allowed come up with innovative ways to lift the panels depending on their equipment. If they have lifting rigs they can probably simplify those details.

The intermediate diaphragm connected to the deck appears to be a standard detail here. Most states don't do that, and elimination of that detail can reduce difficulties. Most states do connect end diaphragms.

In the northeast region, panels have been used over negative moment regions of continuous spans, with the post-tensioning cranked up to 250 psi net after all dead loads were applied. One bridge is performing well after 17 years in service. Post-tensioning should be seriously considered in negative moment regions.

A contractor came up with an interesting way to take a deck off without damaging the girders. He demolished the slab on either side of the beam. He then took a hoe ram, laid it flat and peeled the deck off like a banana peel with no damage to the girder. Contractors get innovative when they are allowed to come up with ways to remove the deck.

Longitudinal post-tensioning may be more difficult than some of these details. It takes about a day to put in. The northeast region did deck replacements during weekend closures, three spans a weekend with post-tensioning, so can have rapid projects with post-tensioning. In the northeast region, if too much post-tensioning was crammed into the ducts, there were problems feeding the strands through the ducts because there are slight misalignments at each joint. It's recommended to oversize the ducts or undersize the number of strands inside the duct. If it says four 0.6-inch diameter strands inside a duct, use three, or use four 0.5-inch strands.

UDOT has used several methods to address the negative moment region: post-tensioning, varying the number of bars in the panels so that the number of bars is increased as

approach the bent, doubled up on the shear connectors as approach the bent, and closure pours.

To reduce the level of post-tensioning, AASHTO code must be violated. Is any research looking at reducing the minimum 250 psi requirement? Why is that requirement there, and can we reduce it?

Response: A researcher said we could reduce it to 200 psi but not much more than that.
Response: The proceedings of the 1997 International Bridge Conference in Pittsburgh include a paper by William Nickas and Paul Csagoly on the development of the 200 and 250 psi. In Florida it was based on double tee sections with v-shaped joint, so it was tied to the geometry of the joint and particularly with double tees you want to leave out the end diaphragm. So the increase at the end of the structure, as those familiar with fatigue characteristics know, you get biplanar bending vs. single-axle bending. It's tied to that work. Paul Csagoly worked on LRFD code development team, and that's how the 250 psi was brought into the LRFD code.

Related to the question on means and methods on lifting eyes, some states believe that the means and methods should be shown in the plans so that the expectation from the engineer of record on how to pick this thing up and control the stresses should be given to the contractor. A different perspective is requiring the contractor to develop shop drawings and then tell the DOT where he wants to lift it. Is the surface blemish that needs to be repaired the responsibility of the contractor or the DOT? That's a logistics issue that should be worked through while here at the workshop.

Virginia Tech has done significant research on precast full-depth deck systems.

- They have been looking at the NCHRP 12-65 detail in negative moment regions; have lab specimens that are three panels with two connections, made composite with steel girder, and then cycled in negative moment condition. Got significant cracking and leaking in this connection but also had cracking and leaking in the post-tensioned connections with 150 psi precompression. Virginia Tech is doing a new specimen now with higher level of post-tensioning, about 300 psi, to see if it will perform better than the 150 psi panels.
- Another area looked at is post-tensioning time-dependent effects because first the panel is post-tensioned, then locked off to a girder which will restrain the shrinkage and the creep of the deck panel. Over time the panel precompression leaks into the girders and is lost from the deck panels. The loss of precompression over time must be considered. With prestressed concrete girders it's not that bad because they're creeping and shrinking together and the restraint isn't such a big issue. Steel girders are going to restrain the creep and shrinkage significantly. A continuous system is trying to creep downward over time and is being restrained with the interior supports. Virginia Tech showed they could chase their tail all day with a continuous system, increasing the precompression, and over time losing it all. Shown needed 400-600 psi initial compression to make sure maintained precompression over time.
- Leakage around pockets. Several mockups were done in the lab with very mixed results. Some grouts never leaked. Some grouts that are low shrinkage and seem to have good cohesion won't be leaking after three months but will be leaking after six months. So Virginia Tech is currently using a higher level of post-tensioning, and also doing different treatments of those pockets in terms of surface treatments, epoxy

before pouring grout in, sandblasting to roughen the surface, and also using a waterstop to try to prevent the leaks.

- An inspection of the Woodrow Wilson Bridge was completed before it was demolished. The bridge had been redecked with precast concrete panels in the early 1980s. The biggest source of problems with the panels was leakage at all the pourbacks. There are two Woodrow Wilson Bridge reports. One is on the Virginia Transportation Research Council website. The second one will be published in the next month or so at the Pennsylvania Transportation Institute website. Virginia Tech did the work with PennState.

Not only is the post-tensioning lost in the panels, but the girders are also being loaded up with secondary effects. What limited a UDOT post-tensioned panel design was how much the girders were being loaded. The panels were post-tensioned to the extent they could be without overloading the girders. A 56-day panel was assumed. UDOT analyzed it using the new AASHTO code's temperature differential section.

Elastic gains were codified in AASHTO prestressed concrete loss section a few years ago based on Dr. Tadros' research, so that analogy back to the thermal gradient has application. It's become standard practice in the longitudinal direction. There should be a design aid or methodology to streamline that time-dependent analysis; it can be consuming and expensive for every designer to do. AASHTO code has language in the commentary that says if everything is 90 days old, you can start ignoring some of the time-dependent effects, and some of that benchmark was based on Dr. Tadros' research.

How should UDOT deal with the standardization of panel size from a specification or go-by standpoint? How would we get such things as contractor input into that standardized sizing?
Response: We want to go toward standardizing the panel sizes. On new structures it will be easier. For the rehab projects it's more difficult considering span lengths, beam spacing, and other details vary from project to project. A number of fabricators and contractors are at this workshop, and we look forward to getting their input on this during the workshop.

APPENDIX G

Discussion Notes on Use of SPMTs to Remove and Install Bridges

Question 1: What technical assistance does the SPMT mover provide during the design process for a project?

The heavy lifter (HL) provides the information regarding the ability of the transporter to traverse the course based on the provided Digital Terrain Model (DTM) and set the span.

HL generally provides all the rigging/falsework on the transporter.

Need process for shop drawings covering stresses and elevations.

D/B and DBB potentially have different preliminary services by the HL.

During the D/B procurement the HL can interact with the designer more on the potential utilization of HL expertise.

Ground to bottom of structure is HL. Contract should cover who is responsible for ground preparation.

There is a need to explain what the specialty engineer does.

There is a need to define what the construction engineer (owner's inspector) duties include.

Pre-bid communication is important. Particularly important when the HL is planning on utilizing bridge contractors falsework. The inspection and certification of the falsework must be clarified.

The D-B-B and CMGC processes need to outline R7R for the engineer of record (EOR), the contractor, the specialty engineer and the HL.

One HL stated that they can inspect welding and the condition of falsework/shoring to utilize "old stuff" to lower costs.

