March 2010 ABC Pooled Fund Study TAC Teleconference

3/10/2010

Agenda

- Introductions
- Review of January 2010 TAC meeting
- Task 1 updates
- Review of findings from primary literature review content areas
- Next steps
- Discussion
- NOAs

Review of TAC Meeting

JANUARY 2010

Project Goals and Target Users

- Goals of Project
  - Focuses on bringing ABC to ordinary (bread and butter) bridges
  - Tool can be used to help with communications
  - Create decision tool for engineers
  - Assists users of ABC elements in making ABC standard process (standardization)
- Target User Population
  - Project managers: makes the decision => output needs to be clearly communicated
  - Engineers: use the tool to create detailed estimates
  - District owners of project
  - Budget office

Model Variables (1)

- Costs
  - construction costs (ABC vs. Conventional alternatives)
  - user costs e.g. crash costs, delay cost (including quality of life),vehicle operating costs
  - maintenance costs
  - loss of revenue (e.g. tolls)
- Time
  - constraints due to emergencies
  - construction time (ABC vs. Conventional alternatives) e.g. CIT and CCT
- Technical aspects
  - restrictions e.g. level of technical risk, seismic design, conflicts with other constructions
  - detour length (time and mileage) and limitations
  -
- Environment
  - restrictions e.g. urban vs. rural locations, remoteness, railroad, water-work, habitat, weather)
  - environmental impact e.g. noise, emissions, and carbon footprint

Model Variables (2)

- Work zone
  - traffic characteristics e.g. ADT, maximum amount of acceptable traffic queues, traffic closures, lane reductions, delay thresholds, acceptable delays
  - safety and exposure
  - social impact e.g. impact on traveling public, local business
  - life cycle impact

Model Outputs

- $’s
- Cost savings / hour
- Time savings
- Performance measures e.g. hours of travel delay

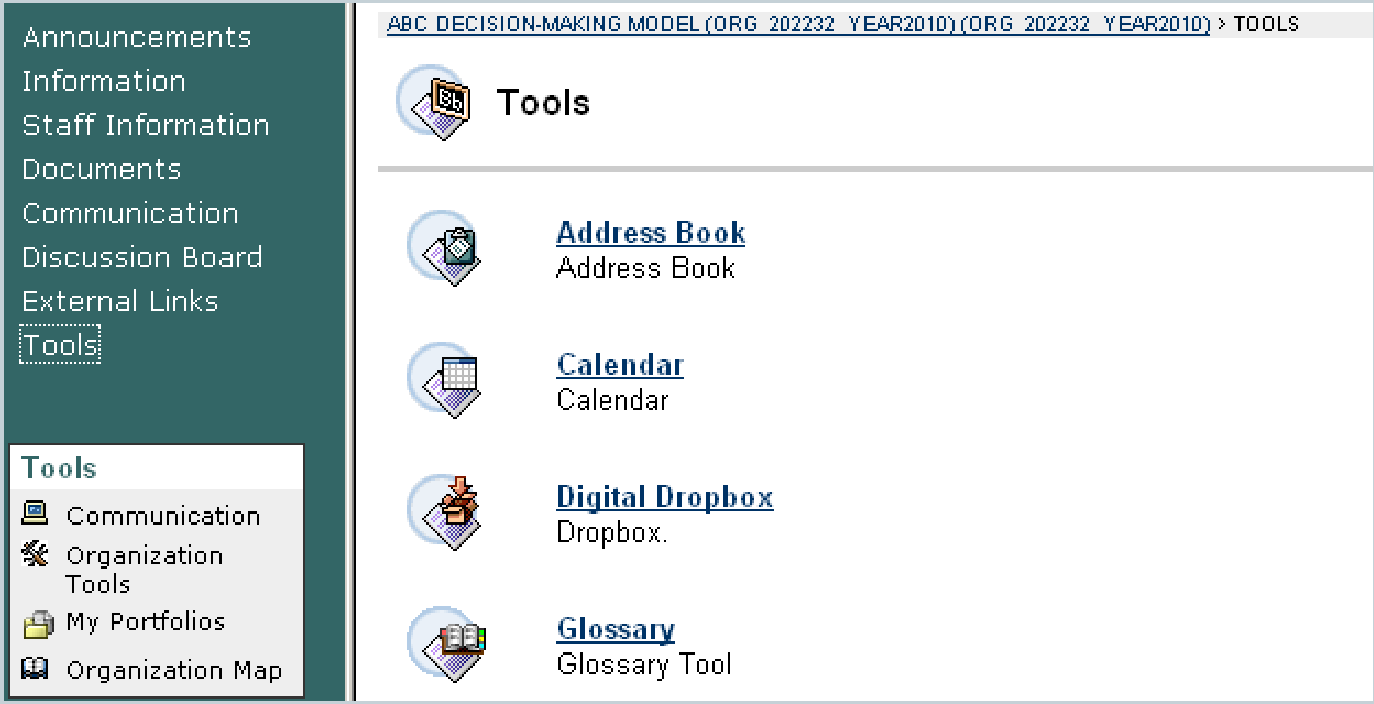
- User manual with references to successful ABC projects and scenarios
- Different contracting methods should allowed
- User should be able to define incentive and disincentives

