NATIONAL ACADEMIES *Sciences Engineering Medicine*

TRB TRANSPORTATION RESEARCH BOARD

TRB Webinar: Accelerated Bridge Construction Programmatic Implementation

August 30, 2023

1:00 – 2:30 PM

NOVEMBER 2022 UPDATE

PDH Certification Information

1.5 Professional Development Hours (PDH) – see follow-up email

You must attend the entire webinar.

Questions? Contact Andie Pitchford at TRBwebinar@nas.edu

The Transportation Research Board has met the standards and requirements of the Registered Continuing Education Program. Credit earned on completion of this program will be reported to RCEP at RCEP.net. A certificate of completion will be issued to each participant. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the RCEP.

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AICP Credit Information

1.5 American Institute of Certified Planners Certification Maintenance Credits

You must attend the entire webinar

Log into the American Planning Association website to claim your credits

Contact AICP, not TRB, with questions

Purpose Statement

This webinar will provide training in implementing ABC programs. Presenters will share how to establish a strategic plan, estimate time and cost for projects, and how to reduce and offset costs.

Learning Objectives

At the end of this webinar, you will be able to:

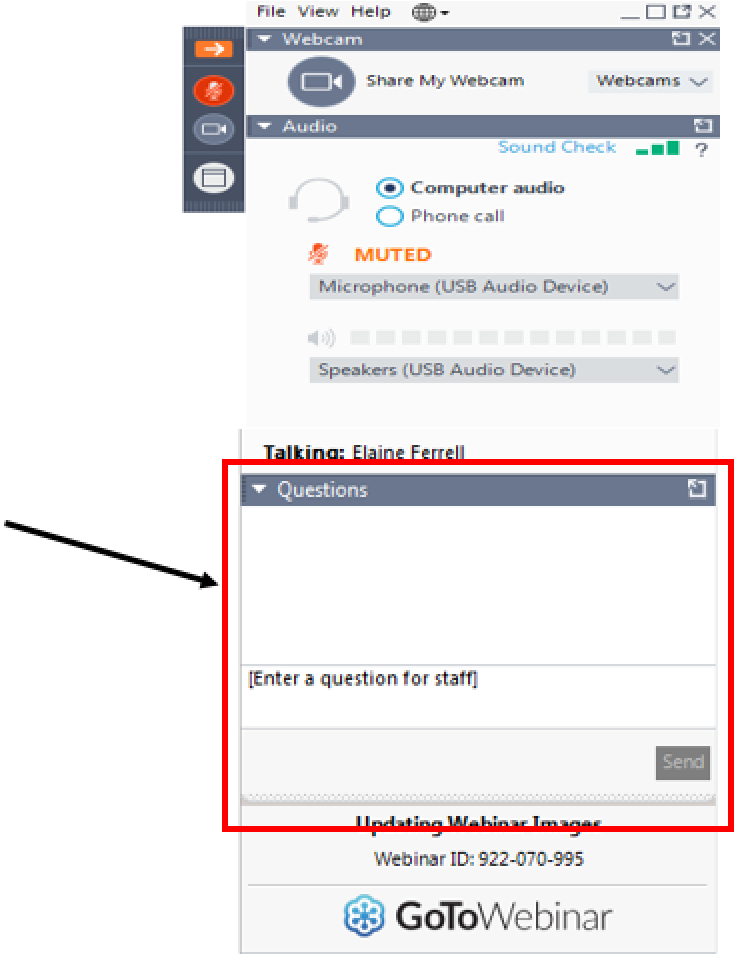
(1) Establish a strategic ABC plan to turn detractors into champions

(2) Estimate time and cost for ABC projects

(3) Reduce and offset ABC costs

Questions and Answers

- Please type your questions into your webinar control panel
- We will read your questions out loud, and answer as many as time allows



Today's presenters

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Timing, cost estimating, and implementing ABC in a state Department of Transportation

Michael P. Culmo
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Transportation Research Board Webinar
Accelerated Bridge Construction Programmatic Implementation
August 30, 2023

ABC Cost and Time

Normally we say:
Time = money

Meaning more time means more money

ABC is somewhat different:

Less time often means more money (higher bid), but not always

Why is this so?
Let’s explore this

How Much Does ABC Construction Cost?

It depends…..

How fast is fast
- Build a bridge in a weekend: Very expensive
- Build a bridge in two weeks: Not too expensive
- Build a bridge in a month: Can be the same price

Overtime pay
- Weekends, nights

Details
- Complex details tend to be more expensive

Site conditions
- Difficult sites can lead to higher costs

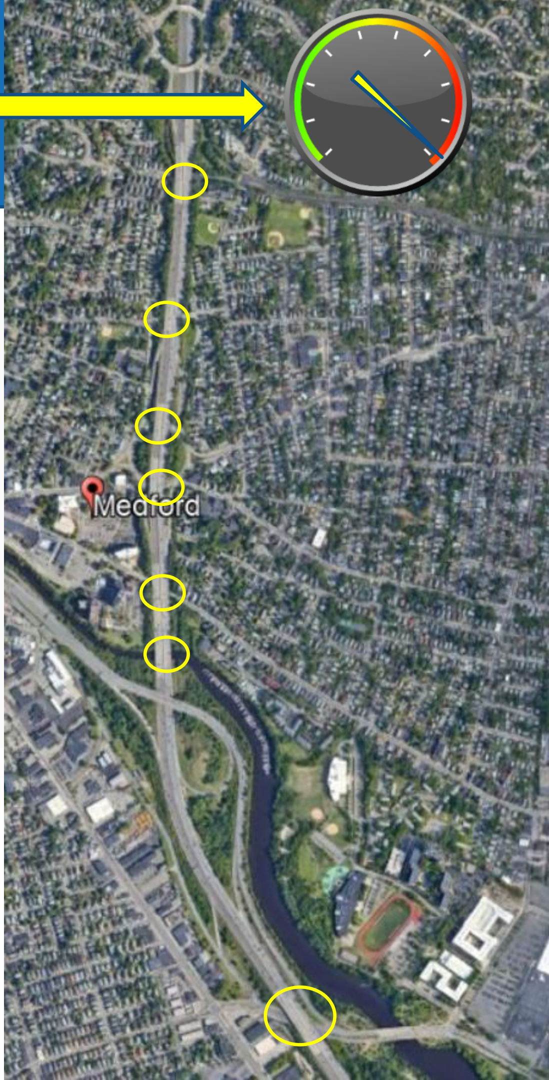
Equipment
- Specialized equipment is pricey

Let's look at some examples

Project Example: Very Fast

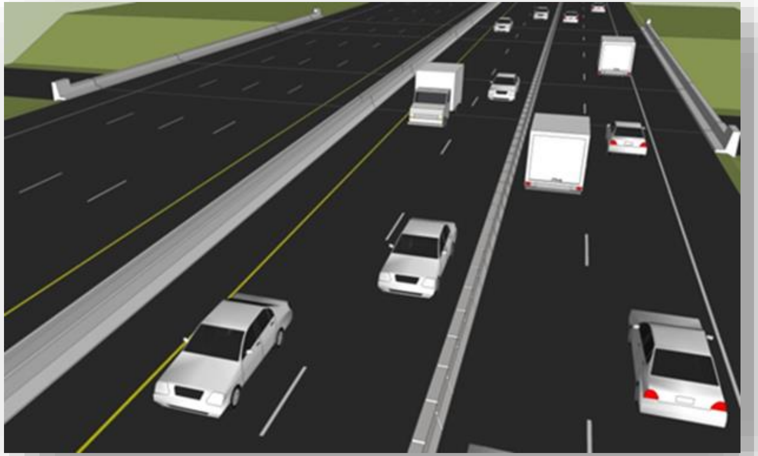
Project Information

- 93Fast14
- I-93 Just north of "Big Dig"
  - 180,000 ADT
- Superstructure replacements
- 14 Bridges
  - 7 Pairs of two: 7 NB, 7 SB
  - Most were 3-span bridges with joints



Traffic Management

- Close entire bound during weekends
  - 55-hour closure
    - Give entire other bound over to the contractor
  - Desired Production:
    - Two bridges per weekend



Construction Sequence

Friday night, 9:00 pm – Demolition begins

Construction Sequence

Friday night – Beam removal and cutting

Construction Sequence

Saturday afternoon – Erection continues

Construction Sequence

Sunday morning – Placement of high early strength concrete in closure joints

Construction Sequence

Completed bridge

Project Example: Very fast

Bid cost information

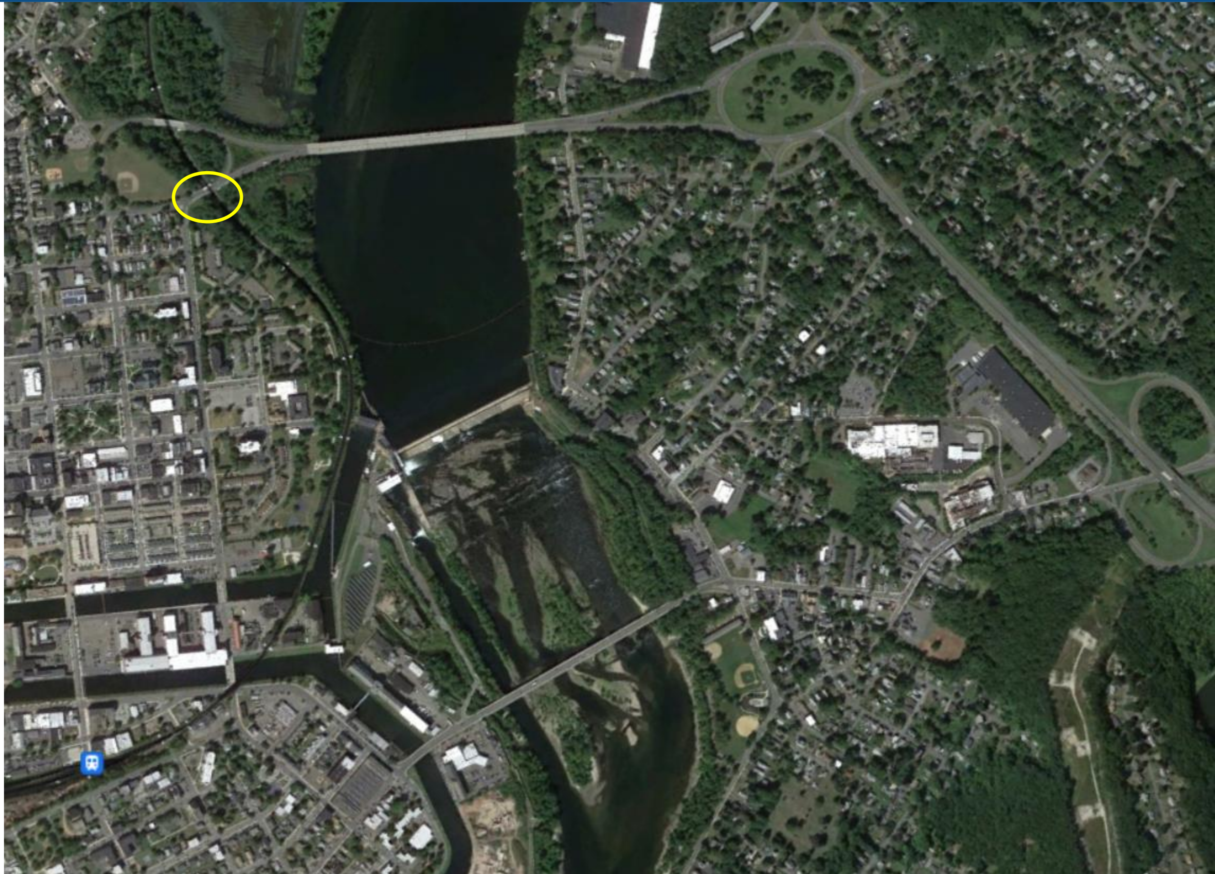
- ABC was 80% more expensive than conventional construction
- Why?
  - Very tight timeframe
  - I/Ds
    - Incentive: $1,000,000 per weekend if completed before Monday morning
    - Disincentive: $1,000,000 per weekend if not
- Considered to be a cost success?
    - Conventional construction would have been 5 years
    - ABC was built in one year
    - CEI and traffic management costs for 4 years were found to be similar to the ABC premium

Project Example: Moderately fast

MassDOT Project

Location: Holyoke, MA

- Road was essentially a bypass for a busy “downtown”
- Detouring traffic was not an option

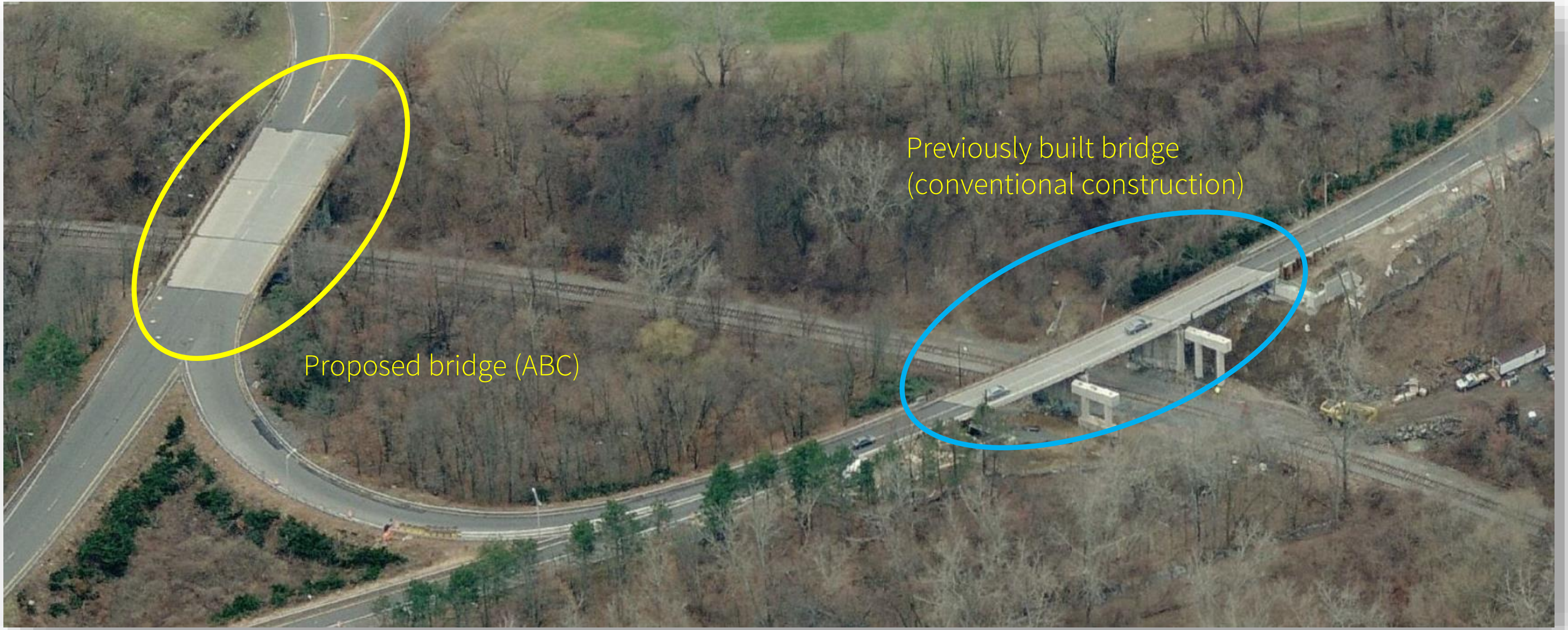


Project Example: Moderately fast

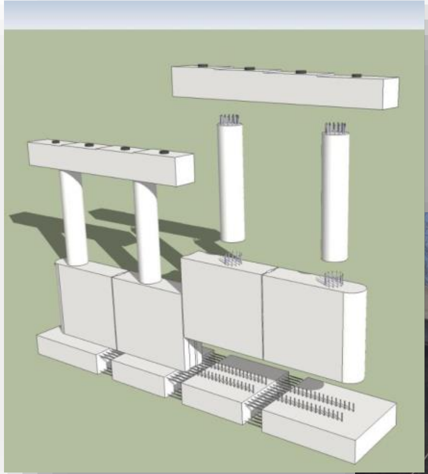
3-span bridge replacement

- Project approach
  - Use staged (or phased) construction
  - ABC light: Replace the bridge in one construction season