EOR should state the bridge stresses so that everyone knows at the time of bid.

Measure and payment….Generally using 3 items. Bridge assemble area prep; HL move; Misc Temp and cleanup item

Question 2: What duties related to the SPMT move should be delineated in the contract documents, including SPMT mover submittal requirements?

Clean up "cross over liability"
Borings along walk-in and walk-out routes…. Too much information in the plans can pose too much risk on the owner. Just let the bidders all plan on preparing the site and grading the walk-in route.

Many project contracts include traffic control notes & criteria and incentive/disincentive delays. Who takes risk and gets the bonus?

Spill thru abutment configuration causes the SPMT to be located away from the end. This causes the HL to supply a transfer girder and that adds costs. The location of the temporary lift point will also influence the state of stress in the girder. Prestressed girders will be carefully analyzed.

D-B-B requires some information be stated on the plans.

D/B is more open.

Generally a site (field) visit and some survey are best during the proposal phase.

Question 3: What should be monitored in the bridge during lifting and transporting, and should this monitoring be continuous during the move?

Heavy Lifters just want to lift and move things.

HL wanted the Owner to monitor the bridge.

Engineering stated one should monitor with a purpose.

Question 4: Who should provide monitoring and inspection of the bridge during lifting and transporting, and how should those responsibilities be delineated in the contract documents?

Should know and calculate the state of stress in the bridge during the move and understand the condition it will be in the final location.

Definitely should inspect carefully before lifted and after set with some observations by inspection consultant for the owner.

Iowa State provided full time monitoring of stresses during a launched steel girder bridge.

One person thought ground may drive the decisions but a HL offered that the site prep unit should just plan on the max ground pressure on the shadow area under the transporter be at 1500 LBS per sq. foot. If soil improvement cannot be made to that level, state it in the plans.

A multiple span bridge move mandates a full time monitoring system. Simple spans simply supported can have key geometry checks during the cast, lift, and set process.

The floor was opened for other ideas and thoughts regarding this topic in general.

Skew both ends in slightly will avoid “shoe horning” in the last span.

Give the twist tolerance of the span to the HL for him to analyze his system for sensitivity. HL routinely monitor the weight on the system. The sensitivity and tolerances will be tied

to the bridge superstructure type. Steel may be more flexible but one must guard against even temporary over stress to avoid future performance issues.

With this idea of a limit established, monitoring with a purpose (and within reason) would be known in advance.

Need load factors for limits for both strength and service limit states.

To build the span at ground level would cost less to assemble. This would add time and $ to the HL subcontract.

Better methods (including actual survey) are needed to determine the dead loads/total heavy lift loads. The haunches are often under estimated.

How close do the weights even need to be? Is the system designed to the limit? Generally the group believed that the heavy lift system should have reasonable redundancy/tolerate some redistribution and not have the trailer stressed to the limit. (Appropriate Safety Factor)…….. The term arrived upon was “Appropriately Conservative”

The understanding of stresses is worthwhile to understand the long term performance of the span. (In general, how did we change the stress distribution?)

A discussion took place regarding monitoring of distortions in the span. Who is best suited to accomplish this activity? Assuming rigid body translation and rotation is okay the primary interest for a simple span is torsion and the three HL firms present felt the owner (or his representative) is best suited to accomplish this engineering survey.

Some group participants stated if the project is a D/B contract the intermediate support conditions should be analyzed by the designer. (Note added after meeting: if the designer performs these services then UDOT will need to address who will then have the “Approval” role like the EOR typically has on behalf of the owner?) At the meeting the contractors noted in a CMGC or a D-B-B contract the contractors will have to include the costs for specialty engineers.

For a single movement of a two span structure (or a sensitive structure) the falsework/SPMT system will dramatically increase in costs as the warping criteria tighten.

APPENDIX H

Notes from Breakout Team # 1

Breakout Session A

A-1. Investigation (Team 1)
Presentation by UDOT project engineer on example upcoming UDOT bridge project (to generate ideas on opportunities and obstacles to UDOT ABC standard practice by 2010)

- Team members can ask questions for clarification only
- List basic project objective and constraints
- List basic bridge objective and constraints
- Each breakout team member keep individual list of ideas on opportunities and obstacles to UDOT ABC standard practice by 2010, as related to example and any other upcoming UDOT bridge projects

Individual Notes; Ideas of Opportunities and Obstacles:

Project Objective / Bridge Objective: Rehabilitate the bridge
Constraints: - Detour (5-7 miles) - Deck removal (arch loading) (temp variations) - Lead abatement – environmental issues - Geometry constraints - Construction loads (MN)

A-2. Brainstorming (Team #1)
Open brainstorming on opportunities and obstacles to UDOT ABC standard practice by 2010 (Golden Rule: no critiquing ideas)

Identified Opportunities:

Innovative panel installation methods - Lewis & Clark Bridge – systematic panel replacement used SPMTs to deliver panels - use highline to remove and replace deck
FRP deck panels to reduce load
CMGC contracting

Identified Obstacles:

Remove existing AC overlay
Paint removal – lead abatement?
Validate strength for anticipated construction loads
Construction staging
May reveal more problems when deck removed
2 month timeline – late Fall / early Spring best
Sheared bolts – why?
Deck currently not composite with arch structure (existing splice locations in structure may not facilitate composite action)

A-3. Development (Team #1)
Rate the Opportunities and Obstacles with a pass/fail (simple majority thumbs up); then prioritize Opportunities and Obstacles that pass and assign “Team Priority” (e.g., Team #2’s top priority is designated “T2-1”).

Prioritize Opportunities.

Identified Opportunity	Team Vote	Team Priority
Innovative removal / installation	18	2
Contracting (CMGC)	21	1
FRP Deck panels / lightweight concrete	17	3

Prioritize Obstacles.

Identified Obstacle	Team Vote	Team Priority
AC removal – demo/remove deck	15	4
Paint removal (lead)	0	-
Validate construction loads	21	1
Construction staging	19	2
Additional problems with removal	8	-
Timeline (2 months)	7	-
Sheared bolts understanding	16	3
Noncomposite vs. composite	2	-

A-3. Development, cont'd. (Team #1)
Prepare for report out in Feedback Session A.

Team Priority	Identified Opportunity
T1-1	Contracting vehicle (CMGC)
T1-2	Innovative removal / installation
T1-3	Lightweight deck panels

Team Priority	Identified Obstacle
T1-1	Validate construction loads
T1-2	Construction staging
T1-3	Understanding sheared bolts
T1-4	Demolition / removal of deck

Breakout Session B

B-1. Discussion (Team #1)
Open discussion on Recommendations for what UDOT needs to do to implement the identified Opportunities and to address the identified Obstacles in order to have ABC as the standard practice by 2010 (Golden Rule: Discuss ideas, processes, products…not persons and cultures.)