Task 1 Update

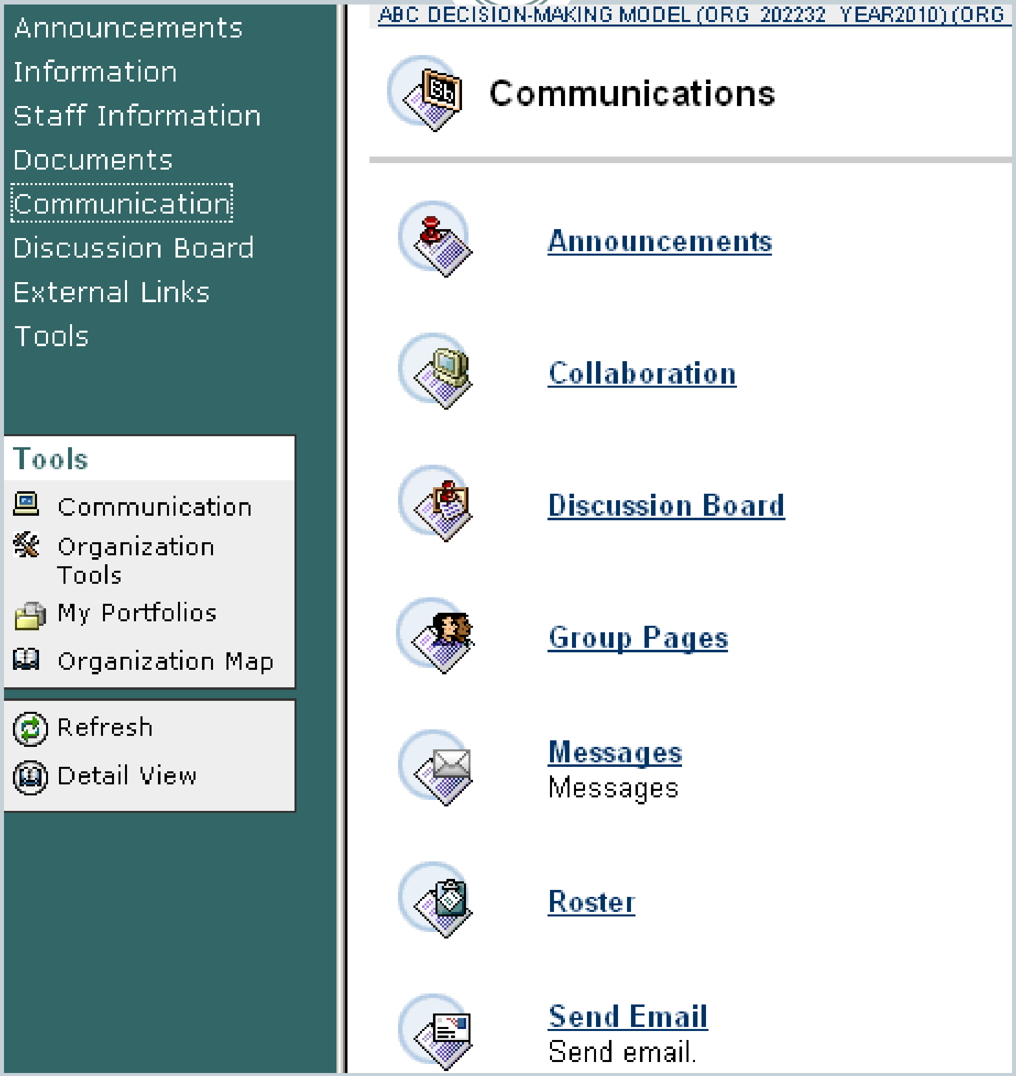
Sharing Information

- Developed project website for sharing all files/information resulting from pooled fund study
- Get a username, send username to research team
- Login at **http://my.oregonstate.edu**