Project Example: Moderately fast



Project Example: Moderately fast



Project Example: Moderately fast

Cost information

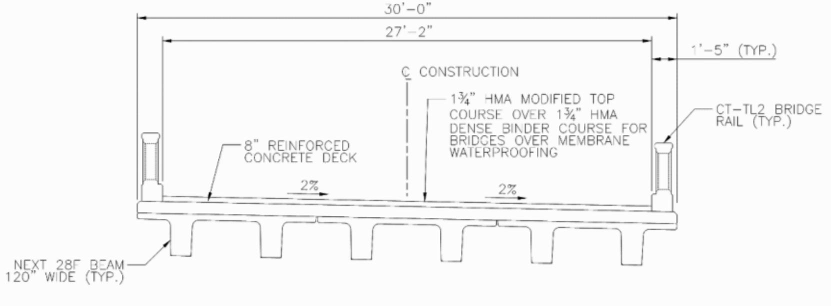
- ABC was 27% more than conventional construction
- Why?
  - Complex post-tensioning system on the deck
  - We would use more simple closure joints now

Project Example: Comfortably fast

MassDOT Project:

Single Span Bridge Replacement

- Project approach
  - Close road and set up a detour
  - Accelerated construction (to a degree)
  - Use prefabricated elements
    - Precast abutments
    - Precast NEXT Beams with CIP topping
  - 60-day full closure allowed



TRANSVERSE SECTION OF SUPERSTRUCTURE
SCALE: ¼" = 1'–0"

Project Example: Comfortably fast

Construction:

Project Example: Comfortably fast

Construction:

Project Example: Comfortably fast

Construction:

Project Example: Comfortably fast

Construction:

Project Example: Comfortably fast

Construction complete:

Project Example: Comfortably fast

Cost differential

- ABC was 10% higher compared to conventional construction
- Why so low?
  - Comfortable speed
  - No overtime or weekends
  - Simple details

Cost of Prefabrication?

Why is precast sometimes more expensive?

- One reason: Handling of the materials
- CIP Construction:
  - Concrete shipped to site in ready mix truck and placed
    handled once
- Precast Construction
  - Concrete placed in forms in the plant
  - Element removed from the form and stacked
  - Element lifted onto truck
  - Element off loaded
    handled 4 times
- Each time it is handled, it costs money

I/Ds and Risk

- Disincentives
  - Disincentives can create RISK for the contractor
  - Tight milestones or high disincentives = RISK
- Risk = $$
- Why is it difficult to put a finger on ABC costs?
  - Contractors bid RISK
  - Designers do not estimate RISK

How Can Owners Address Risk?

Understand that incentives and disincentives come at a price

- Pick incentives and disincentives that are commensurate with the needs
- Typically user costs

Tight schedules come at a price

- Consider relaxing the schedule if possible

Accept that some risk is inherent in ABC

- It will most likely cost more
- Look for cost savings elsewhere – More on this later today

Recommendations for Cost Premiums

These are budget level estimates based on the project examples presented today

This is heavily influenced by a number of factors that were previously discussed

States can develop similar matrices based on their experiences

	Construction Speed				
	1-2 days	4 days	9 days	16 days	1-2 Months
Complex Process Difficult site	2.0	1.8	1.7	1.6	1.5
Complex Process Moderate site	1.8	1.7	1.6	1.5	1.4
Moderate Process Difficult Site	1.7	1.6	1.5	1.4	1.3
Moderate Process Good Site	1.6	1.5	1.4	1.3	1.2
Simple Process Good Site	1.5	1.4	1.3	1.2	1.1

Estimating ABC Construction Durations

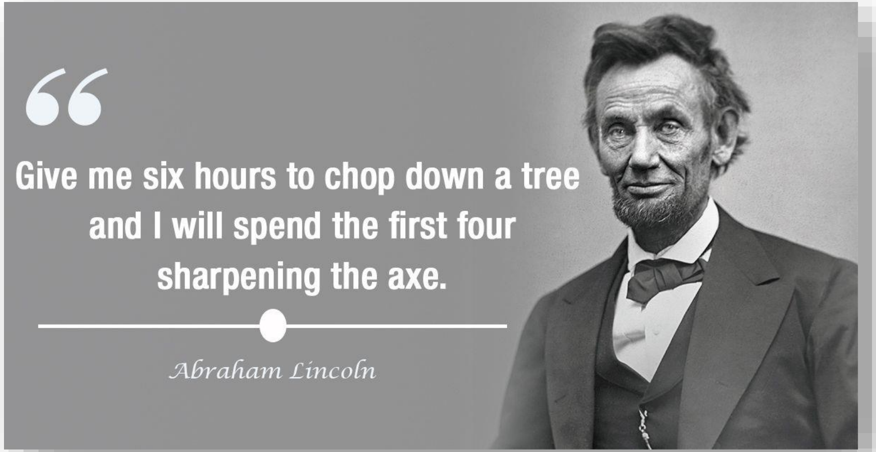
As with cost, there are several factors that influence construction time

- Details
- Site conditions (access, staging areas)
- Specialized equipment
- Contractor experience

Pre-Construction Planning

There is significant planning time required prior to the actual ABC construction period:

- Preparing the site
- Building substructures between existing substructures
- Fabricating elements
- Developing an assembly plan
- Etc.



Estimated minimum durations for ABC

Example:

Superstructure replacement with modular deck beams

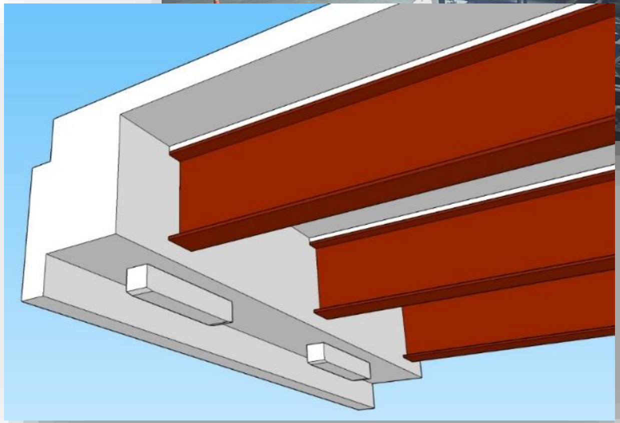
- Weekend (50-55 hours)
- High early strength concrete or UHPC can be used for the closure joints

Estimated minimum durations for ABC

Example:

Superstructure replacement with lateral sliding

- Assuming substructures built ahead of time (under the existing bridge)
- Weekend recommended (50-55 hours)
- Can be done in 24 hours
- Simple details are the key



Estimated minimum durations for ABC

Example:

Superstructure replacement with SPMTs

- Assuming substructures built ahead of time (under the existing bridge)
- Weekend recommended (50-55 hours)
- Can be done in 24 hours
- Simple details are the key

Estimated minimum durations for ABC

Example:

Deck replacement with precast full-depth deck panels

- Can be done in a weekend, but very difficult
- 5-9 days is reasonable

Estimated minimum durations for ABC

Example:

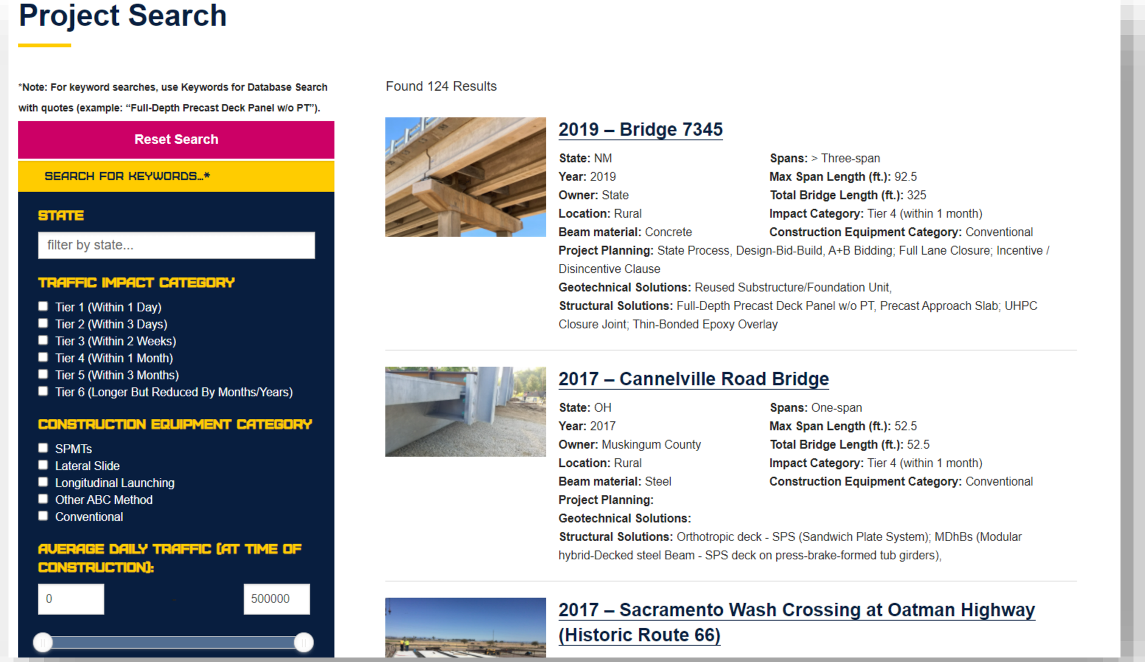
Full bridge replacement including substructures

- 30 -45 days depending on foundations, substructures, and ABC methods
- Try to build some substructures under the existing bridge
- Recommend a detailed CPM schedule to look at all aspects

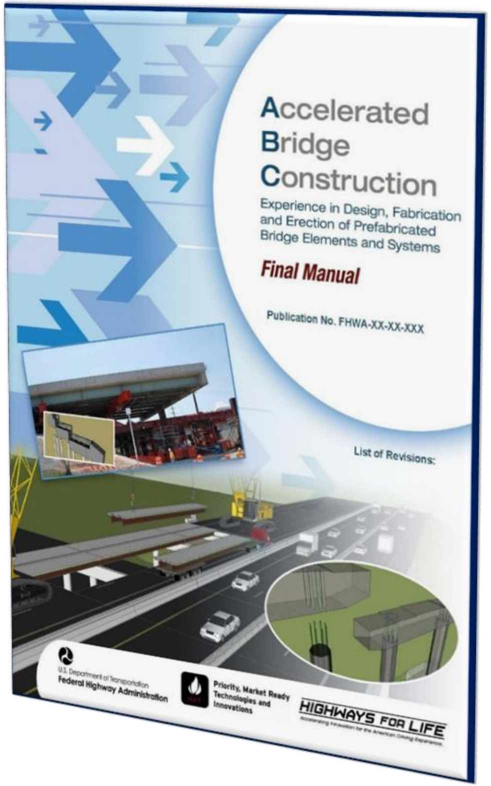
Estimated minimum durations for ABC

Other sources of construction timeframe estimates:

- Florida International University ABC UTC database
  - Numerous example projects that can be reviewed
  - Sorted by project type



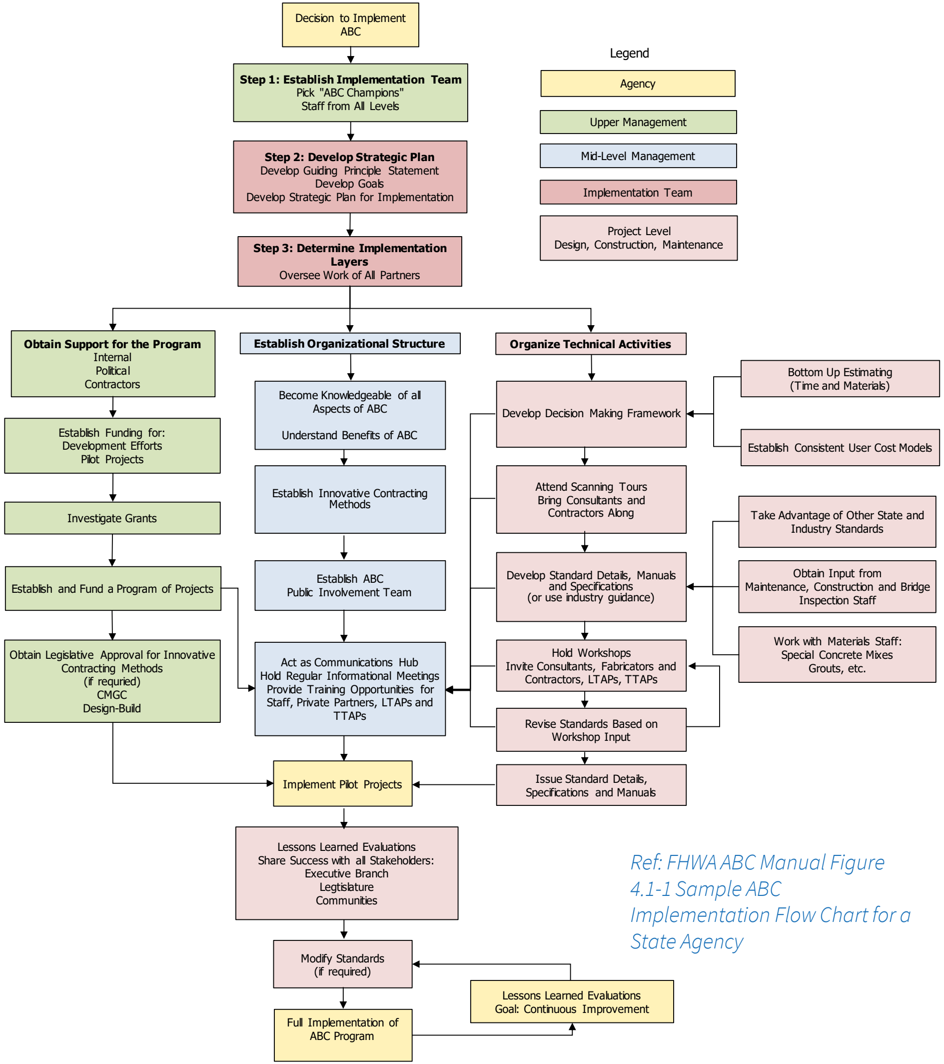
Implementing an ABC Program



Suggested ABC Organization

Based on successful programs (Utah)

- 3 Levels of implementation
  - Upper management
  - Mid-level management
  - Project level
- 3 Layers of activities
  - Programmatic
  - Organizational structure
  - Project-level implementation
- A single ABC unit cannot effectively re-direct an entire agency

