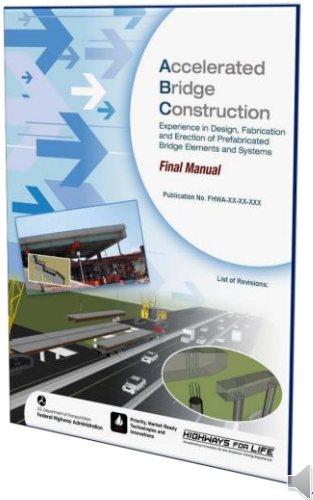
Programmatic use of ABC

Module 3:

ABC Decision Making Processes



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This module will cover the decisions that need to be made at the onset of a project where ABC is being considered.

The basis of this module is the FHWA manual entitled "*Accelerated Bridge Construction – Experience in Design, Fabrication and Erection of Prefabricated Bridge Elements and Systems*".

Module 3: ABC Decision Making Process

This Module Covers:

- Important factors to consider
  - Type of ABC
  - Traffic patterns and detours
  - Cost
- Decision processes in Use
  - Overview of different processes
- Recommended process

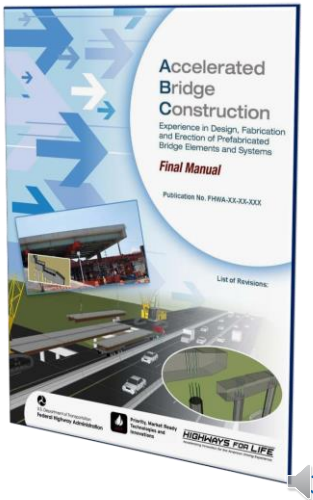
This module will cover the following topics:

- Important factors to consider
- Decision processes in use
- An example of a recommended process: CTDOT Decision Matrix

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



ABC has matured to the point where there are multiple options available to the agency when deciding to consider ABC. To make a decision, it is important to determine which form of ABC is appropriate for a given site. Later in this module, we will explore different decision matrices. Several of these processes require a basic knowledge of the type of ABC chosen and the estimated time and cost required to execute the work. In the last module, we covered the approximate time and cost of different ABC methods.

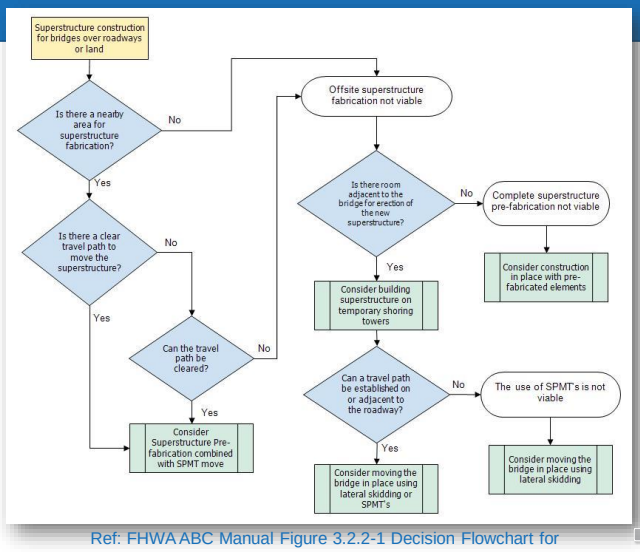
The FHWA manual includes a chapter that gives guidance on ABC method selection. It is a straightforward process that will become obvious after a few uses.

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

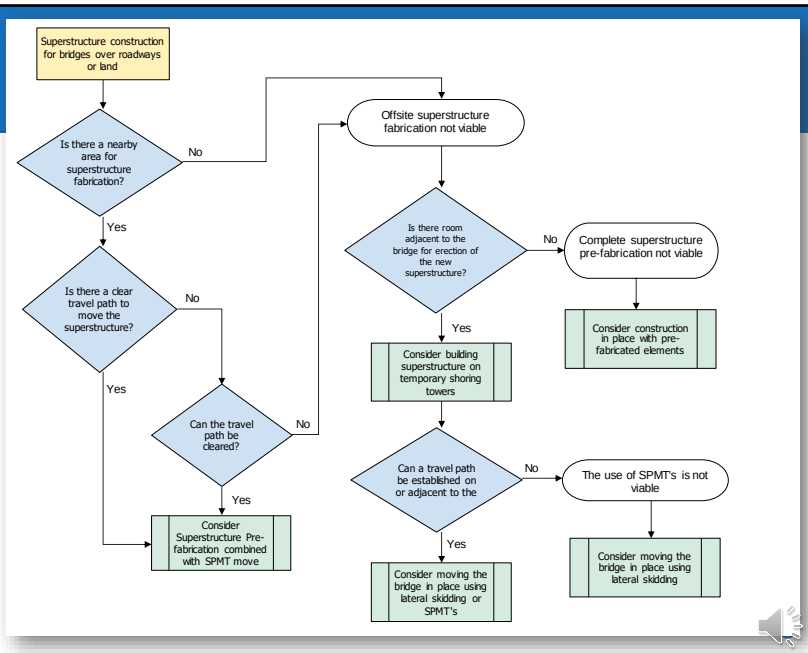


Ref: FHWA ABC Manual Figure 3.2.2-1 Decision Flowchart for Superstructure Construction over Roadway or Land

The ABC method selection process is in Chapter 3 entitled “Project Planning and Scoping” in the FHWA manual. This chapter contains simple flowcharts that can steer a user to a decision. One basic assumption is that any project can be built using prefabricated individual elements. These flowcharts will help to identify other options that may be applicable such as lateral sliding or SPMT installations.