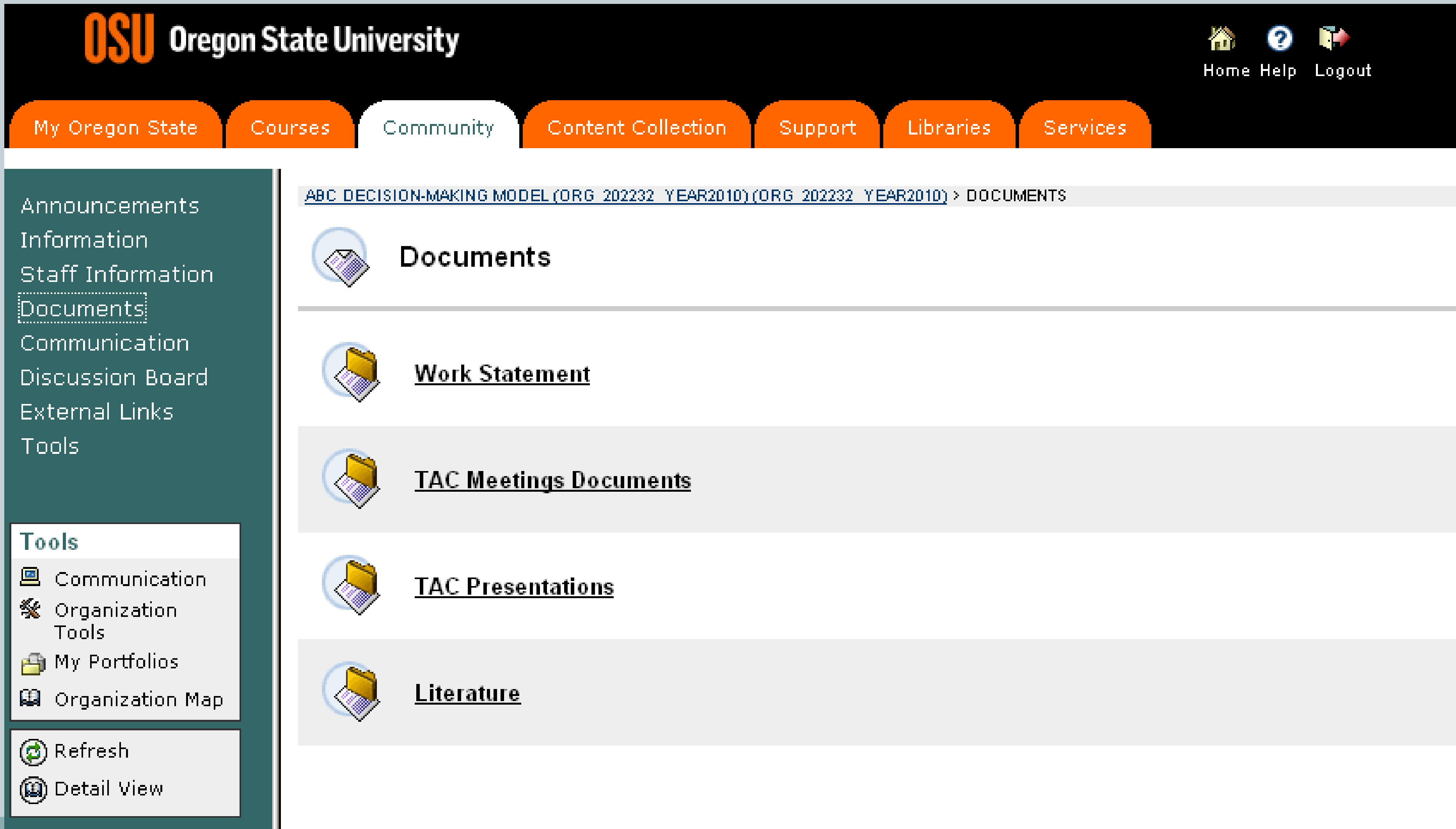
Sending Files to Research Team



Sending E-mail to Research Team



Finding Content



Task 1: WBS

- **1 Task 1**
  - **1.1 Literature Review**
    - **1.1.1 Current state of ABC implementation**
      - 1.1.1.1 Collect all existing reports and presentations
      - 1.1.1.2 Current processes and criteria for decision making
      - 1.1.1.3 Current goals and barriers of using ABC to determine ABC maturity level
      - 1.1.1.4 summarization
    - 1.1.2 Reports on best practices associated with ABC projects
    - 1.1.3 Current propensity for using ABC due to organization culture and industry
    - 1.1.4 Recommendations from ASHTO, NCHRP, RGB, FHWA
    - **1.1.5 Cost estimation studies**
      - 1.1.5.1 Collecting all relevant papers and studies
      - 1.1.5.2 Review economic models and evaluation processes
      - 1.1.5.3 Preliminary ideas for cost estimation model
  - 1.2 Task1 Report

Task 1: Conduct Literature Review

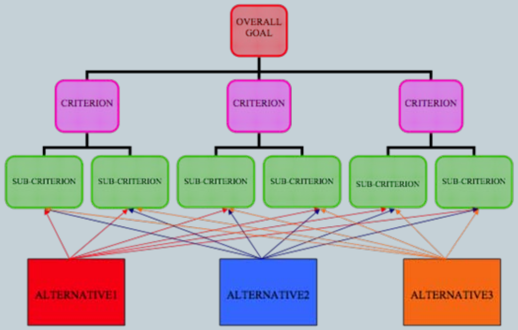
- Reviewed more than 40 documents (journal and conference publications, technical reports, theses, presentations, etc).
- Identified four primary content areas
  - Decision making
  - Successful ABC projects
  - PBES techniques and innovations
  - Cost estimation

Findings from Literature

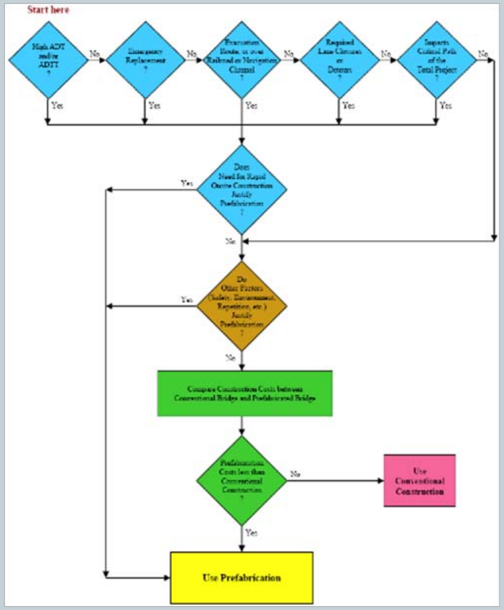
DECISION MAKING

Decision Making Processes and Criteria

- Framework for PBES Decision Making: Flowchart and Matrix for High-Level decision making
- Using AHP to consider both tangible and intangible factors.



Question	Yes	Maybe	No
Does the bridge have high average daily traffic (ADT) or average daily truck traffic (ADTT), or is it over an existing high-traffic-volume highway?			
Is this project an emergency bridge replacement?			
Is the bridge on an emergency evacuation route or over a railroad or navigable waterway?			