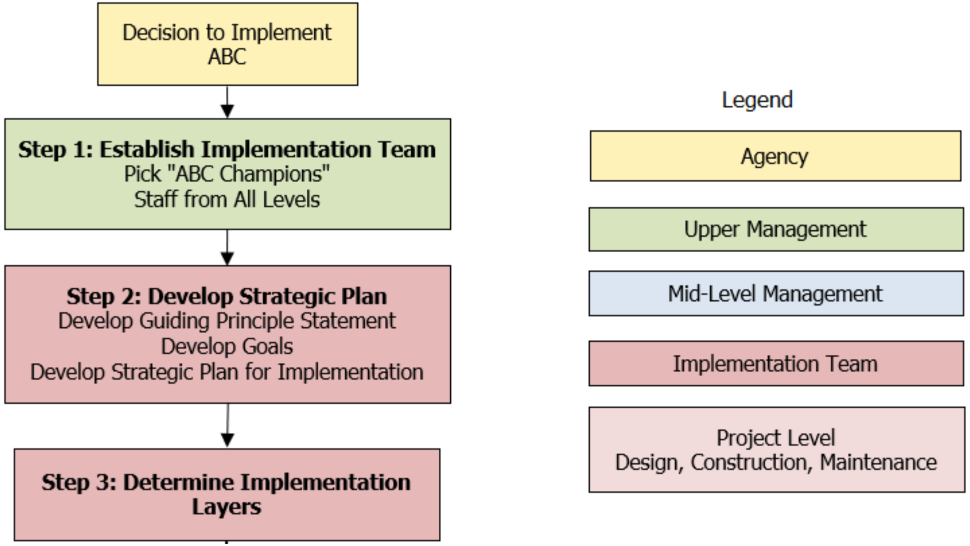


Ref: FHWA ABC Manual Figure 4.1-1 Sample ABC Implementation Flow Chart for a State Agency

First Steps

Getting started:
Establish a policy then…

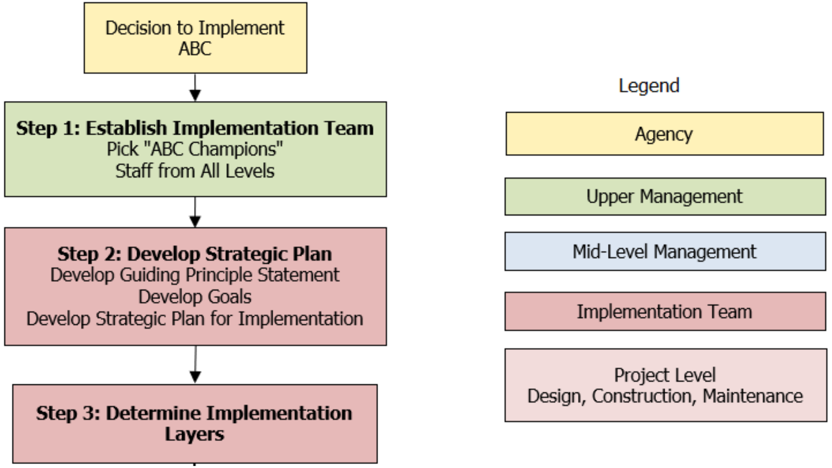
- Step 1: Implementation Team
- Step 2: Strategic Plan
- Step 3: Determine Implementation Approach



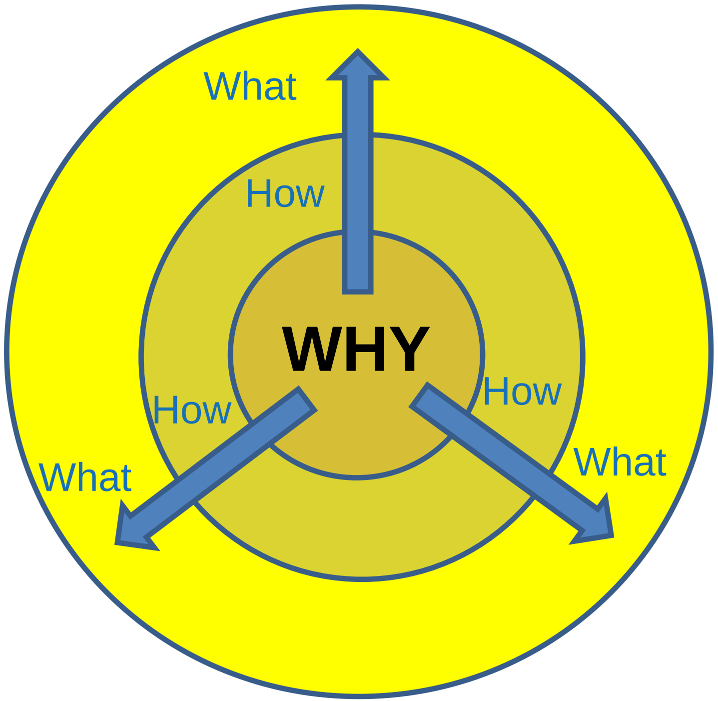
Step 1: Establish Implementation Team

Team make-up

- Upper management: Administration
- Mid-level management: Unit heads
- Project-level
    - Design team leaders
    - Construction managers
    - Materials staff
- These folks will be the champions of ABC within the agency
- They will get the ball rolling and oversee the implementation of ABC
- Act as a resource to all units

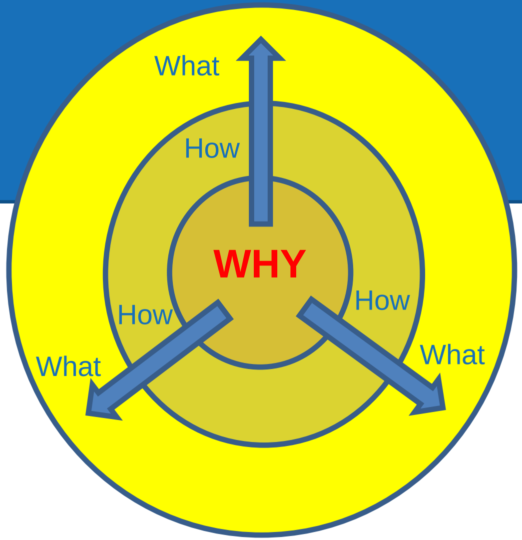


Step 2: ABC Strategic Plan Development



- The concept of the "Golden Circle"
  - Every process needs to be based on the "WHY" (origin of the circle)
  - The "HOWs" are the processes to achieve the desired outcomes
  - The "WHATs" are the desired outcomes

Start with "WHY"

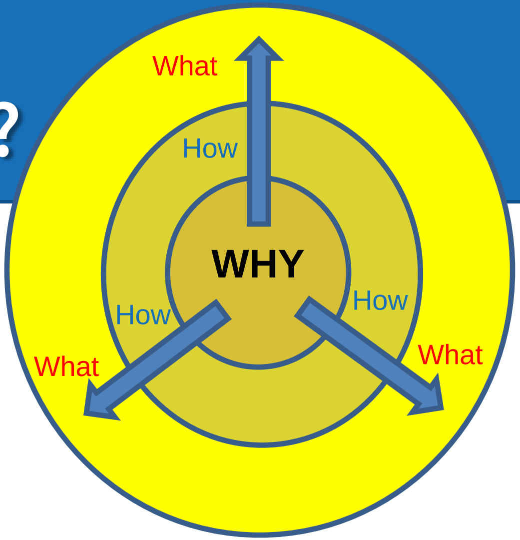


The ABC Team should determine the messaging for WHY do we use ABC?

- Fortunately, as an industry, we have stated this already
- FHWA ABC website (and virtually every ABC publication)
  - Improved safety for travelers and workers
  - Improved quality and durability
  - Reduced user impacts (Time = $$)
  - Reduced environmental impacts
  - Reduced construction management costs
- Develop a "Guiding Principle Statement": My idea…..

  "Changing construction to better serve society"
  - The agency can develop something similar depending on the needs of the agency

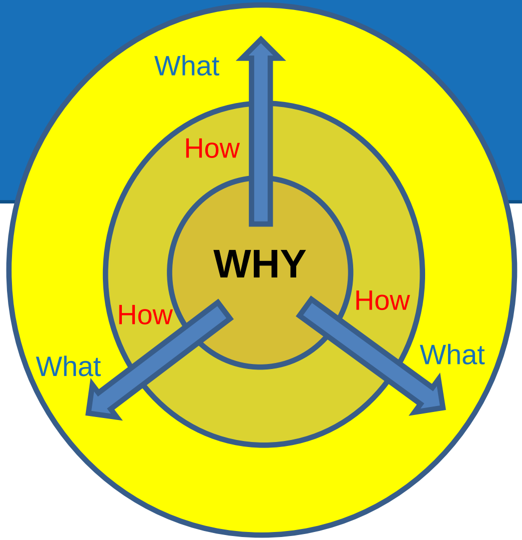
“WHAT” do we want to accomplish with an ABC Program?



Based on the Guiding Principle Statement, the ABC Team should identify WHAT should be accomplished in an ABC Program

- Identify the goals of the program
- Develop a framework for an ABC Program
- Use the SMART principle
  - Specific
  - Measurable
  - Achievable
  - Relevant
  - Time based

“HOW” do we get there?



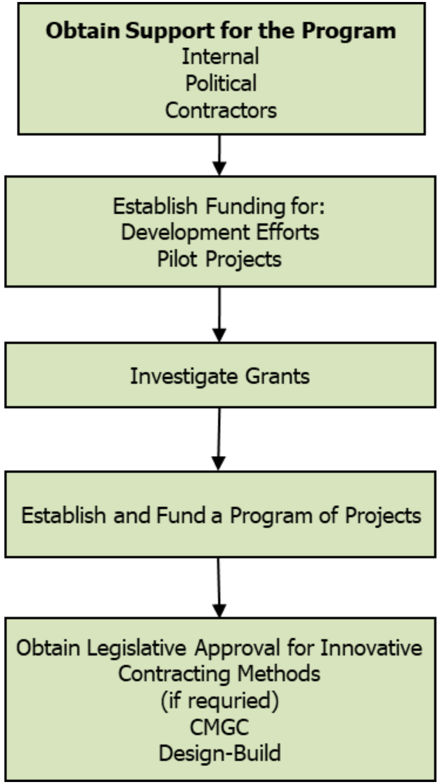
The ABC implementation team can then develop a strategic plan

- We know the “WHY” and the “WHAT”, what about the “HOWs”?
  - Determine the tools necessary to execute an ABC Program
  - Connect the WHY to the WHATs
  - The following slides will provide a suggested roadmap

Three Layers of Activities – Layer 1

Use a multi-layer approach

- Obtain support for the program
- Establish organizational structure
- Organize technical activities



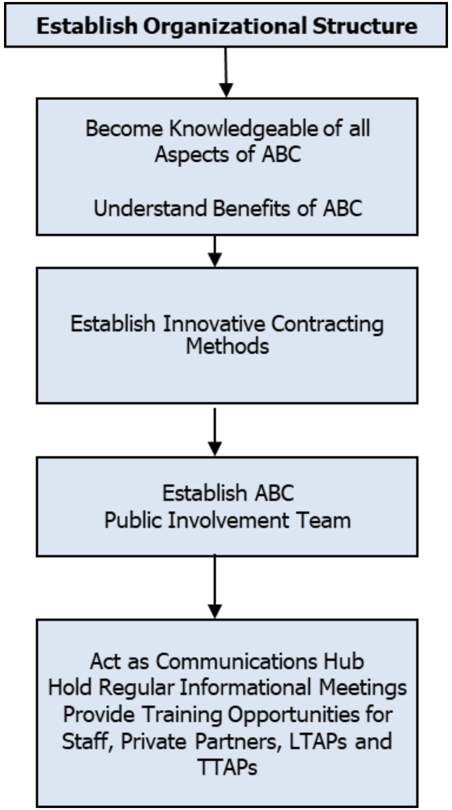
Key to success

Upper Management

Three Layers of Activities – Layer 2

Use a multi-layer approach

- Obtain support for the program
- Establish organizational structure
- Organize technical activities



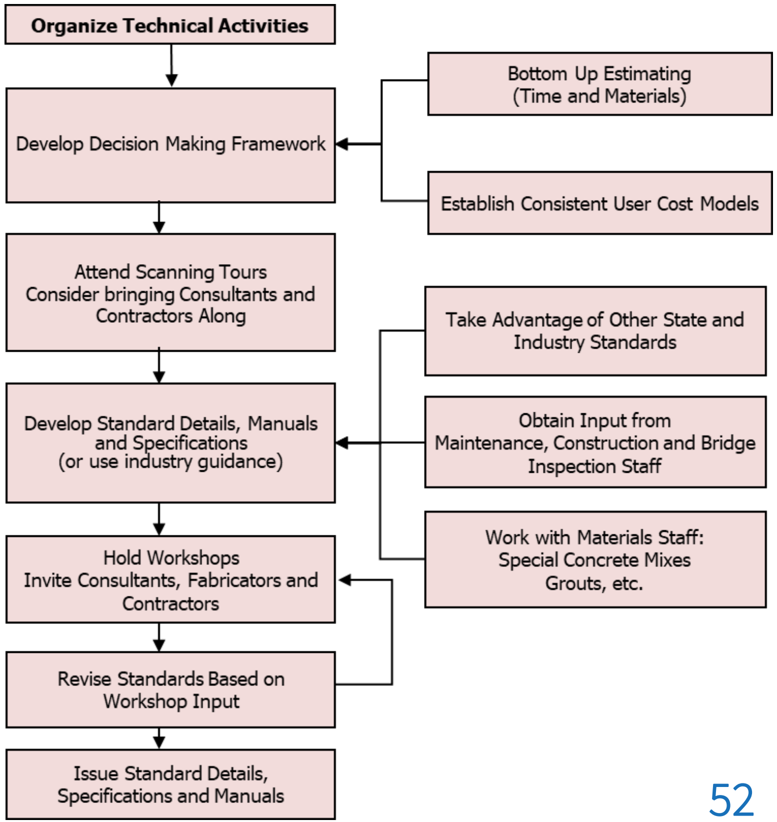
Mid-Level Management

Three Layers of Activities – Layer 3

Use a multi-layer approach

- Obtain support for the program
- Establish organizational structure
- Organize technical activities

Project Level
Design, Construction, Maintenance

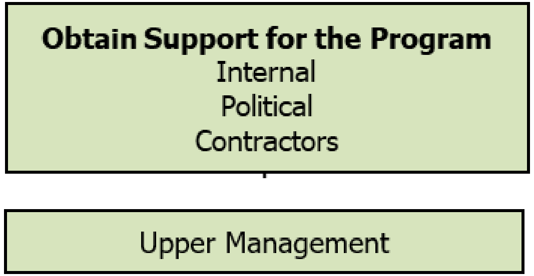


Obtaining Support for an ABC Program

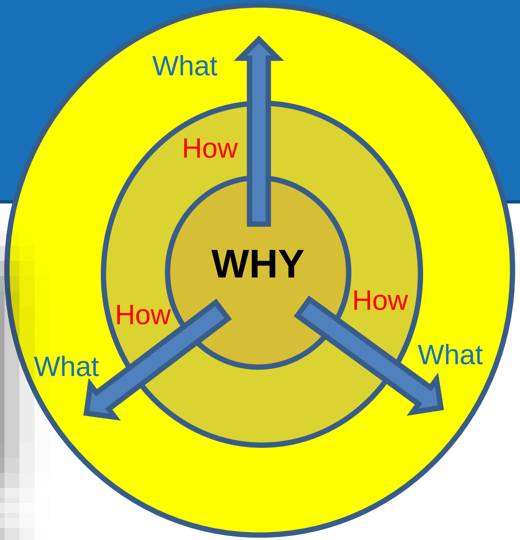
This is a key feature of a successful ABC program

- Step 1: Internal agency buy-in
- Step 2: Gain political and public support
- Step 3: Contractor engagement