OP_	Identified Opportunity	Recommendation to Implement Identified Opportunity
OP4	Deck panels	Lightweight panels as part of overall standards development
		Need good specification to preclude damage to existing girders (limit energy input); allow innovation while preserving existing structure
		Use similar methods for removal / installation (noncomposite)
		Remove studs if not replacing deck with cast-in-place (or hairpins on pretensioned beams)
OP5	CMGC	Contractor works with designer early to eliminate / reduce risk
		Involve heavy lifter and other specialty subs early
		CMGC fosters innovation through early collaboration
		Refine CMGC process

B-2. Development (Team #1)

Refine each proposed Recommendation for implementing the Opportunities and/or addressing the Obstacles to UDOT ABC standard practice by 2010 with a pass/fail (simple majority thumbs up); then prioritize Recommendations that pass and assign "Team Priority" (e.g., Team #2's top priority is designated "T2-1").

OP_	Recommendations to Address Opportunity	Team Vote	Team Priority
OP4	Lightweight deck panels	21	2
	Damage specification	21	1
	Similar removal / installation methods	0	-
	Studs (shear)	0	-
OP5	Engage specialty subs early	7	-
	Refine CMGC process	21	3

Breakout Session C

C-1. Discussion (Team #1)

Based on the Group-consolidated Recommendations, open discussion on proposed UDOT Action Plans for 2008, 2009, and 2010, including activity, by whom, for whom, by when, needed resources, and estimated budget.
(Golden Rule: Discuss ideas, processes, products…not persons or cultures.)

OP_/OB_	Activity	By Whom	For Whom	By When (Date)	Needed Resources	Estimated Budget
Opportunity OP4: Innovative ways to remove decks and install deck panels						
Recommendation OP4-1: Look at lightweight deck panels						
OP4-1A	Use lightweight concrete panels					
	- Develop specifications	UDOT / AGC	UDOT	12/08	0.5 PY	
	- Develop design standards	UDOT / consultant	UDOT	06/09	0.5 PY	
OP4-1B	Use FRP / composite panels					
	- Develop specifications	UDOT / AGC	UDOT			
	- Develop design standards	UDOT / consultant	UDOT			
	- Pilot projects					
OP4-1C	Use steel grid decks with lightweight overlay					
	- Develop specifications	UDOT / AGC	UDOT	12/08	0.5 PY	
	- Develop design standards	UDOT / consultant	UDOT	06/09	0.5 PY	
OP4-1D	Use orthotropic panels					
	- Develop specifications	UDOT / AGC	UDOT			
	- Develop design standards	UDOT / consultant	UDOT			
Recommendation OP4-2: Develop / improve deck removal specification						
OP4-2A	- Limit equipment size - Define allowable stress state in girders during demo - Require demo plan to verify non-composite section (frame	UDOT	UDOT	07/08	0.5 PY	-

	stability)					
OP4-2B	Develop pilot projects for specific removal methods (hydro demo, foam); scan efforts in other states	UDOT	UDOT	2010	2 PY	
Opportunity OP5: Use of CMGC						
Recommendation OP5-1: Refine the CMGC process						
OP5-1A	Refine selection process (construction company) - publish scoring used on projects	UDOT / AGC	UDOT	3 mo.	0.1 PY	
OP5-1B	Determine project applicability for CMGC (standard requirements; flowchart)	UDOT	UDOT	2 mo.	0.25 PY	
OP5-1C	Negotiations ("perceptions") (force 10% limit or throw out bids)	UDOT / AGC	UDOT / public	6 mo.	0.25 PY	
OP5-1D	Early definition of contract method	UDOT	UDOT / AGC	4 mo.	0.05 PY	

C-2. Development (Team #1)

Rate each proposed Action to help UDOT be ready to implement ABC as the standard practice by 2010 with a pass/fail (simple majority thumbs up); then prioritize proposed Actions that pass and assign "Team Priority" (e.g., Team #2's top priority is designated "T2-1").

OP_/OB_	Activity	Team Vote	Team Priority
OP4-1A	Use lightweight deck panels	17	3
OP4-1B	Use composite deck panels	11	
OP4-1C	Use steel grid deck panels	17	5
OP4-1D	Use orthotropic deck panels	12	
OP4-2A	Improve deck removal specification	17	1
OP4-2B	Develop pilot projects	17	4
OP5-1A	Refine contract selection process	17	
OP5-1B	Determine project applicability for CMGC	17	2
OP5-1C	Improve negotiation process	17	
OP5-1D	Determine contract method early	17	

APPENDIX I

Notes from Breakout Team # 2

Breakout Session A

A-1. Investigation (Team 2)
Presentation by UDOT project engineer on example upcoming UDOT bridge project (to generate ideas on opportunities and obstacles to UDOT ABC standard practice by 2010)

- Team members can ask questions for clarification only
- List basic project objective and constraints
- List basic bridge objective and constraints
- Each breakout team member keep individual list of ideas on opportunities and obstacles to UDOT ABC standard practice by 2010, as related to example and any other upcoming UDOT bridge projects

Individual Notes; Ideas of Opportunities and Obstacles:

The type bridge projects for this Renewal project along 43 miles of the interstate.
Public involvement is critical
Minimizing Traffic delays
Typical urban challenges on a high speed, high volume roadway.
Truck traffic extremely high at 20+%
Bridges carrying mainline over side street are very typical grade separations structures. Existing typical spans are approximately 60 feet and the maximum structure length is 330+/-.
Most have joint leakage and heavy salt damage.

A-2. Brainstorming (Team #2)
Open brainstorming on opportunities and obstacles to UDOT ABC standard practice by 2010 (Golden Rule: no critiquing ideas)

Identified Opportunities:

Older bridge geometry generally makes clearances a challenge
Approach Span Lengths area of study
Usage of Simple Span DL and Continuous Span LL
Standardize inverted U bridge section (Single three sided box and multiple Three sided configuration with slab over sections between boxes with horizontal movement.
Need better uniformity in structure type selection

Identified Obstacles:

Contracts need standardizing
R/W needed for staging areas
Innovative MOT
Environmental Challenges
Long term Settlement

A-3. Development (Team #2)
Rate the Opportunities and Obstacles with a pass/fail (simple majority thumbs up); then prioritize Opportunities and Obstacles that pass and assign “Team Priority” (e.g., Team #2’s top priority is designated “T2-1”).

Prioritize Opportunities.

Identified Opportunity	Team Vote	Team Priority
Bridge Replacement by Heavy Move-in from adjacent assemble area	14-1	1
Single 3~sided box and multiple 3~sided box system	2-13	Dropped
ABC ~ Seismic Connection Details	11-4	5
Clearly state the desired bridge acceptable to UDO by way of a bridge Manual including advanced concepts like Simple for DL and Continuous for LL. (follow-up Item came out for a more specific project criteria package)	12-3	3
Standardize D/B Contracts RFP, Scopes/Project Concept Reports for Uniformity and Clarity	11-4	4
Standardize Contractor QC and QC/QA roles responsibilities on Large Projects	5-10	Dropped
How and where to use Incentive/Disincentive; Lane Rental; other contracting techniques.	12-3	Dropped

Prioritize Obstacles.