Will the bridge construction impact traffic in terms of requiring lane closures or detours?			
Will the bridge construction impact the critical path of the total project?			
Can the bridge be closed during off-peak traffic periods, e.g., nights and weekends?			
Is rapid recovery from natural/manmade hazards or rapid completion of future planned repair/replacement needed for this bridge?			
Is the bridge location subject to construction time restrictions due to adverse economic impact?			
Does the local weather limit the time of year when cast-in-place construction is practical?			
Do worker safety concerns at the site limit conventional methods, e.g., adjacent power lines or over water?			
Is the site in an environmentally sensitive area requiring minimum disruption (e.g., wetlands, air quality, and noise)?			
Are there natural or endangered species at the bridge site that necessitate short construction time windows or suspension of work for a significant time period, e.g., fish passage or peregrine falcon nesting?			
If the bridge is on or eligible for the National Register of Historic Places, is prefabrication feasible for replacement/rehabilitation per the Memorandum of Agreement?			
Can this bridge be designed with multiple similar spans?			
Does the location of the bridge site create problems for delivery of ready-mix concrete?			
Will the traffic control plan change significantly through the course of the project due to development, local expansion, or other projects in the area?			
Are delay-related user costs a concern to the agency?			
Can innovative contracting strategies to achieve accelerated construction be included in the contract documents?			
Can the owner agency provide the necessary staffing to effectively administer the project?			
Can the bridge be grouped with other bridges for economy of scale?			
Will the design be used on a broader scale in a geographic area?			
Totals:			