Let’s explore how to do these



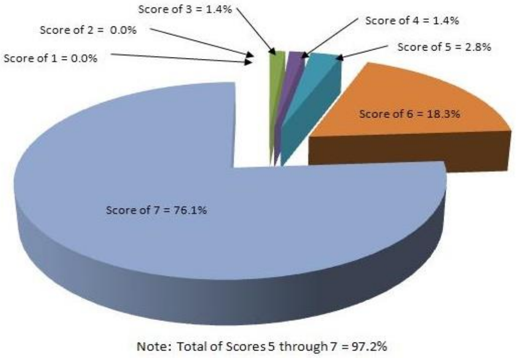
Step 1: Internal Agency Buy-in



- Upper management
  - They need to be the flag bearers for external communications
  - Contractors will contact them, not the design staff
- Design Staff
  - We need to develop buildable and efficient designs
- Construction Staff
  - They are at the front line with the contractors

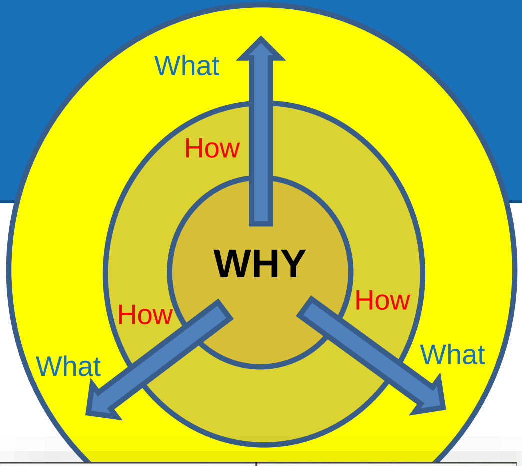
Step 2: Gain Political Support

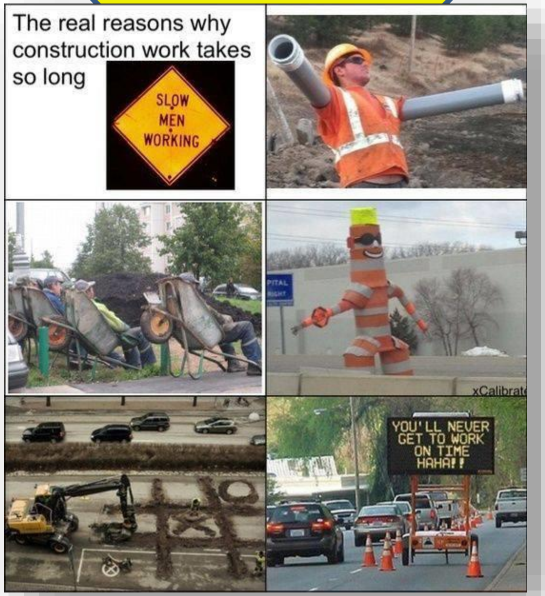
- Political Support
  - Politicians need to be educated as to the benefits of ABC
  - Why is this important?
    - The public will contact them, and they listen
    - Happy travelers are happy voters
    - Politicians secure funding for projects



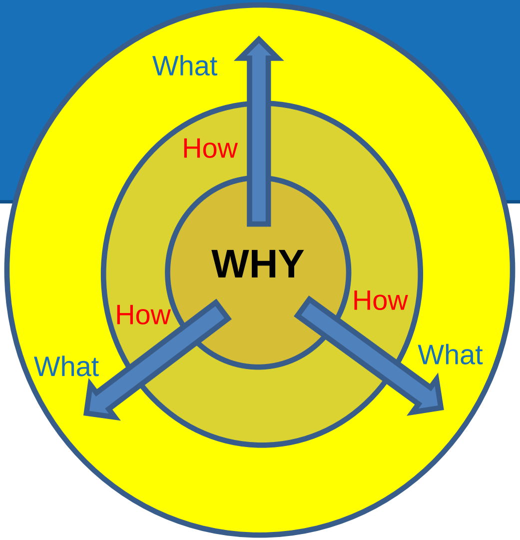
Step 2: External Buy-in

- Public involvement
  - We need to educate the public about what we are doing and WHY we are doing it.
  - Normally done as part of the public outreach process
  - Why is this important?
    - We often plan short-term increases in impacts for long-term reductions in impacts.
    - The public needs to know the big picture and WHY
    - Initially there will be a trust issue
    - They have driven for years through work zones
    - We are the butt of their jokes
    - A few successful ABC projects can turn that around fast



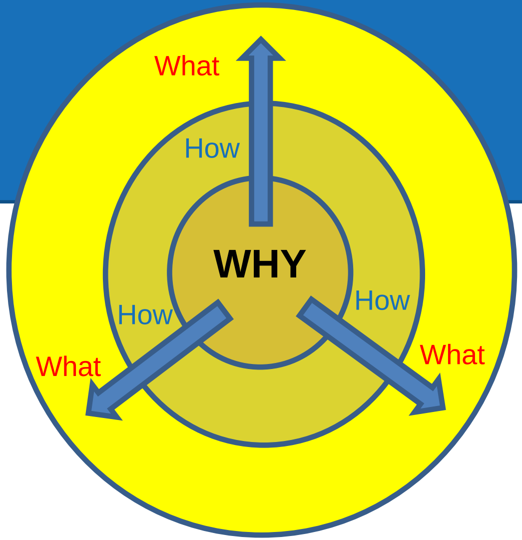


Step 3: Contractor Engagement



- Contractors
  - We need to educate contractors about what we are doing and WHY we are doing it.
  - If we don't do this….
    - Given a chance, contractors will switch out precast concrete to cast-in-place concrete

Step 3: Contractor Engagement



- Why is contractor “buy-in” important?
- If contractors push back…
    - They won’t call the design office
    - They will call
        - Agency construction office
        - Agency management
        - Political leaders
    - If everyone is not on board with the “WHY”, the program can fall apart

Step 3: Contractor Engagement

Why many contractors dislike ABC?

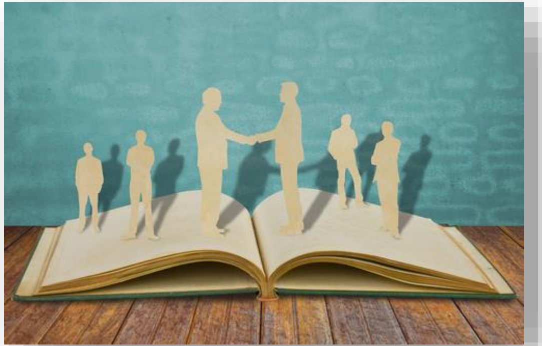
- They like to pour concrete
  - They are staffed and equipped for cast-in-place concrete work
  - Precasting takes work away from their staff
- Staffing ABC projects can have its challenges
  - You need a lot of staff for a short time
  - What do you do with them after the work is done?
- Potential loss of control over project production and schedule
- Risk:
  - Working with new technologies
  - Risk = $$ = loss of bid advantages

Step 3: Contractor Engagement

How to engage the contracting community on a programmatic level

- An agency can hold regular meetings with the contractor’s associations
- Educate them about the “WHY” = Guiding Principle
- Ensure that they know that ABC is agency policy and not a fad
- Benefits of ABC
  - Less overhead: Do more with less staff
  - Safer work environment:
    - Shorter duration work zones
    - Building off-site
  - Benefits to the traveling public
    - Reduced user costs due to delays
    - Happy motorists = Happy voters = better political support for more highway construction

Step 3: Contractor Engagement



What can we do to reduce contractor push-back?

- Start with "trial projects"
  - Get everyone on the same page
  - Try several "Practice Projects"
  - Bid a few projects with more relaxed schedules
    - Make it clear that switching to cast-in-place construction will not be allowed even if there is time
      - Build contractor familiarity with ABC without so much risk
      - At some time in the future, there will be projects with much tighter schedules where ABC will be necessary
      - Goal: Reduce risk on future projects through practice
    - This should be clearly communicated with….
      - Agency management at all levels
      - Politicians
      - The contracting community

Step 3: Contractor Engagement

Project Level

- Pre-bid conferences
  - Explain why ABC is being used
    - Both programmatic and project level
  - Go through the proposed details
  - Invite comments:
    - Live
    - Post conference
  - Make it clear that switching to cast-in-place concrete will not be allowed

Step 3: Contractor Engagement

How can we make ABC more palatable to contractors?

- Relax schedules on early projects
  - But not too much
  - Reduces risk = lower bids
- Limit the value of disincentives
  - Reduces risk = lower bids
- Consider allowing self-performance of precasting
  - Require development of QA/QC processes
    - Expected quality should be the same as a precast plant
    - Utah DOT has contractors obtain PCI “Precast” certification
  - Allows the contractor to keep work in-house
  - This has worked well in Utah

Conclusions

- Estimating cost and time is difficult due to many factors
  - Speed, Complexity, I/Ds, Equipment, Risk, etc.
  - We are building a knowledge base that is making this a little easier
  - Consider the FIU ABC UTC project database
- Be careful when developing Incentive/Disincentive provisions
  - Should be based on a real benefit (not a bonus)
  - Limit to 5% of the contract value
  - These can lead to higher bid costs if there is a risk of the disincentive being applied
- Use a multi-tier approach to implementing an ABC program
  - Engage all stakeholders (internal and external), politicians, and the public
  - Recommend using the “Golden Circle Approach”

Important factors to consider in ABC project selection

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Transportation Research Board Webinar
Accelerated Bridge Construction Programmatic Implementation
August 30, 2023

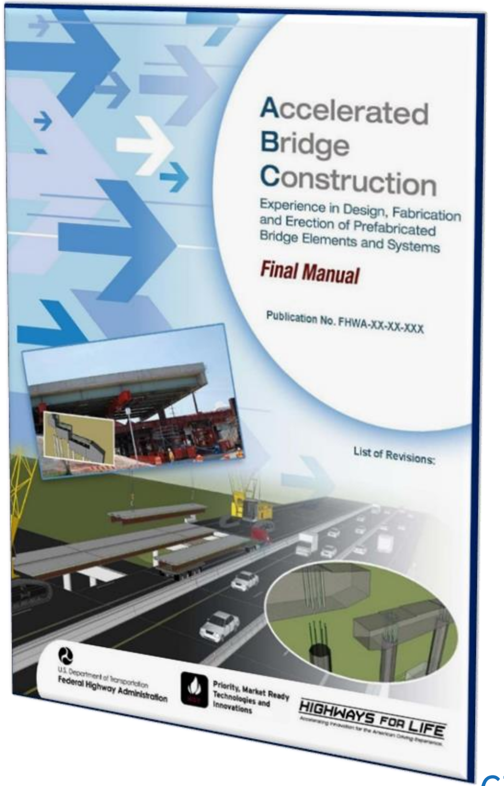
This Module Covers:

- Important factors to consider
  - Type of ABC
  - Road User Impacts
  - Cost
- Recommended Decision processes

Important Factors – Part 1

Type of ABC

- There are many options for ABC
- Which one(s) are appropriate for each site?
- The FHWA ABC Manual has guidance
  - Helps in decision making
  - After a few projects, this will become more obvious

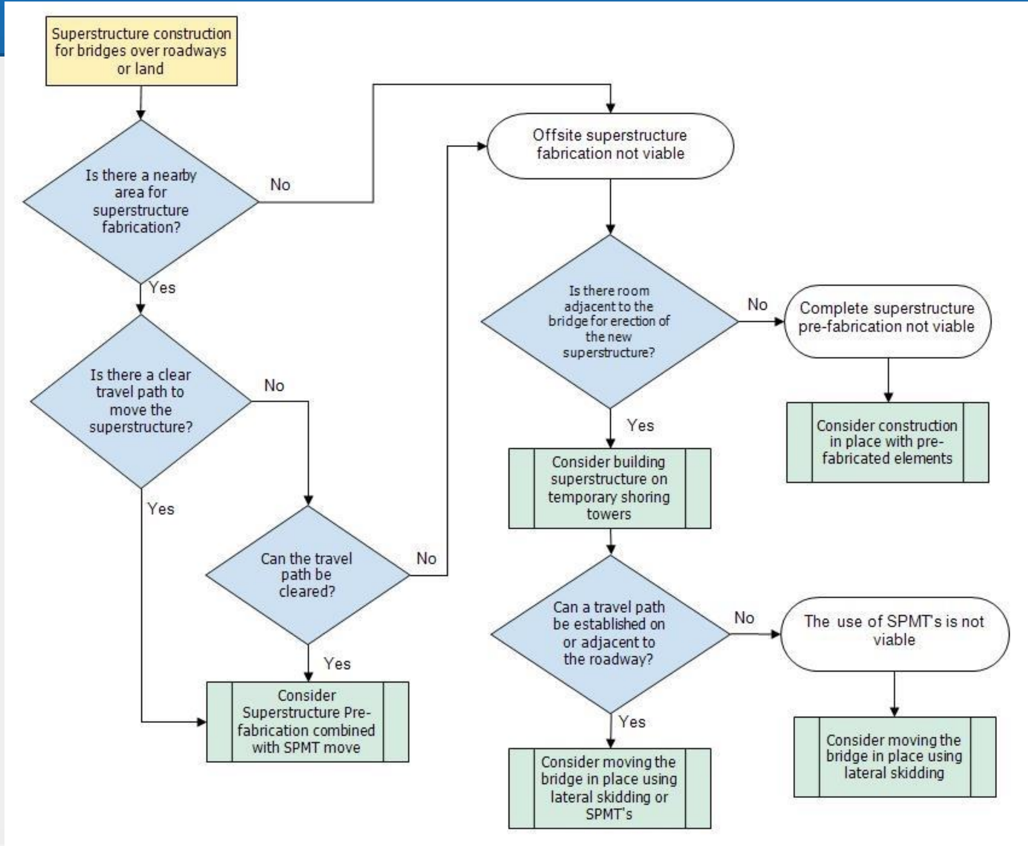


FHWA ABC Manual

Chapter 3:

Project planning and scoping

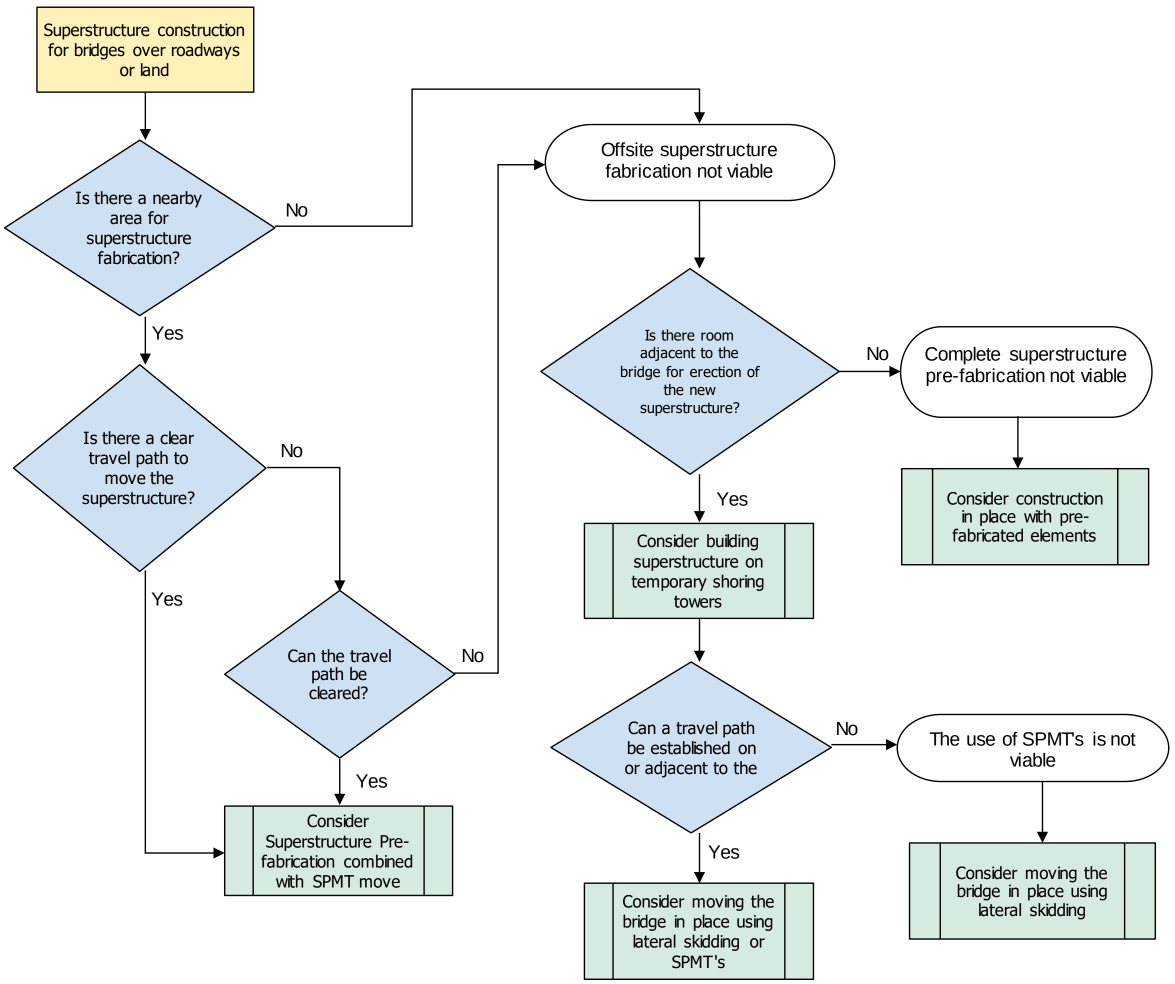
- Determination of appropriate ABC methods
- Flowcharts developed to assist in decision making
- Assumption: Construction with prefabricated bridge elements is always an option