Identified Obstacle	Team Vote	Team Priority
Longitudinal Grade challenges and MOT	3-12	Dropped
Environmental Challenges	7-8	Dropped
Options for removing ridership during construction period (Ie. Virtual office and alternate route selection and encouragement to reduce MOT issues)	7-8	Dropped
Pre-purchasing and stock pile/provide Fabricated Materials	3-12	Dropped
Accelerated Decision Making during Construction	3-12	2
Overcoming inertia of ABC to achieve the Programmatic Conversion	12-3	6

A-3. Development, cont'd. (Team #2)
Prepare for report out in Feedback Session A.

Team Priority	Identified Opportunity
T2-1	Bridge Replacement by Heavy Move-in from adjacent assemble area
T2-3	Clearly state the desired bridge acceptable to UDO by way of a Bridge Manual including advanced concepts like Simple for DL and Continuous for LL. (follow-up Item came out for a more specific project criteria package)
T2-4	Standardize D/B Contracts RFP, Scopes/Project Concept Reports for uniformity and Clarity
T2-5	Standardize D/B Contracts RFP, Scopes/Project Concept Reports for Uniformity and Clarity

Team Priority	Identified Obstacle
T2-2	Accelerated Decision Making during Construction
T2-6	Overcoming inertia of ABC to achieve the Programmatic Conversion

Breakout Session B

B-1. Discussion (Team #2)
Open discussion on Recommendations for what UDOT needs to do to implement the identified Opportunities and to address the identified Obstacles in order to have ABC as the standard practice by 2010 (Golden Rule: Discuss ideas, processes, products…not persons and cultures.)

OP_	Identified Opportunity	Recommendation to Implement Identified Opportunity
OP2	Total Bridge Superstructure Delivery by HL/SPMT	Early involvement of HL/SPMT and how to accomplish this
		Allow SPMT only on D/B or CMGC type construction contracts
		Define Specialty Engineer Roles
		Define Geotechnical Roles
		EOR Roles
		HL Roles
		Get an owner defined set of responsibilities for above 4 parties
		Need boundary conditions stated like site geometry, Digital Terrain Model etc. Clearly depiction of Bridge staging area and travel path.
		Bridge structure Deflection and Loadings
		Lack of general awareness of Heavy moving industries capabilities for launching, moving and erecting bridges

OB_	Identified Obstacle	Recommendation to Address Identified Obstacle
OB1	Accelerated Decision Making during Construction	Train and Recruit Qualified People
		1ST round submittals in D/B process. The slow down occurs in D-B-B process for field resolution issues
		There is a need for a field resolution/escalation method/process
		Quality Management efforts are good in D/B but missing good practices in D-B-B
		Clearly delineation of Roles/Responsibilities
		Timeliness of decisions
		Expanding the use of partnering into more projects
		Consider use of Disputes Review Board (DRB)into more projects with a scheduled monthly meeting. (Scheduled monthly top cause more accountability)
		Generally first submittal of Shops get processed timely
		Problem Solving for Hot issues. Potentially have a Central Office fast response team evaluate issues and quickly get an answer back to the field thus minimizing the delay
		Always delineate lines of communication on every project like partnering sessions faciliatates

B-2. Development (Team #2)

Refine each proposed Recommendation for implementing the Opportunities and/or addressing the Obstacles to UDOT ABC standard practice by 2010 with a pass/fail (simple majority thumbs up); then prioritize Recommendations that pass and assign "Team Priority" (e.g., Team #2's top priority is designated "T2-1").

OP_	Recommendation to Address Opportunity	Team Vote	Team Priority
OP2	Early involvement of HL/SPMT	14-1	3
	Promote use of Heavy Movers in D-B-B	6-9	6
	Defines Roles and Responsibilities for EOR, Specialty Engineers, Heavy Mover, Geotechnical Engineering.	15-0	1
	Boundary Conditions and Site layout, travel way	12-3	5
	Deflections and Loads	13-2	4

	Awareness of Heavy Movers Capabilities including technical guidance	15-0	1

OB_	Recommendation to Address Obstacle	Team Vote	Team Priority
OB2	Qualified People(Recruit, Train, Empower)	15-0	1
	Field Resolution aids like RFI, Shop Drawing identification and process procedures, time lines for review and Quality Management Plan.	11-4	5
	DRB as a monthly progress activity	2-13	Dropped
	Partnering formatted meeting weekly with action items, timelines and lead identified.	15-0	1
	Roles and responsibilities	14-1	3
	Time lines identified in the boiler plate documents at UDOT	14-1	3

B-2. Development, cont'd. (Team #2)
Prepare for report out in Feedback Session B.

OP_/OB_	Team Priority	Recommendations
OP2	1	Define roles and responsibilities for the EOR, Specialty Engineer, heavy lifter, geotechnical engineer
OP2	2	Develop a plan for expanding the awareness of the heavy move capabilities including technical guidance
OP2	3	Develop methodology for early involvement for the heavy movers
OP2	4	Standardize deflections, loads, and load factors for allowable during movement. Give guidance on monitoring and what tolerances are acceptable.
OP2	5	Develop methodologies for communicating boundary conditions between the contractor and heavy mover such as site layout, Digital Terrain Models and basic geometry
OP2	6	Develop methods to promote specialized bridge movement systems and heavy move use in Design-Bid-Build contracts
OB2	1	Qualified people (empowering, training, and recruiting talent to Utah)
OB2	2	Develop a formal partnering process weekly involving subs, suppliers and the owner
OB2	3	Clearly define roles and responsibilities at the job site
OB2	4	Timelines (accountability for submittals and decisions between contractor and owner)
OB2	5	Formalize field resolution processes (including a centralized escalation/resolution entity)

Breakout Session C

C-1. Discussion (Team #2)
Based on the Group-consolidated Recommendations, open discussion on proposed UDOT Action Plans for 2008, 2009, and 2010, including activity, by whom, for whom, by when, needed resources, and estimated budget.
(Golden Rule: Discuss ideas, processes, products…not persons or cultures.)