Findings from Literature

SUCCESSFUL ABC PROJECTS

ABC Best Practices Sources

- Accelerated Bridge Construction Success Stories (FHWA, 2006)
- Final Report Highways for Life Report (ODOT, 2009)
- California and Washington strategic plans, UDOT white paper on benefits and costs of PBES
- Scan reports from Europe and Japan introducing accelerated construction projects conducted using innovative accelerated technologies

ABC Maturity Level

- Primary ABC Goals
    - Deliver projects earlier to traveling public
    - Reduce the impacts of on-site construction
    - ABC to become Standard Practice

ABC Maturity Level

- Barriers to ABC Use
  - Traffic detour issues
  - Technical issues related to seismic design, structure durability and reliability
  - Poor communication and coordination between stakeholders
  - Lack of technology for rapid bridge construction and replacement technologies for extreme events
  - Development needed in design methodologies, contracting approaches, material supply chain management

ABC Justification from Community/Industry Perspective

- Delivering bridge construction projects quickly to reduce congestion and improve safety.
- Delivering long lasting bridges quicker.
- September 11 and subsequent potential threats to U.S. transportation systems ➔ need to develop emergency response plans to quickly react to consequences of extreme events.

ABC Justification from Federal Perspective (1)

- Develop, Implement, and Promote ABC: Because of the success of accelerated bridge construction projects to date, the FHWA has increased its support efforts and resources to further advance the development of these systems into more conventional practice nationwide.
- The FHWA Framework for Prefabricated Bridge Elements and Systems (PBES) Decision-Making, to ensure cost-effective use of prefabricated bridges.

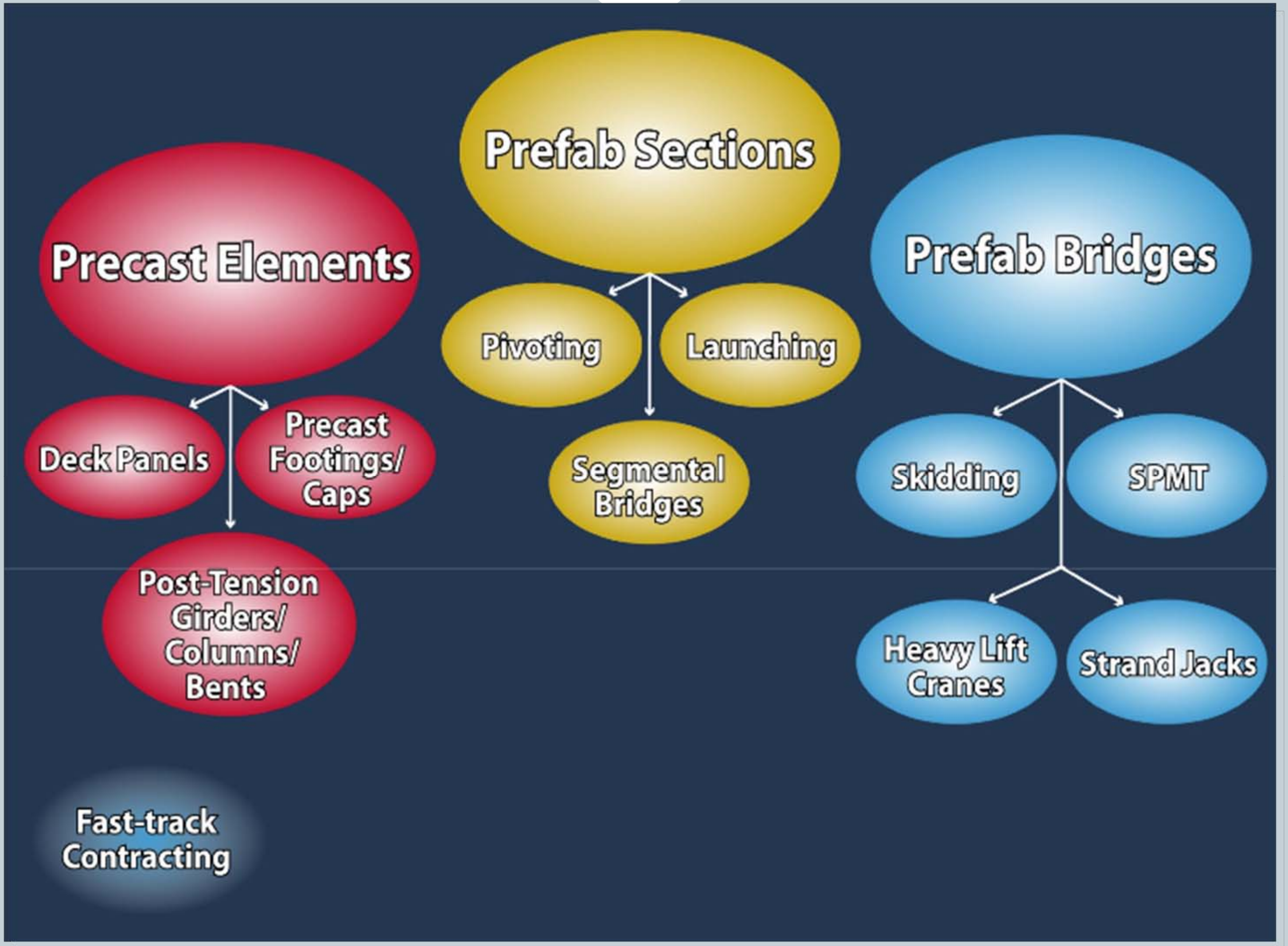
ABC Justification from Federal Perspective (2)