Ref: FHWA ABC Manual Figure 3.2.2-1 Decision Flowchart for Superstructure Construction over Roadway or Land

ABC Decision Flowcharts

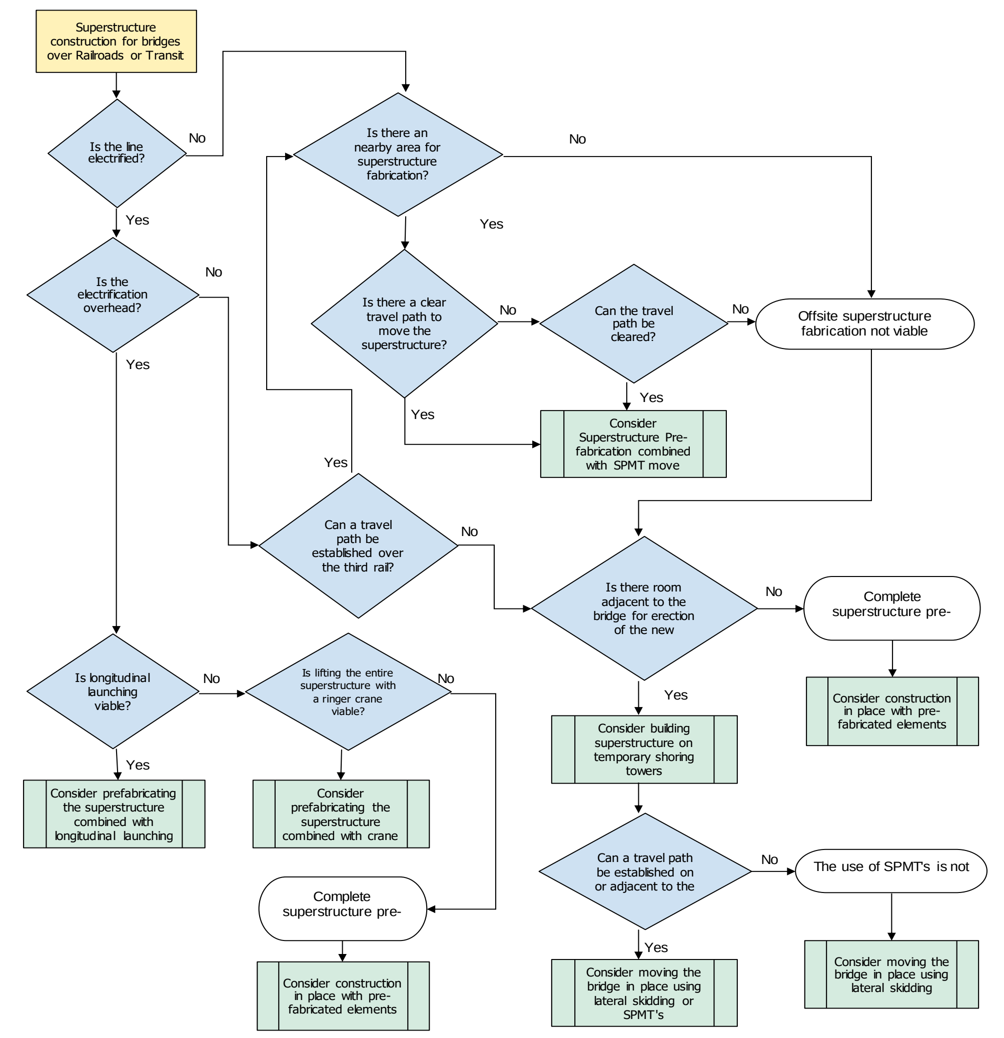
Superstructure over roadways



Ref: FHWA ABC Manual Figure 3.2.2-1 Decision Flowchart for Superstructure Construction over Roadway or Land

ABC Decision Flowcharts

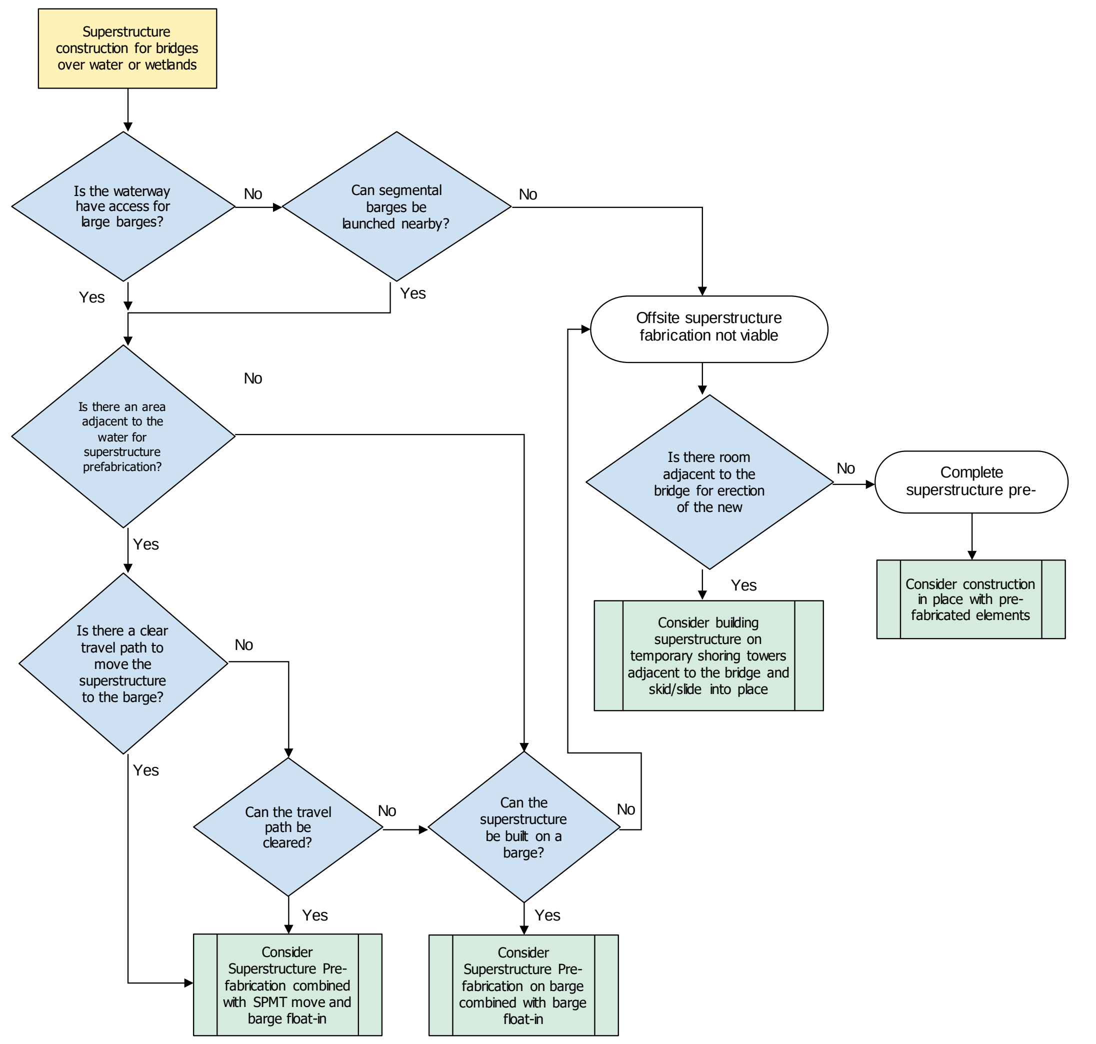
Superstructure over railroads



Ref: FHWA ABC Manual Figure 3.2.2-2 Decision Flowchart for Superstructure Construction over Railroad

ABC Decision Flowcharts

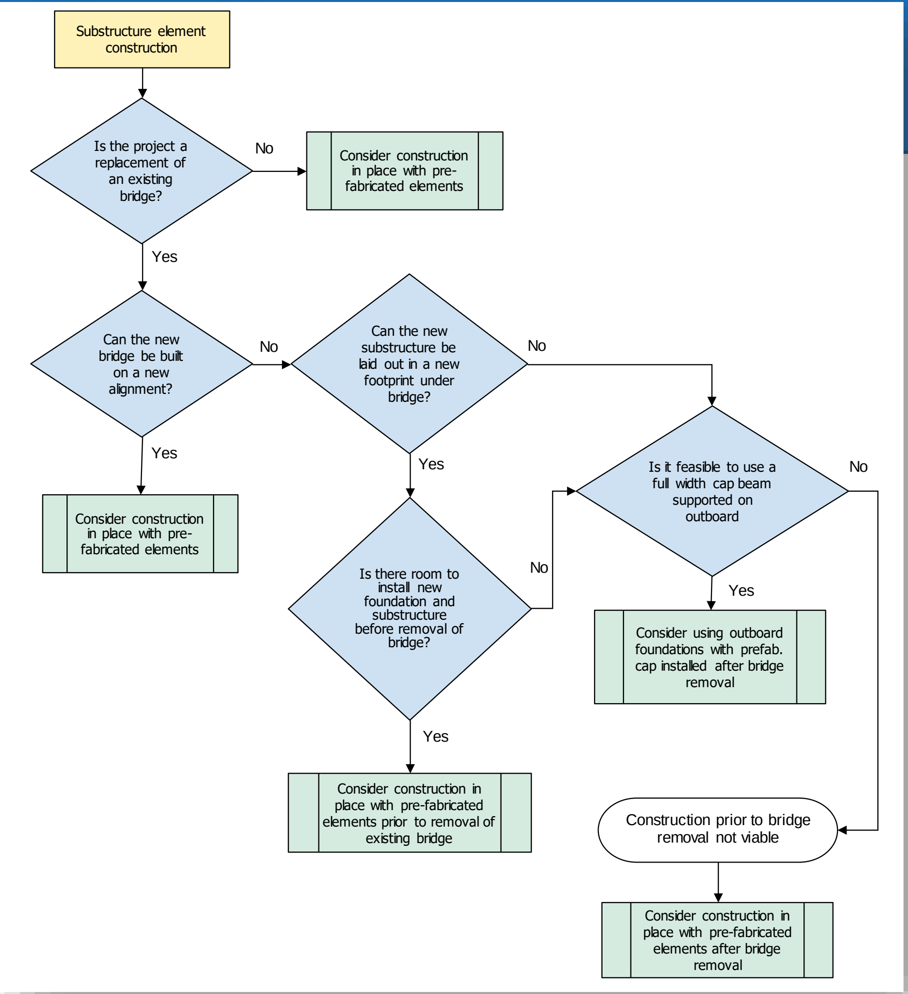
Superstructure over water or wetlands



Ref: FHWA ABC Manual Figure 3.2.2-3 Decision Flowchart for Superstructure Construction over Water or Wetlands

ABC Decision Flowcharts

Substructures



Ref: FHWA ABC Manual Figure 3.2.2-4 Decision Flowchart for Substructure Construction

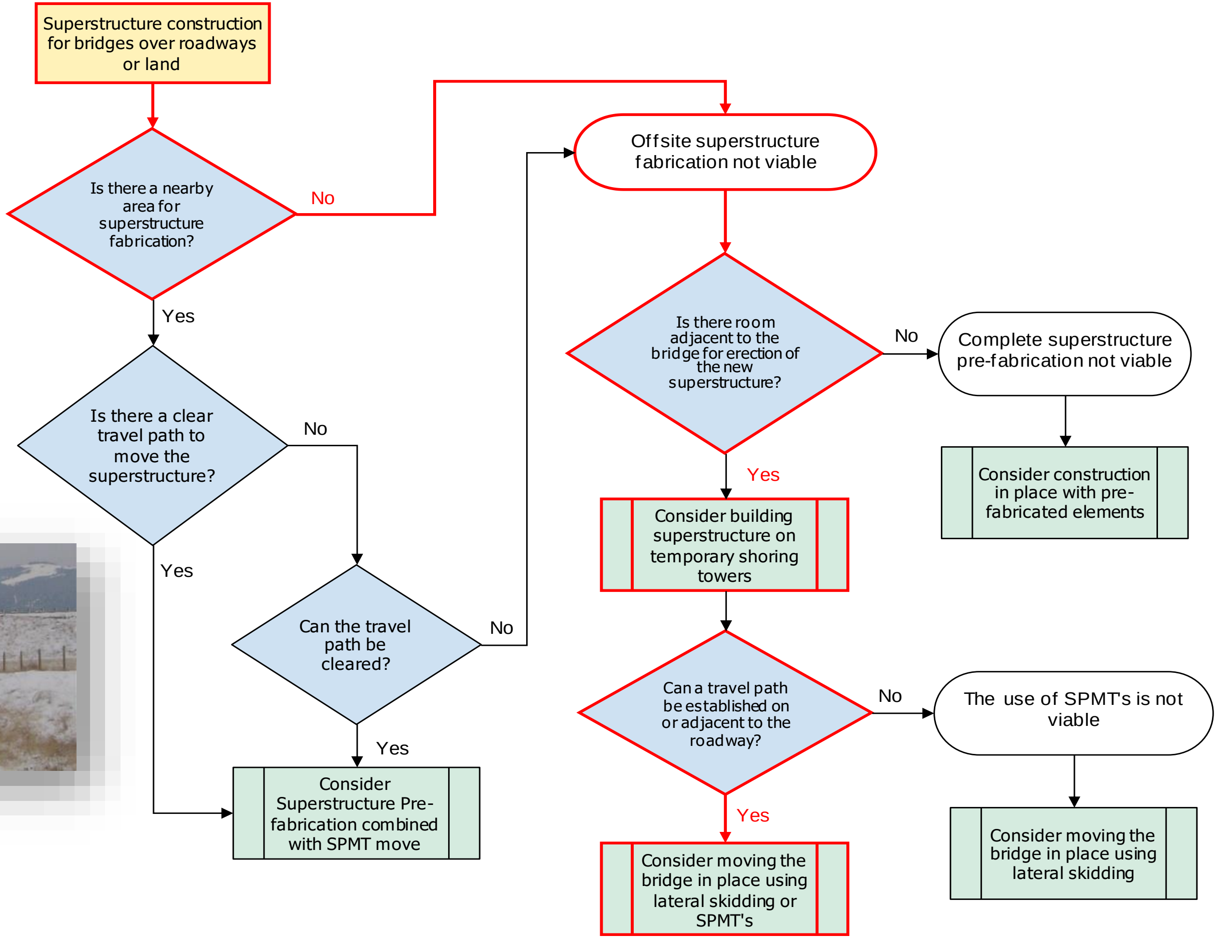
Example Project

Highway Overpass

- Heavy traffic on overpass road (retail area)
- Relatively light traffic on interstate
- No land available nearby for large staging area