OP_/OB_	Activity	By Whom	For Whom	By When (Date)	Needed Resources	Estimated Budget
OP2-1	Listed Ideas: Develop a Special provision to be used with UDOT Construction Specifications					
	Define the process with specific tasks to specific entities (ie EOR, HL, Bridge Contractor)					
	Prequalification's like used for MSE walls verses at time of Bid or award submitting the Quals for Specialty Engineer and or Heavy Mover.					
	Establish a task force					
	Cross over liability and define the Roles/Responsibilities					
	Share the experiences (Lessons Learned) thru Synthesis, Virtual meetings					
	Publish a Selection methodology for which ABC methods to be deployed at a bridge site.					
	Prequalification system may incentives Heavy Movers to develop the processes					
	Checklists for plans development					
	Develop language for BM and AASHTO Specs…					
	Establish a Task Force: Define the process; Establish Quals for HL,SE,Geo; Roles and Responsibilities; Bridge Manual Language (Bridge structure, Haul Road, Temporary Foundations) Checklists Develop Typical RFP/Construction Spec Language					
OP2	Look at task force and team leader(s)make up and consider inside engineer, outside engineer, Contractor)					
OP2	Assign Construction industry, Owner reps/Members and have cross discipline mixture					
OB1	Need to have timely involvement of EOR in D-B-B					

OB1	Empower Jobsite staff for change orders with established Values and overall thresholds					
	Better or improved Jobsite methodologies					
	More use of Partnering and encourage personnel growth thru the experience					
	Look at task forces to expedite critical decisions and organizationally which personnel best handle a process					
OB1	Better process for escalation in the field					
	Need to have Counterpart identified and establish clear lines of communication					
	Currently contractual review times are being meet thru informal submittals thru “back door”					
	Partnering meetings for better accountability					
	Use existing processes and accelerate those though education					

C-2. Development (Team #2)

Rate each proposed Action to help UDOT be ready to implement ABC as the standard practice by 2010 with a pass/fail (simple majority thumbs up); then prioritize proposed Actions that pass and assign "Team Priority" (e.g., Team #2's top priority is designated "T2-1").

OP_/OB_	Activity	Team Vote	Team Priority
	Team 2 with additional members from other two Heavy movers prioritized and grouped similar efforts from the above listed activities.		
OB1	Review existing Processes such as training for: Developing and maintaining action item list, Scheduling, handling progress meetings and Decision Resolutions		
	Utilize a facilitator on critical meetings to clarify who, what, & when. Empower the project team to work it out.		
	Train and Update module		
	Implement Plan into work force		
	Clarify when and better utilize a routine project meeting		
	Utilize Partnering process and populate routine meetings with these type techniques to bring expedited closure to issues		
	On- line training with a Quiz		
	Have principal players occasionally attend the Day to Day weekly for an overview of the real applications and issues		

C-2. Development, cont'd. (Team #2)
Prepare for report out in Closeout Session C

OP_ / OB_	Team Priority	Activity	By Whom	For Whom	By When (Date)	Needed Resources	Estimated Budget
OP2-a	I	Establish a task force and members to include EOR, Specialty Engineers, HL, Geotech	UDOT	Design / Construction	Mo. 1		
OP2-b		Look at UDOT Prequalification system like MSE walls	Team	Design / Construction	Mo. 2		
OP2-c		Develop Roles and Responsibilities	Team	Design / Construction	Mo. 2		
OP2-d		Develop Bridge Manual Language	Team	Design / Construction	Mo. 3		
OP2-e		Develop Checklists for items like temp Foundations, lift, move…	Team	Design / Construction	Mo. 3		
OP2-f		RFP/Construction Specification Language	Team	Design / Construction	Mo. 3	Total in-house effort 700-800 staff hours	
OB1-1		No Direct Activity identified; subsequent OB1 activities will attract talent to Utah					
OB1-2 thru OB1-5		Review the current UDOT Processes such as training for: action item development; Critical Path Methodology/ schedule development; Decision and resolution methods; and training for conducting efficient progress meetings					
		Clean-up and clarify current processes (utilizing a facilitator on critical activities eg. Partnering)					
		Offer training for beginners as well as an update module on some best practices(clarify the implementation into the workplace); method and timing to be determined by UDOT (on-line self paced training)	UDOT	Industry	Dec 08	250 hours of in-house effort	

APPENDIX J

Notes from Breakout Team # 3

Breakout Session A

A-1. Investigation (Team 3)
Presentation by UDOT project engineer on example upcoming UDOT bridge project (to generate ideas on opportunities and obstacles to UDOT ABC standard practice by 2010)

- Team members can ask questions for clarification only
- List basic project objective and constraints
- List basic bridge objective and constraints
- Each breakout team member keep individual list of ideas on opportunities and obstacles to UDOT ABC standard practice by 2010, as related to example and any other upcoming UDOT bridge projects

Individual Notes; Ideas of Opportunities and Obstacles:

Good location for precast box or arch – Conspan or Bebo
Can 14' minimum clearance be allowed because of low volume?
Possibly excavate roadway to meet clearance?
Objectives: - replace 2 structures - maintain 42' span & 16' clearance - maintain gap at median

A-2. Brainstorming (Team #3)
Open brainstorming on opportunities and obstacles to UDOT ABC standard practice by 2010 (Golden Rule: no critiquing ideas)

Identified Opportunities:

Conspan or Bebo arch - maintain clearance - allow for fill on top so it can be built with road open
Voided slab / box girder - 5"-6" deck to protect box - if all precast, minimize closures
Plate arch
Full precast bridge elements
Temporary bridge for MOT
Take only ½ structure down + phase construction
Shut Interstate down, demolish & replace with precast structure

Identified Obstacles:

Aesthetics - flat slab simple span with free standing abutments – aesthetics with single span
Clearance - Conspan or Bebo arch to maintain clearance

A-3. Development (Team #3)
Rate the Opportunities and Obstacles with a pass/fail (simple majority thumbs up); then prioritize Opportunities and Obstacles that pass and assign "Team Priority" (e.g., Team #2's top priority is designated "T2-1").

Prioritize Opportunities.

Identified Opportunity	Team Vote	Team Priority
Precast box or arch	8	T3-1
Voided slab	7	T3-3
Plate arch	3	T3-7
Full precast FRP elements	7	T3-4
Box girder	2	T3-9
Phased construction, ½ bridge	6	T3-5
Temporary bridge for MOT	4	T3-6
Shut down, with SPMT	8	T3-2
Precast I girders / deck panels	3	T3-8

Prioritize Obstacles.

Identified Obstacle	Team Vote	Team Priority
Clearance	10	T3-1
Aesthetics	3	T3-2

Breakout Session B

B-1. Discussion (Team #3)
Open discussion on Recommendations for what UDOT needs to do to implement the identified Opportunities and to address the identified Obstacles in order to have ABC as the standard practice by 2010 (Golden Rule: Discuss ideas, processes, products…not persons and cultures.)

OB_	Identified Obstacles	Recommendation to Implement Identified Opportunity
OB2		Define who is identified in programmatic - suppliers & vendors - upper management (must be worth the money) - DOT & FHWA - taxpayers / legislature - contractors – specify it will be accelerated - designer buy-in
		Include user costs in policy, procedures, standards
		Research better quality
		Research on lower costs – life cycle - other industries
		Have designers work with contractors during design for constructability
		Set up conceptual estimates to include ABC funding
		Education – add to university classes
OB3		Ensure appealing bridges with public involvement
		Publish “Get in, get out, stay out!” / improve PR
		Projects that work well for use as an example
		Talk about economics
		Use the media

B-2. Development (Team #3)

Refine each proposed Recommendation for implementing the Opportunities and/or addressing the Obstacles to UDOT ABC standard practice by 2010 with a pass/fail (simple majority thumbs up); then prioritize Recommendations that pass and assign "Team Priority" (e.g., Team #2's top priority is designated "T2-1").