- Recommendations for Updating Highway Emergency Response Plans for Extreme Events (AASHTO, FHWA), Design of Bridges for Extreme Events (NCHRP)
- Focus of recent national initiatives by AASHTO TIG and FHWA is on newer, innovative prefabricated bridge elements and systems, e.g., bent caps, abutments, full-depth deck panels, and totally prefabricated superstructure and substructures.

Findings from Literature

PBES TECHNIQUES AND INNOVATION

ABC Technologies Currently in Use



Source: Successful use of accelerated bridge construction techniques in UTAH, New Jersey DOT, 2009

Management Best Practices in Use

- Staged construction
- Changing normal operational procedures along with A+B contracting
- Changing normal operational procedures I/D contracting
- Lane Rentals
- New design techniques and materials

Findings from Literature

COST ESTIMATION

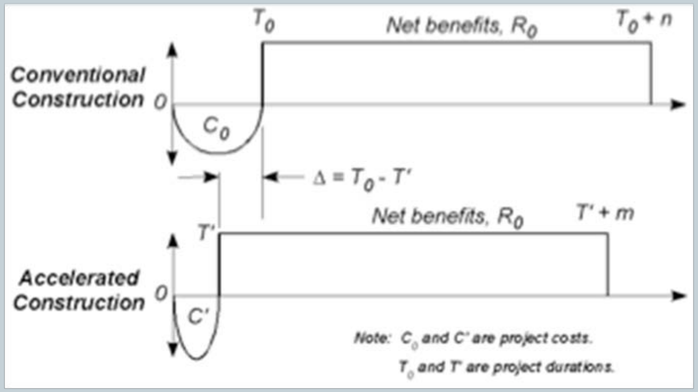
Cost Estimation Approaches (1)

- User Cost Categorization: Vehicle operational costs (VOC), Delay Costs, Crash Costs or Safety Related Costs (report_012309)
- Assessing value of time lost in congestion and vehicle operating costs resulting from congestion

Cost Estimation Approaches (2)

- Many agencies are investigating economic tools such as life-cycle cost analysis (LCCA) to help them choose the most cost-effective alternatives and communicate the value of those choices to the public.
- Estimating User Costs and Economic Impacts of Roadway Construction in Six Federal Lands Projects (FLH–QuickZone)

Cost Estimation Approaches Examples



$$PW = \sum_{k=a+1}^{b} \frac{R_k}{(1+r)^k} = R_0 \sum_{k=a+1}^{b} \frac{1}{(1+r)^k}$$

$$NPV = Initial\ Cost + \sum Future\ Cost * \left[\frac{1}{(1+i)^n} \right]$$

Table A-3: Average Auto Operation Cost in Washington State.