Example Project

Superstructure

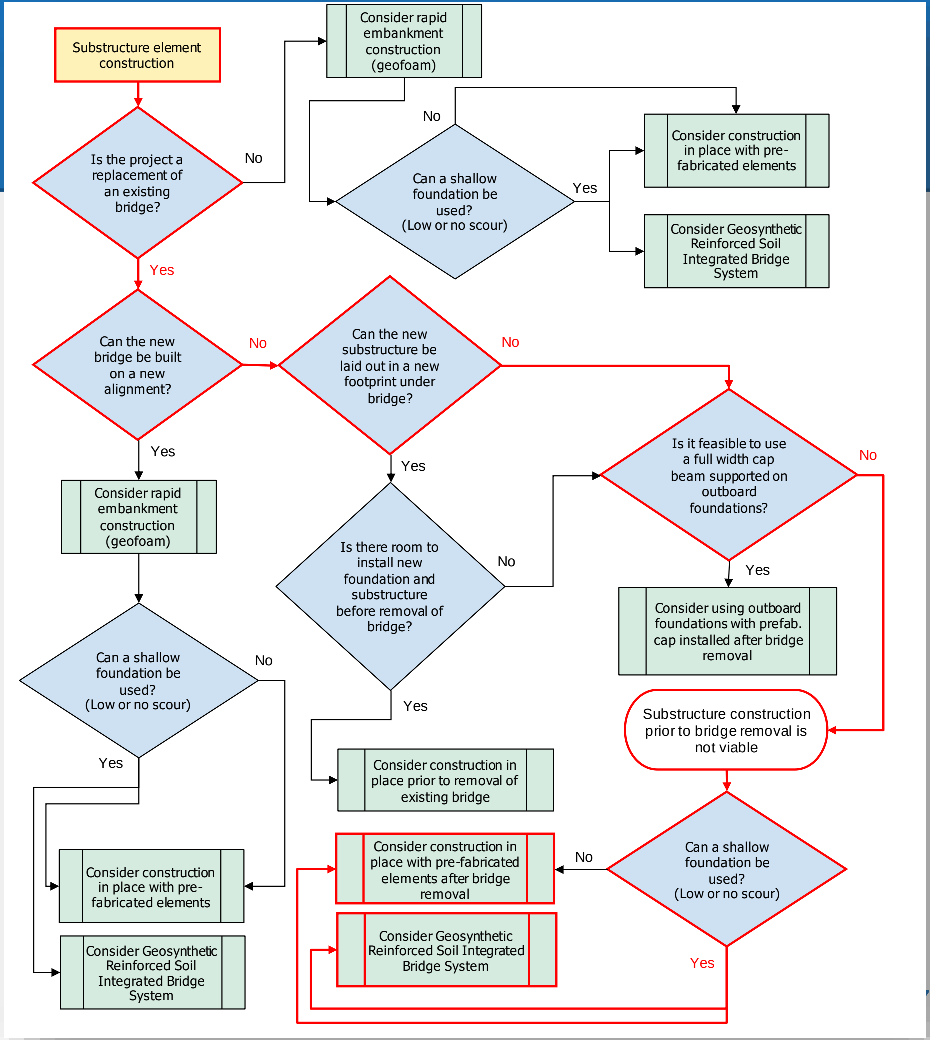


Ref: FHWA ABC Manual Figure 3.2.2.1-2
ABC Flowchart for Example Bridge Superstructure

Example Project

Substructure

Ref: FHWA ABC Manual Figure 3.2.2.1-3 ABC Flowchart for Example Bridge Superstructure



Important Factors – Part 2

Investigate traffic patterns

- Traffic impacts are a significant part of any decision process
- In order to make a proper decision, the designer needs to understand the existing traffic patterns including:
  - Hourly volumes (weekdays and weekends)
  - Seasonal changes (resorts\beaches\local events)
  - Available detours
    - State highways
    - Local roads?
  - Evacuation routes and emergency vehicle routes
  - Impact on local businesses?

Important Factors – Part 3

Cost

- In the previous module, we discussed the potential premiums for ABC
- Is this the whole picture?   No
- We should investigate TOTAL project costs

Important Factors – Part 3

Total Project Cost

- What is the total cost of a project?
  - Bid price? No
- Common non-bid costs
  - Construction inspection
  - Back-office staff
  - Field office
  - Flagging
- These can be reduced with ABC by reducing the overall project schedule

Important Factors – Part 3

Other ways to save costs with ABC

- Maintenance of traffic costs
  - Staging\Barriers\Temporary traffic control
- Overbuild
  - Sometimes we will overbuild to facilitate staging
  - May not be necessary with ABC
- Temporary bridges
  - We may be able to eliminate a temporary bridge with ABC

ABC Decision Processes

Processes in use in the US

- Many states have developed ABC decision processes
- Not all the same, but that is ok
- Each state has different priorities

Types of decision matrices

- Simple checklists
- Weighted scoring (algorithms)

Recommended Approach to ABC Decision Making

Connecticut DOT ABC Decision Matrix (or something similar)

- This decision process has a few key elements that stand out
  1. It is a simple method based on weighted scoring
     - Similar to the UDOT method and others
  2. It compares ABC to Conventional Construction
  3. Uses a simplified road user impact process
  4. It accounts for non-bid savings
     - Offset ABC costs with costs that can be reduced or eliminated with ABC

CTDOT Approach to User Impacts

User costs

- Some agencies calculate user costs
- Good tool for justification of ABC
- Problem:
  - You cannot spend user costs
    - Not a real cost to the agency (Monopoly Money)
  - Approach to calculating user costs can vary widely
- What is really important?
  - Impact of ABC on road users, environment, etc.
  - The ratio of impacts is more important than the $$

CTDOT Approach to User Impacts

User cost impact ratio approach

- Compare aggregate road user impacts for ABC vs. conventional construction
  - Calculated in "vehicle days"
  - Add up impacts to travelers on the bridge and below the bridge
  - Calculate a percent increase or reduction
- Key factors needed
  - ADT for all roadways
  - Delay time for all roadways

CTDOT Approach to Cost Analysis

Ways to save $$ with ABC

Reduced construction management costs

- Field inspectors: Less time on the job
- Backoffice staff: Reduced number of invoices and reports
- Field office and equipment rental: Reduced number of months

Reduced traffic management costs

- Temporary signals
- Flagging and police
- Multiple stages of construction
- Elimination of temporary bridges
- Elimination of overbuilds to accommodate construction stages

CTDOT ABC Decision Matrix

Connecticut Department of Transportation
2800 Berlin Turnpike, PO Box 317546
Newington, CT 06131-7846

Project:	103-265		
By:	AH	Checked:	
Date:	2/7/2017		
Sheet No.	1	of	4

CTDOT ABC Decision Making Process 11-1-16

Site Information

Project Description: Replacement of Bridge No. 02589; Route 97 over Cold Brook in the City of Norwich

Prop. ABC Method: Integral bridge with precast abutments, wingwalls and beams (with deck already implemented, NEXT Beams).

Conventional Construction Method: Integral bridge with precast abutments, wingwalls and beams. Deck and parapets CIP.

Roadway on Bridge Route 97

Average Daily Traffic 4100 vehicles per day

Conventional Construction

Delay Time	13.00	minutes
Construction Impact Duration	90	Days
Aggregate Impact Time	3331	Person Days

ABC

Delay Time	13.00	minutes
Construction Impact Duration	49	Days
Aggregate Impact Time	1814	Person Days

Roadway Below Bridge N/A

Average Daily Traffic vehicles per day

Conventional Construction

Delay Time		minutes
Construction Impact Duration		Days
Aggregate Impact Time	0	Person Days

ABC

Delay Time		minutes
Construction Impact Duration		Days
Aggregate Impact Time	0	Person Days

Percent Reduction in Aggregate Impact Time

Conventional Construction
Total Aggregate Impact Time 3331 Person Days

ABC
Total Aggregate Impact Time 1814 Person Days

User Impact Reduction 46%
Note: Negative value indicated that ABC has more impact

Connecticut Department of Transportation
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Newington, CT 06131-7846

Project:	103-265		
By:	AH	Checked:	0
Date:			
Sheet No.	2	of	4

CTDOT ABC Decision Making Process 11-1-16

Preliminary Cost Evaluation

Estimated conventional construction project cost =

Required Bridge	$2,666,000
Overbuild	$0
Total conventional bridge cost	$2,666,000

Estimated CE&I Costs per month

Field office monthly cost	$3,563
CE&I staff monthly cost (field plus main office)	$20,000
Total CE&I Monthly Cost =	$23,563

Notes: Small field office = $xxxx per month
Medium office = $xxxx per month
Large office = $xxxx per month
Staff = $20,000 per person per month

Net time savings for ABC = 1.4 months

Estimated Percent Premium for ABC = -1%

MPT savings with ABC
Things that you can eliminate from conventional construction by using ABC

Overbuild for staging	$0
Temporary bridge	$0
Temporary signal	$0
Other	$0
Total MPT Savings with ABC	$0

Cost analysis

Premium for ABC =	-$26,660
CEI Cost Savings =	$32,988
MPT savings with ABC =	$0
Net cost change for ABC =	-$59,648

ABC is less expensive than conventional

Net percentage of conventional cost = -2%

Connecticut Department of Transportation
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Newington, CT 06131-7846

Project:	103-265		
By:	AH	Checked:	0
Date:			
Sheet No.	3	of	4

CTDOT ABC Decision Making Process 11-1-16

ABC Rating procedure
Enter values for each aspect of the project. Attach back-up data if applicable

Average Daily Traffi 1
Combined traffic on and under

0	No traffic impacts
1	Less than 10000
2	10000 to 40000
3	40000 to 70000
4	70000 to 100000
5	More than 100000

User Impact Reducti 3
Calculated by spreadsheet

0	Zero
1	1% to 20%
2	21% to 40%
3	41% to 60%
4	61% to 80%
5	81% to 100%

Bridge Location 2
Stakeholder Impact

0	Rural Bridge away from town center
1	Rural bridge near town center
2	Suburban bridge away from town center
3	Suburban bridge near major traffic generators
4	Urban Bridge near major traffic generators
5	Urban Bridge near emergency services

Use of Typical Detai 4

1	Complex and unfavorable geometry
2	Curved and skewed bridges
3	Curved bridges
4	Skewed Bridges
5	Simple geometry well suited for typical details

Work Zone Geometr 2
Detour quality and/or MPT Quality

1	Short duration project with good geometry & flow
2	Short duration project with moderate geometry & flow
3	Average project duration with average geometry & flow
4	Long duration project with moderate geometry & flow
5	Long duration project with complex geometry & flow

Site Conditions 3
Utilities/ROW/Env. Compliance

0	significant limitations on work
1	moderate construction limitations for portions of the work
2	
3	minor construction limitations
4	
5	No Restrictions

Railroad Impacts 0

0	No Railroad (entry of 0 = not considered in score)
1	Freight Siding (Less than 1 train per week)
2	Light Freight (1 Train per week to 1 Train per day)
3	Heavy Freight (More than 1 Train per day)
4	Commuter rail
5	Electrified Commuter Rail

Connecticut Department of Transportation
2800 Berlin Turnpike, PO Box 317546
Newington, CT 06131-7846

Project:	103-265		
By:	AH	Checked:	0
Date:			
Sheet No.	4	of	4

CTDOT ABC Decision Making Process 11-1-16

Cost Analysis Factor : 5 -2%
Net percentage of conventional co: Negative value means that ABC ha less net cost when compared to conventional construction

0	>30%
1	20% < Factor < 30%
2	10% < Factor < 20%
3	5% < Factor < 10%
4	0% < Factor < 5%
5	Factor <0%

Envir. /Water Handli 1

0	No Restrictions (entry of 0 = not considered in score)
1	minor construction limitations
2	
3	moderate construction limitations for portions of the work
4	
5	significant limitations on work

Waterway Limitation 0

0	No impact (entry of 0 = not considered in score)
1	Minor impacts
2	
3	Seasonal recreational impacts
4	Significant recreational impacts
5	Significant commercial impacts

ABC Rating

	Score	Weight Factor	Adjusted Score	Maximum Score	Adjusted Score
Average Daily Traffic	1	10	10	5	50
User Impact Reduction	3	30	90	5	150
Bridge Location	2	5	10	5	25
Use of Typical Details	4	5	20	5	25
Work Zone Geometry	2	8	16	5	40
Site Conditions	3	5	15	5	25
Railroad Impacts	0	5	0	0	0
Cost Analysis	5	30	150	5	150
Envir. /Water Handling	1	5	5	5	25
Waterway Limitations	0	5	0	0	0
		Total Score	316	Max. Score	490

ABC Rating 64

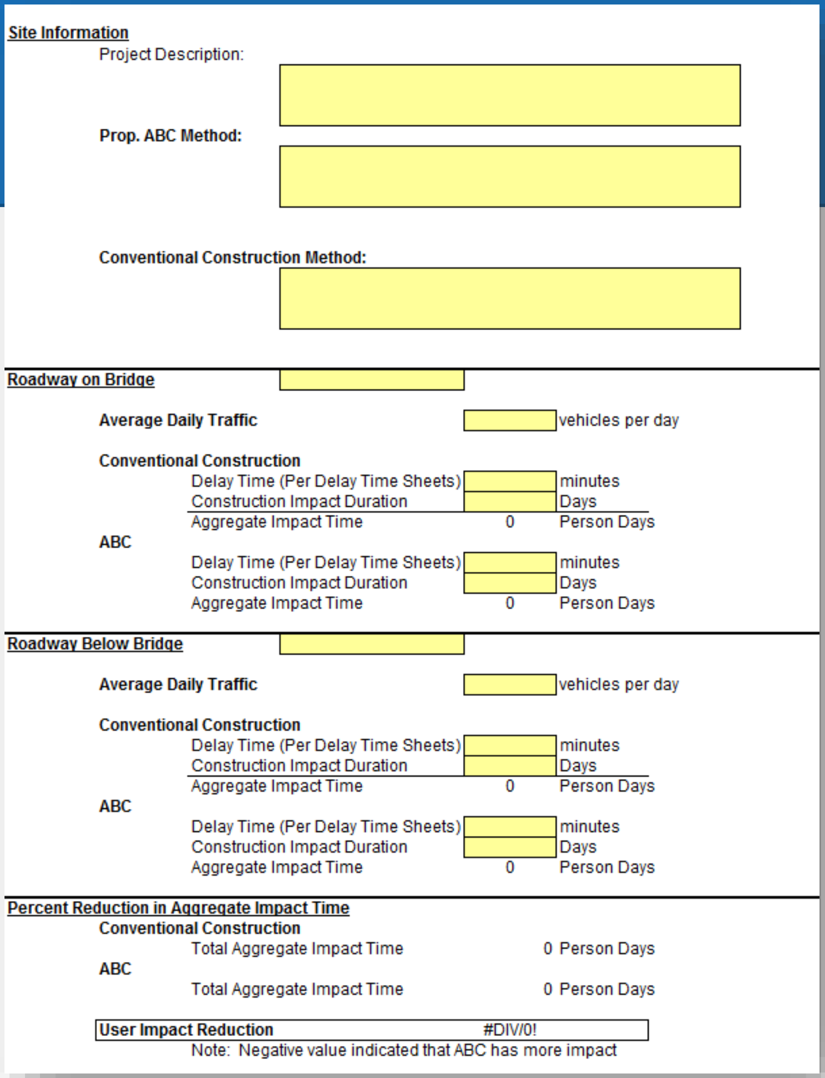
ABC Rating Scale	
60-100	Use ABC
50-60	Consider ABC
0-50	Do not use ABC