OB_	Recommendation to Address Obstacle	Team Vote	Team Priority
OB2	Standardize model for user costs	14	1
	Designers work with contractor for constructibility	13	3
	Develop standards & specifications for ABC	14	2
	Education at university level	5	5
	Conceptual estimates include ABC	9	4

OB_	Recommendation to Address Obstacle	Team Vote	Team Priority
OB3	Publish successes	14	
	Broadcast economic benefits	14	
	Emphasize aesthetics	14	
	Utilize the media	14	

Breakout Session C

C-1. Discussion (Team #3)

Based on the Group-consolidated Recommendations, open discussion on proposed UDOT Action Plans for 2008, 2009, and 2010, including activity, by whom, for whom, by when, needed resources, and estimated budget.
(Golden Rule: Discuss ideas, processes, products…not persons or cultures.)

OP_/OB _	Activity	By Whom	For Whom	By When (Date)	Needed Resources	Estimated Budget
Obstacle OB2: Programmatic Conversion, including stakeholder buy-in						
Recommendation OB2-1: Standardize model for user costs						
	Review existing models: - who is using what models? - car traffic vs. truck traffic					
	Evaluate models: - how do they apply to Utah? - how applied to each project?					
	Hourly rate, time wasted, gas wasted					
	Collect safety data					
	How do user cost $'s translate to real $'s? - ABC pot – established by UDOT and commission - Contractor incentives/disincentives					
	Publish on website with justification?					
Recommendation OB2-2: Have designers work with contractors early for constructability review						
	Addressed by CMGC group					
	Develop and implement process requiring that large ABC projects cannot be DBB (with exceptions)					
Recommendation OB2-3: Include contingencies in conceptual estimates						
	Collect data on cost increase from conventional to ABC					
	Determine % increase in cost for various ABC techniques					
	Improve ABC scope definition at conceptual design stage					
	Review concept report annually					
Recommendation OB2-4: Add ABC to college curriculum						
	Develop seminars on ABC to present on campus (Department driven)					
	Constructions means and methods – discussions with professors					

	Increase student participation in internships (UDOT, designers, contractors, etc.)					
Obstacle OB3: Public buy-in to short closures						
Recommendation OB3-1: Improve PR/PI related to ABC						
	Develop and present seminar for Public Information Coordinator (PIC)					
	Develop short video describing ABC successes					
	Increase ABC information on website					
	Address PR/PI issues early (prior to environmental documentation)					

C-2. Development, cont'd. (Team #3)

Prepare for report out in Closeout Session C

OP_/OB_	Activity	By Whom	For Whom	By When (Date)	Needed Resources	Estimated Budget
Opportunity OB2: Programmatic Conversion, including stakeholder buy-in						
Recommendation OB2-1: Standardize a model for quantifying user costs						
OB2-1A	Review existing models; evaluate models	UDOT	UDOT	07/08	400 man-hr	$40k
OB2-1B	Collect safety data	UDOT	UDOT	done		
OB2-1C	How do user $'s translate to real $'s – pot of money	Technical Committee (UDOT, contractors, designers)	UDOT	12/08	100 man-hr	$20k
OB2-1D	Publish on website	Web guy	UDOT	01/09	8 hrs	$800
Recommendation OB2-2: Have designers work with contractors early in design process – constructability reviews						
-	Addressed by CMGC Group	-	-	-	-	-
OB2-2A	Develop and implement process requiring that large ABC projects cannot be DBB (with exceptions)	UDOT ESD	UDOT	as needed	exists; ongoing job requirement	-
Recommendation OB2-3: Include contingencies in conceptual estimates						
OB2-3A	Collect data on cost increase from conventional to ABC	UDOT	UDOT	On going	100 hr/yr	$10k/yr
OB2-3B	Determine % increase in cost for various ABC techniques	UDOT	UDOT	On going	40 hrs/yr	$4k/yr
OB2-3C	Improve ABC scope definition at conceptual design stage	UDOT	UDOT	On going	-	-
OB2-3D	Review concept report annually	UDOTBridge	UDOT	On going	-	-

		Operations				
Recommendation OB2-4: Coordinate with universities to include ABC in curiculum						
OB2-4A	Develop seminars on ABC to present on campus – department driven	UDOT Structures	Universities	now		
OB2-4B	Construction means & methods – discussion with professors	UDOT Structures	Universities	now		
OB2-4C	Increase student participation in internships (UDOT, designers, contractors, etc.)	UDOT Structures	Everybody	now		
Opportunity OB3: Public buy-in to short closures						
Recommendation OB3-1: Improved PR/PI						
OB3-1A	Develop seminar for the Public Information Coordinators (PIC)	UDOT PIC/Consultant	PICs	now	20 hrs	$2k
OB3-1B	Develop short video discussing ABC successes	PICs/Structures Consultant	Public	07/08 & ongoing		$8k / 15-min. video
OB3-1C	Increase ABC information on website	UDOT	UDOT	ongoing	-	-
OB3-1D	Address PR/PI issues early (prior to environmental documentation)	UDOT Structures/PICs/ Environmental	UDOT	now	Existing	-

APPENDIX K

Notes from Breakout Team # 4

Breakout Session A

A-1. Investigation (Team 4)
Presentation by UDOT project engineer on example upcoming UDOT bridge project (to generate ideas on opportunities and obstacles to UDOT ABC standard practice by 2010)

- Team members can ask questions for clarification only
- List basic project objective and constraints
- List basic bridge objective and constraints
- Each breakout team member keep individual list of ideas on opportunities and obstacles to UDOT ABC standard practice by 2010, as related to example and any other upcoming UDOT bridge projects

Individual Notes; Ideas of Opportunities and Obstacles:

Question: Is 5' drop feasible from RR perspective? Answer: Yes
Question: How many feet are necessary? Answer: Couple hundred feet, RR can handle the grade.

A-2. Brainstorming (Team #4)
Open brainstorming on opportunities and obstacles to UDOT ABC standard practice by 2010 (Golden Rule: no critiquing ideas)

Identified Opportunities:

Standardized details
Prefabrication – superstructures / substructures
Fill engineered (lightweight)
Retaining walls – MSE
Simplify geometry
Good public relations
Coordination with RR & utilities
Use detours in place of staging

Identified Obstacles:

Geometry
Contractor buy-in
Cost
Right-of-way, settlement, utilities, time
Highway geometry, ROW
Cost, staff
Buy-in of ideas & time, cost
Political pressure, overlapping contracts

A-3. Development (Team #4)
Rate the Opportunities and Obstacles with a pass/fail (simple majority thumbs up); then prioritize Opportunities and Obstacles that pass and assign "Team Priority" (e.g., Team #2's top priority is designated "T2-1").

Prioritize Opportunities.