	$/mile	$/hour
Vehicle-Based		
Fuel cost (excluding taxes)	0.121	5.44
Fuel taxes	0.023	1.05
Engine oil change	0.012	0.53
Repair and maintenance	0.049	2.205
Tire cost	0.007	0.315
Tolls	0	0
Sub Total	**0.21**	**9.53**
Driver/Passenger-Based		
50% of average wage rate	0.25	11.19
Sub Total	**0.25**	**11.19**
Total Expense	**0.46**	**20.72**

Table 11. Summary of LCCA cost computations (20-year analysis period).

Cost Category	Age (yrs)	Baseline Pavement Service Life (11 years)	As Built (PCfC) Pavement Service Life (20 years)
Preliminary Design and Engineering, Construction, Construction Engineering, and Incentives Delay-Related User Costs Crash-Related User Costs	0	$3,792,056 $2,064,185 $ 67,667	$5,161,128 $ 346,816 $ 0
Preventive Maintenance (MDOT Manual) 11.12 lane-mile @ $27,192 per lane-mile	5 (baseline) 6 (as-built)	$ 302,375	$ 302,375
Preventive Maintenance (MDOT Manual) 11.12 lane-mile @ $44,891 per lane-mile	9 (as-built)		$ 499,188
Reconstruction or HMA Overlay (Preliminary Design and Engineering, Construction [Roadway Pay Item, Mobilization, Traffic Control, Contingencies], Construction Engineering) Delay-Related User Costs Crash-Related User Costs	11 (baseline)	$ 102,043 $2,551,065 $ 127,553 $ 178,575 $ 76,532 $ 165,819 $2,064,185 $ 67,667	
Salvage Value (2 of 11 years remaining life for baseline pavement)	20	- $ 582,107	$ 0
Total Actual Costs		**$ 10,977,615**	**$ 6,309,507**
Net Present Value of All Costs		**$ 9,679,453**	**$ 6,116,503**

Next Steps

Task 1: Conduct Literature Review

- Document literature review findings in written report
  - Complete list of reviewed reports and citation
  - One paragraph summary of each document
  - Synthesized summary of findings

Task 2: Document Current Use of ABC

- Develop a data collection template
  - Recommend that we use BCI framework
- Analyze 8 ABC projects, completed under the Highway for LIFE program.
- Use archival records and/or interviews to summarize project characteristics, cost data, and specific elements of ABC that were applied

Bridge Construction Impact (BCI)

- Facility Category
  - I. Residential community traffic
  - II. Local streets (business and residential).
  - III. State routes, major city arties, or minor utilities (water channel etc).
  - IV. Interstate or State Highways
  - V. Essential artery, major landmark facilities, utilities, or natural hazard (waterways, swamp lands, etc.)
- Mission Impact Type
  - Capacity Improvement/Restoration- Improve or restore capacity to relief existing traffic congestion due to an event, incident, or demand growth.
    - C1- Lanes and shoulder widen, soundwall addition, and add/restore 1-30% of total lanes and/or shoulder widen.
    - C2- Add/restore 31-66% of total lanes + shoulder widen.
    - C3- Add/restore 67-100% of total lanes + shoulder widen.
- Traffic Impact Intensity
  - Traffic Delay- Due to temporary construction-related operations on traffic congestion (number of days).
    - T1 - Reduce widths of lanes and shoulder, closure of 1-30% of total lanes and/or shoulder or lane realignment.
    - T2 - Closure of 31-66% of total lanes + shoulder.
    - T3 - Closure of 67-100% of total lanes + shoulder.
- Environmental Impact Levels- Due to temporary construction-related operations (number of days).
  - E1- None to Mild
  - E2- Moderate
  - E3- Severe
- Impact Measures: in XX of YY-hour days (Z)
  - XX= Number of days; YY= Number of hours; Z = Type of hours:
  - PK= Peak, commuting and heavy traveled hours.
  - OP=Off-Peak, non-commuting and moderate traveled hours.
  - NS=Non-standard, light-traveled hours (e.g. midnight)

BCI index is used to evaluate different structural alternatives in decision making.

This criteria set can help to identify and characterize structure types and projects.

Discussion

Discussion

- Additional reports that we have missed
- Synthesized findings (consistent or not with TAC member experiences)
- Decision-making tools
- Next face-to-face TAC meeting purpose