Note: Weight factors determined by CTDOT. Do not adjust factors without prior consultati

ABC Decision Matrix Sheet 1

- Enter site information data
- Enter the following traffic inputs for Roadway on Bridge and Roadway Below Bridge (if applicable) for both conventional and ABC alternatives for determination of user impact reduction:
  - ADT
  - Delay time (entered from supplementary traffic delay time spreadsheets)
  - Construction impact duration
- Spreadsheet calculates user impact reduction value for ABC compared to conventional construction

CTDOT ABC Matrix Screen Shot



Site Information

Project Description:

Prop. ABC Method:

Conventional Construction Method:

Roadway on Bridge

Average Daily Traffic — vehicles per day

Conventional Construction

Delay Time (Per Delay Time Sheets)		minutes
Construction Impact Duration		Days
Aggregate Impact Time	0	Person Days

ABC

Delay Time (Per Delay Time Sheets)		minutes
Construction Impact Duration		Days
Aggregate Impact Time	0	Person Days

Roadway Below Bridge

Average Daily Traffic — vehicles per day

Conventional Construction

Delay Time (Per Delay Time Sheets)		minutes
Construction Impact Duration		Days
Aggregate Impact Time	0	Person Days

ABC

Delay Time (Per Delay Time Sheets)		minutes
Construction Impact Duration		Days
Aggregate Impact Time	0	Person Days

Percent Reduction in Aggregate Impact Time

Conventional Construction

Total Aggregate Impact Time 0 Person Days

ABC

Total Aggregate Impact Time 0 Person Days

User Impact Reduction #DIV/0!

Note: Negative value indicated that ABC has more impact

Alternating Traffic Delay Time
(Supplementary Spreadsheet)

- Determine and enter estimated cycle time
- Use assumed values for preliminary investigations

Connecticut Department of Transportation
2800 Berlin Turnpike, PO Box 317546
Newington, CT 06131-7846

Project:			
By:		Checked:	
Date:			

ABC Decision Matrix - Supplementary Spreadsheet
Alternating Traffic Delay Time

Sheet No. of

Traffic Delay Calculation Recommendations Key
- Input areas
- Calculations and results

One Way Alternating Traffic Delays

For each direction:

Estimated Cycle Time	2.00	minutes (See note 2)
Average Delay Time	1.00	minutes (use this in the Base Spreadsheet)

** The estimated average cycle time can be assumed based on the following:

ADT <2000	1.00 minutes
2001 < ADT < 4000	1.25 minutes
4001 < ADT < 6000	1.50 minutes
6001 < ADT < 8000	2.00 minutes

Do not use alternating one way traffic for ADT over 8000

Comments

These calculations would be for a typical bridge replacement project where one way alternating traffic is proposed. The basis for this calculation is the following assumptions:

1. On average, a typical car will spend one half of a complete cycle at the signal. Some vehicles will arrive at the worst moment and wait an entire cycle to go. Some vehicles will arrive just as the light goes green and have no delay.

2. The values given are for one way alternating stop signs for low volume roads and and signals for higher volume roads.

3. For stop sign control, maximum length of alternating traffic must be no greater than 400 feet and clear sightline must be provided between the two opposing traffic stop signs.

Detour Length Delay
(Supplementary Spreadsheet)

Traffic Delay Calculation Recommendations Key

(yellow)	Input areas
(white)	Calculations and results

Detour Delays			Comments
Detour Segment 1 Length		miles	1. These caculations would be used if a detour was planned. The adjustment factor is to account for the anticipated volume of trafic on the detour.
Segment 1 speed limit		mph	
Segment 1 Congestion Factor		See Note 1	
Segment 1 Time	#DIV/0!	minutes	
Detour Segment 2 Length		miles	2. Segment Congestion Factor variables may be reduced for short term detours if the project will include special advance notice to motoring public during construction phase with the effect of reducing overall short term traffic volumes.
Segment 2 speed limit		mph	
Segment 2 Congestion Factor		See Note 1	
Segment 2 Time	#DIV/0!	minutes	
Detour Segment 3 Length		miles	
Segment 3 speed limit		mph	
Segment 3 Congestion Factor		See Note 1	
Segment 3 Time	#DIV/0!	minutes	
Detour Segment 4 Length		miles	
Segment 4 speed limit		mph	
Segment 4 Congestion Factor		See Note 1	
Segment 4 Time	#DIV/0!	minutes	
Detour Segment 5 Length		miles	
Segment 5 speed limit		mph	
Segment 5 Congestion Factor		See Note 1	
Segment 5 Time	#DIV/0!	minutes	
Number of Stops along detour		stop signs or signals	
Delays at stop signs	0.00	minutes	
Aggregate Detour Time	#DIV/0!	minutes (use this in the Base Spreadsheet)	

Assumptions

Delay Time per stop 1.00 minutes

Note 1: This factor accounts for the additional delay on the detour route due to congestion. For example, a value of 1.25 equates to a 25% increase in travel time on the detour route.

Segment Congestion Factor

Conditions on Detour Segment	Conditions at Bridge: Non-limited access highway, total ADT < 5,000	Non-limited access highway, total ADT 5,000 - 10,000	Non-limited access highway, total ADT > 10,000	Limited access highway, directional ADT < 25,000	Limited access highway, directional ADT > 25,000
Longer than 2.0 miles, ADT > 8,000 per lane	1.50	1.75	2.00	2.00	2.00
Longer than 2.0 miles, ADT< 8,000 per lane	1.25	1.50	1.75	2.00	2.00
0.5 - 2.0 miles, ADT < 3,000 - 8,000 per lane	1.25	1.25	1.50	1.75	2.00
0.5 - 2.0 miles, ADT < 3,000 per lane	1.00	1.25	1.50	1.50	1.75
Less than 0.5 mile, ADT < 3,000 per lane	1.00	1.00	1.25	1.50	1.50

Conditions on Detour Segment - Guidance:

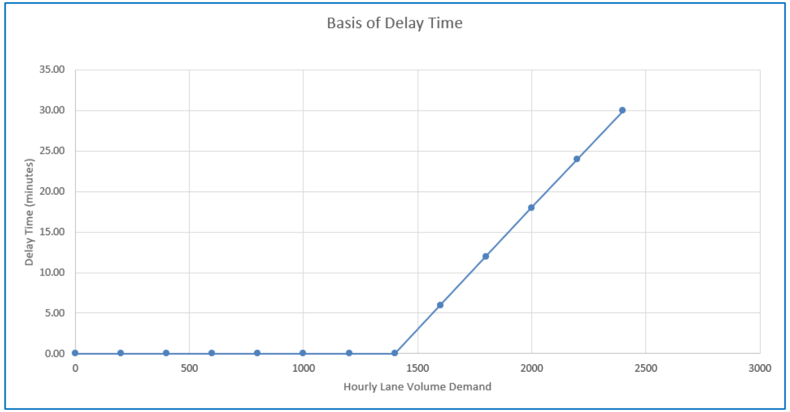
ADT per lane = ADT on segment / number of total available lanes on roadway

If length of detour and ADT per lane do not match one of the above categories, use higher value condition

Reduced Lane Delay Time (Supplementary Spreadsheet)

Basis:

- Each lane can accommodate up to 1400 vph without delay
- Delay varies linearly as volume increases



ABC Decision Matrix - Supplementary Spreadsheet
Reduced Lane Delay Time

Sheet No. of

Traffic Delay Calculation Recommendations Key

(yellow)	Input areas
(white)	Calculations and results

Lane Reduction Delays

Heavy Commute Peak Period 1

Hourly volume during peak periods		total vehicles per hour
Number of Lanes in service during peak		lanes
Peak Lane Volume	#DIV/0!	vehicles per hour per lane
Average delay time per vehicle	#DIV/0!	minutes (see basis to the right)
Aggregate delay time for this peak period	#DIV/0!	vehicle minutes per hour
Length of peak period	3	hours (see note below)
Aggregate delay time for this period	#DIV/0!	vehicle minutes

Note: Length of Peak Period: enter 1 for light traffic; 2 for medium traffic; 3 for heavy traffic

Heavy Commute Peak Period 2

Hourly volume during peak periods		total vehicles per hour
Number of Lanes in service during peak		lanes
Peak Lane Volume	#DIV/0!	vehicles per hour per lane
Average delay time per vehicle	#DIV/0!	minutes
Aggregate delay time for this peak period	#DIV/0!	vehicle minutes per hour
Length of peak period		hours (see note below)
Aggregate delay time for this period	#DIV/0!	vehicle minutes

Note: Length of Peak Period: enter 1 for light traffic; 2 for medium traffic; 3 for heavy traffic

Off peak periods

Average Hourly volume during off-peak periods		total vehicles per hour
Number of Lanes in service during peak		lanes
Peak Lane Volume	#DIV/0!	vehicles per hour per lane
Average delay time per vehicle	#DIV/0!	minutes
Aggregate delay time for this peak period	#DIV/0!	vehicle minutes per hour
Length of peak period	21	hours (24 hours minus peak hours)
Aggregate delay time for this period	#DIV/0!	vehicle minutes

Average delay time

Aggregate delay time for period 1	#DIV/0!	vehicle minutes (from above)
Aggregate delay time for period 2	#DIV/0!	vehicle minutes (from above)
Aggregate delay time for off peak period	#DIV/0!	vehicle minutes (from above)
Total Aggregate delay time	#DIV/0!	vehicle minutes
Total ADT		vehicles
Average Delay time per vehicle	#DIV/0!	minutes (use this in the Base Spreadsheet)

Comments

1. These calculations would be used if staged construction was planned where there is a proposed reduction in the number of lanes. The basis of the delay times is that a lane can accommodate 1400 vehicles per hour without delay. Increased delays would result as the lane volume increases.

2. The assumption is that the delay time increases linearly from 1400 vehicles per hour (see Basis of Delay Time Plot to Right). The rate of increase can be easily adjusted by changing the delay value for the 2400 vph line in the table to the right (blue cell).

3. The peak hourly volume can be estimated to be 10% of the ADT if specific hourly volumes are not available.

4. The off peak hourly volume can be estimated to be 3% of the ADT if specific hourly volumes are not available.

5. Reduced ADT input values may be used for short term lane reductions (2 to 3 day intervals) if special advance notice to motoring public is implemented during construction phase with the effect of temporarily reducing ADT.

ABC Decision Matrix Sheet 2

Entire following project inputs:

Conventional project cost

- Overbuild
- Required base bridge costs

CE&I monthly costs

- Field office
- CE&I staff

ABC net time savings

ABC estimated additional cost premium

Maintenance & Protection of Traffic (MPT) cost savings with ABC

- Overbuild not needed
- Temporary bridge not needed
- Temporary signal not needed
- Other

Spreadsheet calculates the ABC premium as a "Net percentage of conventional cost"

CTDOT ABC Matrix Screen Shot

Estimated conventional construction project cost =	
Required Bridge	
Overbuild	$0
Total conventional bridge cost	$0
Estimated CE&I Costs per month	
Field office monthly cost	
CE&I staff monthly cost (field plus main office)	
Total CE&I Monthly Cost =	$0
Notes: Small field office = $xxx per month Medium office = $xxx per month Large office = $xxx per month Staff = $20,000 per person per month	
Net time savings for ABC =	months
Estimated Percent Premium for ABC =	
MPT savings with ABC	
Things that you can eliminate from conventional construction by using ABC	
Overbuild for staging	$0
Temporary bridge	$0
Temporary signal	$0
Other	$0
Total MPT Savings with ABC	$0
Cost analysis	
Premium for ABC =	$0
CEI Cost Savings =	$0
MPT savings with ABC =	$0
Net cost change for ABC =	$0
ABC is less expensive than conventional	
Net percentage of conventional cost =	#DIV/0!

ABC Decision Matrix Sheet 3

- Enter project rating values:
- Average Daily Traffic (ADT)
- Bridge location
- Use of typical details
- Work zone geometry
- Site conditions
- Railroad impacts

- User impact reduction is internally computed from data input on Sheet 1

CTDOT ABC Matrix Screen Shot

ABC Rating procedure

Enter values for each aspect of the project. Attach back-up data if applicable

Average Daily Traffic Combined traffic on and under		0	No traffic impacts
		1	Less than 10000
		2	10000 to 40000
		3	40000 to 70000
		4	70000 to 100000
		5	More than 100000
User Impact Reduction Calculated by spreadsheet	#DIV/0!	0	Zero
		1	1% to 20%
		2	21% to 40%
		3	41% to 60%
		4	61% to 80%
		5	81% to 100%
Bridge Location Stakeholder Impact		0	Rural Bridge away from town center
		1	Rural bridge near town center
		2	Suburban bridge away from town center
		3	Suburban bridge near major traffic generators
		4	Urban Bridge near major traffic generators
		5	Urban Bridge near emergency services
Use of Typical Details		1	Complex and unfavorable geometry
		2	Curved and skewed bridges
		3	Curved bridges
		4	Skewed Bridges
		5	Simple geometry well suited for typical details
Work Zone Geometry Detour quality and/or MPT Quality		1	Short duration project with good geometry & flow
		2	Short duration project with moderate geometry & flow
		3	Average project duration with average geometry & flow
		4	Long duration project with moderate geometry & flow
		5	Long duration project with complex geometry & flow
Site Conditions Utilities/ROW/Env. Compliance		0	significant limitations on work
		1	moderate construction limitations for portions of the work
		2	
		3	minor construction limitations
		4	
		5	No Restrictions
Railroad Impacts		0	No Railroad (entry of 0 = not considered in score)
		1	Freight Siding (Less than 1 train per week)
		2	Light Freight (1 Train per week to 1 Train per day)
		3	Heavy Freight (More than 1 Train per day)
		4	Commuter rail
		5	Electrified Commuter Rail

ABC Decision Matrix Sheet 4

- Enter project rating values:
- Cost analysis factor
- Environmental water handling
- Waterway limitations

Cost Analysis		0	>30%
Factor =	#DIV/0!	1	20% < Factor < 30%
Net percentage of conventional cost		2	10% < Factor < 20%
Negative value means that ABC has		3	5% < Factor < 10%
less net cost when compared to		4	0% < Factor < 5%
conventional construction		5	Factor <0%
Envir. /Water Handling		0	No Restrictions (entry of 0 = not considered in score)
		1	minor construction limitations
		2	
		3	moderate construction limitations for portions of the work
		4	
		5	significant limitations on work
Waterway Limitations		0	No impact (entry of 0 = not considered in score)
		1	Minor impacts
		2	
		3	Seasonal recreational impacts
		4	Significant recreational impacts
		5	Significant commercial impacts

CTDOT ABC Matrix Screen Shot

ABC Decision Matrix Sheet 4 (Continuation)
ABC Rating Table

ABC rating table computes the comparative rating for ABC project methodology under consideration