Identified Opportunity	Team Vote	Team Priority
Standardized detail	10	T4-2
Prefabrication – superstructures & substructures	12	T4-1
Use engineered fill	4	T4-7
Retaining walls	7	T4-6
Simplify geometry	7	T4-4
Good public relations	7	T4-5
Coordination with RR & utilities	4	T4-8
Use detours in place of staging	8	T4-3

Prioritize Obstacles.

Identified Obstacle	Team Vote	Team Priority
Need for simplified geometry		T4-4
Contractor buy-in		T4-1
Coordination with utilities & RR		T4-8
Public Buy-in		T4-3
Cost		T4-7

Breakout Session B

B-1. Discussion (Team #4)
Open discussion on Recommendations for what UDOT needs to do to implement the identified Opportunities and to address the identified Obstacles in order to have ABC as the standard practice by 2010 (Golden Rule: Discuss ideas, processes, products…not persons and cultures.)

OP_	Identified Opportunity	Recommendation to Implement Identified Opportunity
OP1	Use of prefab components for entire bridge including seismic	Use FHWA Manual
		Develop go-by drawings
		Coordinate w/ABC seismic research
		Obtain local supplier/fabricator input
		Visit other DOTs – foundations
		Compile PCI & State work/create pilot project
OP3	Standardize UDOT details	Get dedicated standards staff / consultant
		Establish protocol to accept/adopt standards

OB_	Identified Obstacle	Recommendation to Address Identified Obstacle
1	Lack of details for certain connections	Research
	Designer resistance	Training / communication / to get total industry buy-in

B-2. Development (Team #4)
Refine each proposed Recommendation for implementing the Opportunities and/or addressing the Obstacles to UDOT ABC standard practice by 2010 with a pass/fail (simple majority thumbs up); then prioritize Recommendations that pass and assign "Team Priority" (e.g., Team #2's top priority is designated "T2-1").

OP1	Recommendation to Address Opportunity	Team Vote	Team Priority
	Technology transfer - use FHWA connections manual & PCI documents - coordinate with ABC seismic research	13	1

	Obtain local supplier / contractor input	11	2
	Visit other DOTs to look at foundations	1	5
	Pilot project	4	3
	Research gaps in knowledge	3	4

OP3	Recommendation to Address Opportunity	Team Vote	Team Priority
	Dedicated standards/details staff or consultant	10	1
	Establish acceptance protocol	2	4
	Develop go-by drawings	7	2
	Training / communication	3	3

Breakout Session C

C-1. Discussion (Team #4)
Based on the Group-consolidated Recommendations, open discussion on proposed UDOT Action Plans for 2008, 2009, and 2010, including activity, by whom, for whom, by when, needed resources, and estimated budget.
(Golden Rule: Discuss ideas, processes, products…not persons or cultures.)

OP_/OB_	Activity	By Whom	For Whom	By When (Date)	Needed Resources	Estimated Budget
OP1A	Literature search - FHWA scan tour report - FHWA connections manual - PCINE manual - past research - TRIS - disseminate data	DOT	DOT		200 hrs	
OP1B	Seismic connections for moderate seismic zones - participate in pooled fund research or UDOT research (use FHWA dollars) - Recommended opportunities: - NCHRP 12-74 details - grouted couplers - MCEER - U of Washington	University	DOT	2010	2 yrs	$500k
OP1C	Investigate seismic isolation - standard practice in Utah - develop specs (bridge manual & construction)	DOT	DOT	2008	1000 hrs	$100k
OP1D	Obtain contractor & supplier input - meet with each major contractor - post details on web for comment - meet with precasters	DOT	Users	Mid-09	500 hrs	$ 50k
OP1E	Pilot project - focus on foundations - try for federal funding	DOT/ consultant	DOT	2009		$600k
OP3-2A	Develop go-by drawings - finish deck panels - develop integral abutment (see Maine DOT details) - develop cant. Abut. (see NH details)	Consultant	DOT	2010		$300-600k

	- piers – after seismic research - parapets – integral w/slab - foundations - work with geotechs					
OP3-3A	Staff / consultant training - 1-day seminar - online resources - sample bridge - NHI	University / consultant	DOT & consultant	2010		$100k

C-2. Development (Team #4)

Rate each proposed Action to help UDOT be ready to implement ABC as the standard practice by 2010 with a pass/fail (simple majority thumbs up); then prioritize proposed Actions that pass and assign "Team Priority" (e.g., Team #2's top priority is designated "T2-1").

OP1/OB_	Activity	Team Vote	Team Priority
OP1A	Literature search	6	5
OP1B	Seismic connection development	10	1
OP1C	Develop seismic isolation	6	6
OP1D	Obtain contractor / supplier input	7	2
OP1E	Pilot project (foundation)	5	7
OP3-2A	Develop "go-by" details	6	3
OP3-3A	Staff / consultant training	6	4

APPENDIX L

Proposed Action Plans from Closeout Session C

OP_/OB_	Activity	By Whom	For Whom	By When (Date)	Needed Resources	Estimated Budget	Group Votes
Opportunity OP1: Use of prefabricated components for entire bridge							**53**
OP1-1	**Look at details around the world and other industries (e.g., FHWA & PCI documents), visit other DOTs to look at prefabricated foundations, investigate technology transfer, coordinate with the National Seismic ABC Initiative (Ray Wolfe) on seismic details**						
OP1-2	**Obtain contractor & supplier input**						
OP1-3	**Develop a pilot project**						
OP1-4	**Research gaps in knowledge (including seismic)**						
OP1A	Literature search	UDOT	UDOT	2008	200 hrs.	$20k	
OP1B	Evaluate seismic connections: 12-74 details, grouted couplers, MCEER, U of Washington	University	UDOT	2010		$500k	7
OP1C	Implement seismic isolation	UDOT	UDOT	2008	1000 hrs.	$100k	2
OP1D	Obtain contractor supplier input on ABC	UDOT	Users	Mid 2009	500 hrs.	$50k	
OP1E	Pilot project (focus on foundations)	Consultant	UDOT	2009		$600k	
Opportunity OP2: Complete bridge move-in							**50**
OP2-1	**Define roles and responsibilities for the EOR, specialty engineer, heavy lifter, and geotechnical engineer**						
OP2-2	**Develop a plan for expanding the awareness of the heavy move capabilities**						
OP2-3	**Develop a methodology for early involvement for the heavy movers**						
OP2-4	**Standardize deflections, loads, and load factors for allowable and monitoring and also what tolerances are allowed**						
OP2-5	**Develop methodology for communicating boundary conditions between the contractor and heavy mover such as site, Digital Terrain Model and geometry**						
OP2-6	**Develop a methods to promote specialized bridge movers/heavy move use in DBB**						
OP2A	Establish a taskforce (members to include EOR, Specialty Engineer, Heavy Mover, Geotech)	UDOT	Industry	Month 1	750 Hours	$	
OP2B	- prequalify heavy mover, specialty engineer,	Team	Industry	Month 2			
OP2C	- define R&R's including geotechnical	Team	Industry	month 2			