Rating table

- Compiles all selected or computed rating measures
- Multiples rating measures by weighting factors
- Divides sum of weighted measure by theoretical maximum to produce ABC rating score

Rating scores

- 60-100 - Use ABC
- 50-60 - Consider ABC
- 0-50 - ABC not favorable

ABC Rating

	Score	Weight Factor	Adjusted Score	Maximum Score	Adjusted Score
Average Daily Traffic	0	10	0	5	50
User Impact Reduction	#DIV/0!	30	#DIV/0!	5	150
Bridge Location	0	5	0	5	25
Use of Typical Details	0	5	0	5	25
Work Zone Geometry	0	8	0	5	40
Site Conditions	0	5	0	5	25
Railroad Impacts	0	5	0	0	0
Cost Analysis	0	30	0	5	150
Envir. /Water Handling	0	5	0	0	0
Waterway Limitations	0	5	0	0	0
		Total Score	#DIV/0!	Max. Score	465

ABC Rating	**#DIV/0!**

ABC Rating Scale	
60-100	Use ABC
50-60	Consider ABC
0-50	Do not use ABC

CTDOT ABC Matrix Screen Shot

Decision Matrix Example

Site Information

Project Description:

Short span bridge replacement
Bridge over a waterway

Prop. ABC Method:

Precast Integral Substructure
Modular Deck Beams
Detour traffic

Conventional Construction Method:

Staged construction
One lane alternating traffic

CTDOT ABC Matrix Screen Shot

User Impact Analysis – One Way Alternating Traffic

For each direction:

Estimated Cycle Time	2.00	minutes (See note 2)
Average Delay Time	1.00	minutes (use this in the Base Spreadsheet)

** The estimated average cycle time can be assumed based on the following:

ADT <2000	1.00 minutes
2001 < ADT < 4000	1.25 minutes
4001 < ADT < 6000	1.50 minutes
6001 < ADT < 8000	2.00 minutes

Do not use alternating one way traffic for ADT over 8000

CTDOT ABC Matrix – One-way Alternating Traffic Analysis Screen Shot

User Impact Analysis – Detour

Detour Segment 1 Length	0.60	miles			
Segment 1 speed limit	25	mph			
Segment 1 Congestion Factor	1.3	See Note 1			
Segment 1 Time	1.80	minutes			
Detour Segment 2 Length	1.40	miles			
Segment 2 speed limit	45	mph			
Segment 2 Congestion Factor	1.0	See Note 1			
Segment 2 Time	1.87	minutes			
Detour Segment 3 Length	0.60	miles			
Segment 3 speed limit	25	mph			
Segment 3 Congestion Factor	1.3	See Note 1			
Segment 3 Time	1.80	minutes			
Detour Segment 4 Length		miles			
Segment 4 speed limit		mph			
Segment 4 Congestion Factor		See Note 1			
Segment 4 Time	0.00	minutes			
Detour Segment 5 Length		miles			
Segment 5 speed limit		mph			
Segment 5 Congestion Factor		See Note 1			
Segment 5 Time	0.00	minutes			
			Assumptions		
Number of Stops along detour	3	stop signs or signals			
Delays at stop signs	3.00	minutes	Delay Time per stop	1.00	minutes
Aggregate Detour Time	8.47	minutes (use this in the Base Spreadsheet)			

CTDOT ABC Matrix – Detour Traffic Analysis Screen Shot

User Impact Analysis

Roadway on Bridge		Route 99	
Average Daily Traffic		7000	vehicles per day
Conventional Construction			
	Delay Time (Per Delay Time Sheets)	1.00	minutes
	Construction Impact Duration	700	Days
	Aggregate Impact Time	3403	Person Days
ABC			
	Delay Time (Per Delay Time Sheets)	8.47	minutes
	Construction Impact Duration	30	Days
	Aggregate Impact Time	1235	Person Days

Percent Reduction in Aggregate Impact Time		
Conventional Construction		
	Total Aggregate Impact Time	3403 Person Days
ABC		
	Total Aggregate Impact Time	1235 Person Days
User Impact Reduction		64%
	Note: Negative value indicated that ABC has more impact	

CTDOT ABC Matrix Screen Shots

ABC Decision Matrix Sheet 2 - Example

Interesting side note:

- ABC is often less expensive on smaller bridges
- Reason: Non-bid costs are somewhat fixed for small to medium span bridges, and often are larger than the ABC Premium

Estimated conventional construction project cost =		
Required Bridge	$2,000,000	
Overbuild		
Total conventional bridge cost	$2,000,000	
Estimated CE&I Costs per month		
Field office monthly cost	$2,000	
CE&I staff monthly cost (field plus main office)	$40,000	
Total CE&I Monthly Cost =	$42,000	
Notes: Small field office = $xxx per month		
Medium office = $xxx per month		
Large office = $xxx per month		
Staff = $20,000 per person per month		
Net time savings for ABC =	12.0	months
Estimated Percent Premium for ABC =	20%	
MPT savings with ABC		
Things that you can eliminate from conventional construction by using ABC		
Overbuild for staging		
Temporary bridge	$0	
Temporary signal	$40,000	
Other	$0	
Total MPT Savings with ABC	$40,000	
<u>Cost analysis</u>		
Premium for ABC =	$400,000	
CEI Cost Savings =	$504,000	
MPT savings with ABC =	$40,000	
Net cost change for ABC =	-$144,000	
ABC is less expensive than conventional		

CTDOT ABC Matrix Screen Shot

ABC Decision Matrix Sheet 3 - Example

ABC Rating procedure

Enter values for each aspect of the project. Attach back-up data if applicable

Average Daily Traffic Combined traffic on and under	1	0	No traffic impacts
		1	Less than 10000
		2	10000 to 40000
		3	40000 to 70000
		4	70000 to 100000
		5	More than 100000
User Impact Reduction Calculated by spreadsheet	4	0	Zero
		1	1% to 20%
		2	21% to 40%
		3	41% to 60%
		4	61% to 80%
		5	81% to 100%
Bridge Location Stakeholder Impact	3	0	Rural Bridge away from town center
		1	Rural bridge near town center
		2	Suburban bridge away from town center
		3	Suburban bridge near major traffic generators
		4	Urban Bridge near major traffic generators
		5	Urban Bridge near emergency services
Use of Typical Details	5	1	Complex and unfavorable geometry
		2	Curved and skewed bridges
		3	Curved bridges
		4	Skewed Bridges
		5	Simple geometry well suited for typical details
Work Zone Geometry Detour quality and/or MPT Quality	3	1	Short duration project with good geometry & flow
		2	Short duration project with moderate geometry & flow
		3	Average project duration with average geometry & flow
		4	Long duration project with moderate geometry & flow
		5	Long duration project with complex geometry & flow
Site Conditions Utilities/ROW/Env. Compliance	3	0	significant limitations on work
		1	moderate construction limitations for portions of the work
		2	
		3	minor construction limitations
		4	
		5	No Restrictions
Railroad Impacts	0	0	No Railroad (entry of 0 = not considered in score)
		1	Freight Siding (Less than 1 train per week)
		2	Light Freight (1 Train per week to 1 Train per day)
		3	Heavy Freight (More than 1 Train per day)
		4	Commuter rail
		5	Electrified Commuter Rail

CTDOT ABC Matrix Screen Shot

ABC Decision Matrix Sheet 4 - Example

Cost Analysis	5	0	>30%
Factor = -7%		1	20% < Factor < 30%
Net percentage of conventional cost		2	10% < Factor < 20%
Negative value means that ABC has		3	5% < Factor < 10%
less net cost when compared to		4	0% < Factor < 5%
conventional construction		5	Factor <0%

Envir. /Water Handling	3	0	No Restrictions (entry of 0 = not considered in score)
		1	minor construction limitations
		2	
		3	moderate construction limitations for portions of the work
		4	
		5	significant limitations on work

Waterway Limitations	3	0	No impact (entry of 0 = not considered in score)
		1	Minor impacts
		2	
		3	Seasonal recreational impacts
		4	Significant recreational impacts
		5	Significant commercial impacts

ABC Rating

	Score	Weight Factor	Adjusted Score	Maximum Score	Adjusted Score
Average Daily Traffic	1	10	10	5	50
User Impact Reduction	4	30	120	5	150
Bridge Location	3	5	15	5	25
Use of Typical Details	5	5	25	5	25
Work Zone Geometry	3	8	24	5	40
Site Conditions	3	5	15	5	25
Railroad Impacts	0	5	0	0	0
Cost Analysis	5	30	150	5	150
Envir. /Water Handling	3	5	15	5	25
Waterway Limitations	3	5	15	5	25
		Total Score	389	Max. Score	515

ABC Rating	76

ABC Rating Scale	
60-100	Use ABC
50-60	Consider ABC
0-50	Do not use ABC

CTDOT ABC Matrix Screen Shot

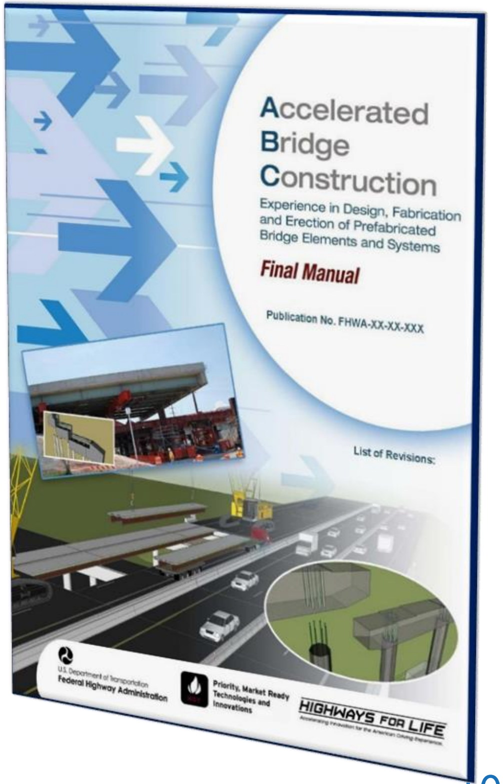
Conclusions

Factors to consider in ABC decision processes

- Type of ABC
- Traffic patterns and detours
- Total project cost
- FHWA ABC Manual offers guidance

There is no one process for ABC decision making

- Each agency should develop a process that works for them
  - There are different options in use to choose from
- Recommendation
  - Use a process that factors in the total project cost
  - CTDOT decision matrix is a good example



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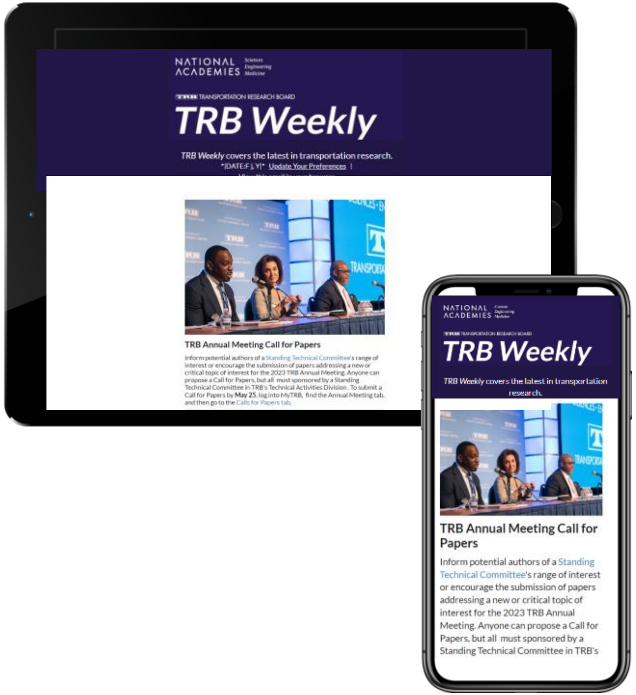

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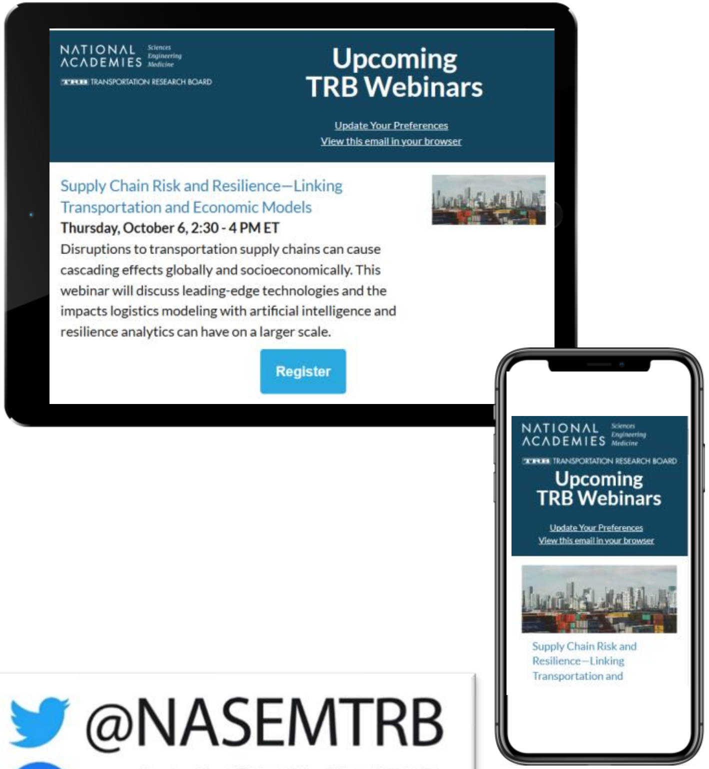

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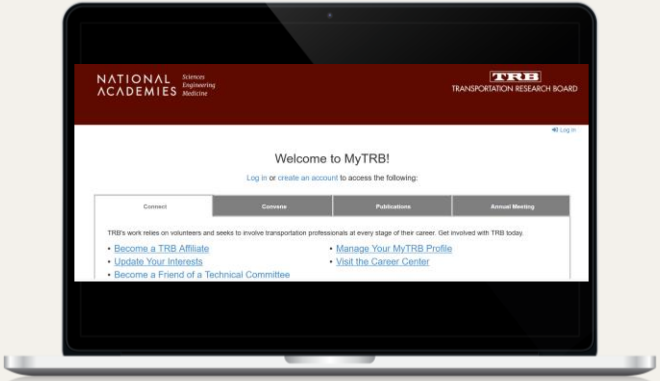

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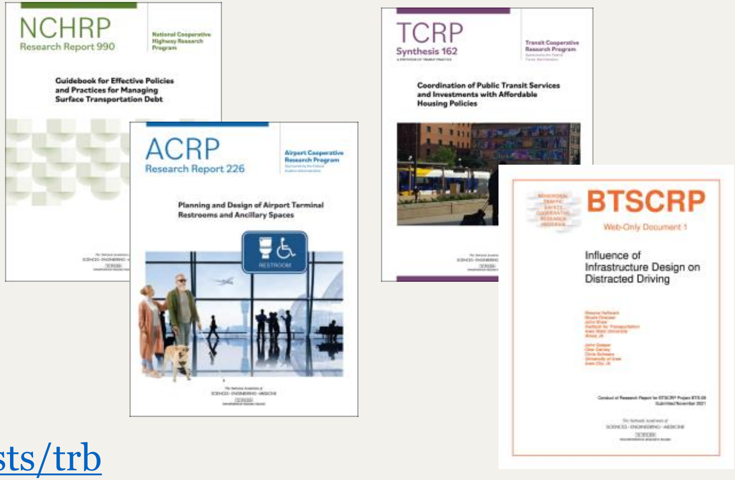

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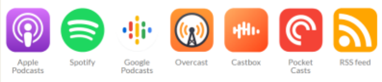

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