OP2D	- develop bridge manual language addressing structural stresses, haul route, temp foundations, and checklists	Team	Industry	Month 3			
OP2E	- define RFP language/construction spec language	Team	Industry	Month 3			
Opportunity OP3: Successful UDOT standard details, including seismic							
OP3-1	**Need dedicated staff to develop details and acceptance protocol**						**50**
OP3-1A	Establish internal committee (design, construction, materials, geotech, etc.)	UDOT	UDOT	ASAP	?		
OP3-2	**Develop go by drawings including methods to facilitate easy removal and future widenings**						**12**
OP3-2A	Finish deck panel details, develop integral abutment details (Maine DOT as a basis), develop cantilever abutment details (NH DOT), piers (as seismic research is completed), parapets (UDOT), foundations (work with geotechs)	Consultant	UDOT	2008-2010		300-600k	
OP3-3	**Staff/Consultant training**						**2**
OP3-3A	1 day seminar, on-line resources, sample bridge design available, use NHI	Consultant / Univ.	All users	2009-2010		100k	
Opportunity OP4: Innovative ways to remove decks and install deck panels							
OP4-1	**Look at light weight deck panels**						**27**
OP4-1A	Light weight concrete deck panels						5
	-develop specs	UDOT/AGC	UDOT	Dec 08	0.5 PY		
	-develop design standards	UDOT / Consultant	UDOT	June 09	0.5 PY		
OP4-1B	Composite deck panels (FRP, etc.)						5
	-develop specs	UDOT / AGC	UDOT	?	?		
	-develop design standards	UDOT / Consultant	UDOT	?	?		
	-pilot projects	UDOT	UDOT	?	?		
OP4-1C	Steel grid decks with light weight concrete overlay						
	-develop specs	UDOT / AGC	UDOT	Dec 08	0.5 PY		
	-develop design standards	UDOT / Consultant	UDOT	June 2009	0.5 PY		
OP4-1D	Orthotropic deck panels						
	-develop specs	UDOT / AGC	UDOT	?	?		

	-develop design standards	UDOT / Consultant	UDOT	?	?		
OP4-2	**Develop a better spec to address damage to the existing girders during removal process**						**15**
OP4-2A	-Limit demo equipment size (eg 60lb hammer)	UDOT	UDOT	July 08	1000 Hours		
	-define allowable stress state in girder during demo						
	-require demo plan to verify non-composite section (frame stability)						
OP4-2B	Develop pilot projects for specific removal methods (hydro-demo, expansive foam)	UDOT	UDOT	2010	2.0 PYs		
	- conduct national scanning tour to see what other states are doing						
Opportunity OP5: Use of CMGC							
OP5-1	**Refine the CMGC process**						**10**
OP5-1A	Refine selection process for the construction firm	UDOT / AGC	UDOT	3 months	0.1 PY		
	-publish scoring system used						
OP5-1B	Determine CMGC applicability for a project	UDOT	UDOT	2 months	0.25 PY		
	-develop flow chart for decision making						
	-develop standard requirements						
OP5-1C	Improving the negotiation process (public perception)	UDOT / AGC	UDOT /Public	6 months	0.25 PY		2
OP5-1D	Determine contracting method early (DBB, DB, CMGC)	UDOT	UDOT / AGC	4 months	0.05 PYs		
Obstacle OB1: Process for Accelerating Decision-Making							
OB1-1	**Qualified people (empowering, training, and recruiting talent to Utah)**						**31**
OB1-1A	No direct activity identified; subsequent activities will attract talent to Utah						
OB1-2	**Develop a formal partnering process weekly involving subs, suppliers and the department**						
OB1-3	**Clearly define roles and responsibilities at the construction job site**						
OB1-4	**Timelines (accountability for submittals and decisions between contractor and owner)**						
OB1-5	**Formalize field resolution processes (including a centralized escalation/resolution entity)**						
OB1A	Review the processes such as training for action item development, CPM and schedule and decision and resolution methods and training (progress meeting training)						

OB1B	Clean-up and clarify current processes (utilize a facilitator on critical activities eg. partnering)						
OB1C	Offer training for beginners as well as an update module on some best practices (clarify the implementation into the workplace); method and timing to be determined by UDOT (on-line self-paced training)	UDOT	Industry	Dec 08	250 Hours	All rolled up	
Obstacle OB2: Programmatic conversion including stakeholders buy-in							
OB2-1	**Standardize a model for quantifying user costs**						**37**
OB2-1A	Review and evaluate existing models	UDOT	UDOT	Summer 08	400 Hours	$40k	
OB2-1B	Collect safety data	UDOT	UDOT	Done			
OB2-1C	Determine how user dollars translate into real dollars	Technical Committee (UDOT, Contractors, Designers)	UDOT	Dec 08	100 Hours	$20k	
OB2-1D	Publish results on website	UDOT	UDOT/Public	Jan 09	8 Hours	$800	
OB2-2	**Have designers work with contractors early in the design process to perform constructibilty reviews**						**7**
OB2-2A	Develop and implement a process requiring that large ABC project not be DBB (with exceptions)	UDOT ESD	UDOT	As needed			
OB2-3	**Include contingencies in the conceptual estimates**						**10**
OB2-3A	Collect data on cost increase from conventional to ABC	UDOT	UDOT	Ongoing	100 hours per year	$10k/yr	
OB2-3B	Determine % increase in cost for various ABC techniques	UDOT	UDOT	Ongoing	40 hours per year	$4k/yr	
OB2-3C	Improve ABC scope definition at conceptual level	UDOT	UDOT	Ongoing			
OB2-3D	Review concept report annually	UDOT Bridge Operation	UDOT	Ongoing			
OB2-4	**Coordinate with Universities to include ABC in curriculum**						**10**
OB2-4A	Develop a seminar on ABC to present on campuses (1 hour)	UDOT	Universities	ASAP			
OB2-4B	Have discussions with construction management professors about course content	UDOT	Universities	ASAP			
OB2-4C	Increase student participation in internships	UDOT	Everyone	ASAP			
Obstacle OB3: Public buy-in to short closures							

OB3-1	**Improve public relations/public involvement** **- Make sure successful projects are in the news** **- Broadcast the economic benefits** **- Emphasize aesthetics** **- Better utilize the media** **- 1% of the project costs should be set aside for public relations**						**18**
OB3-1A	Develop a seminar for the PICs	UDOT PIC/Consultant	PICs	ASAP		$2k	
OB3-1B	Develop a video illustrating ABC successes	PICs/Structures Consultant	Public	Summer 08 & ongoing		$8k	
OB3-1C	Increase ABC information on the website	UDOT	UDOT	on going			
OB3-1D	Address PR/PI issues early in the conceptual phase (prior to environmental phase)	UDOT Structures / PICs / Environmental	UDOT	ASAP			