ABC Decision Flowcharts

Superstructure over roadways



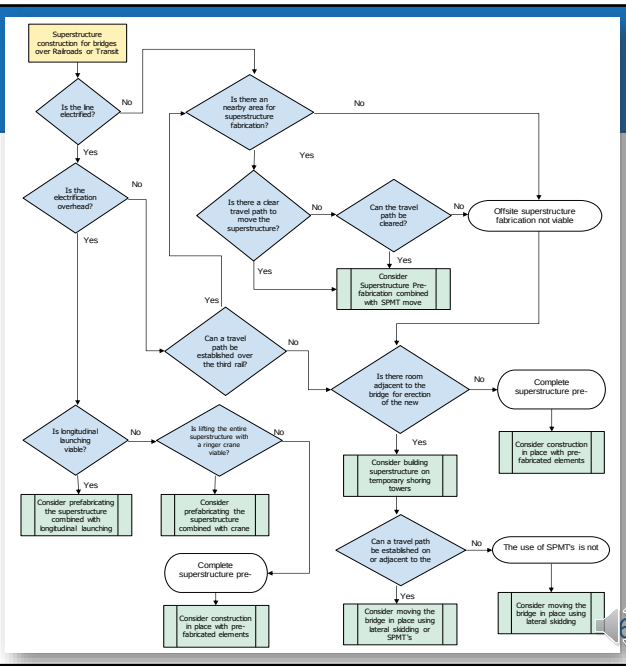
Ref: FHWA ABC Manual Figure 3.2.2-1 Decision Flowchart for Superstructure Construction over Roadway or Land

This flow chart covers the construction of bridge superstructures over roadways.

ABC Decision Flowcharts

Superstructure over railroads

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

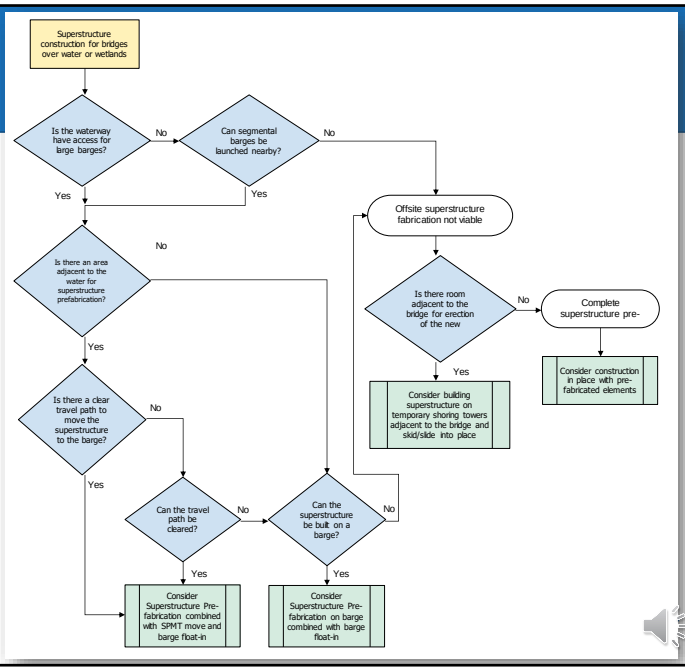


This flow chart covers the construction of bridge superstructures over railroads.

ABC Decision Flowcharts

Superstructure over water or wetlands

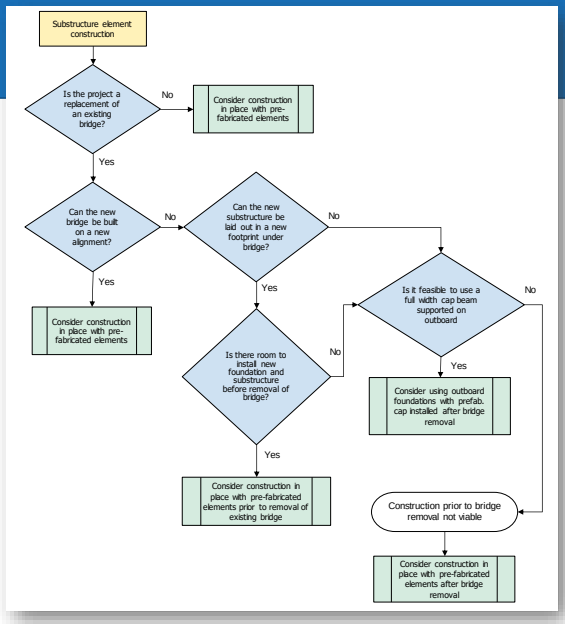
Ref: FHWA ABC Manual Figure 3.2.2-3 Decision Flowchart for Superstructure Construction over Water or Wetlands



This flow chart covers the construction of bridge superstructures over water or wetlands.

ABC Decision Flowcharts

Substructures



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

This flow chart covers the construction of bridge substructures.

Example Project

Highway Overpass

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

The best way to demonstrate the use of these flowcharts is to use a hypothetical project example. This example is actually a bridge in Montana that was investigated for ABC at one time. A few of the parameters have been changed to demonstrate this process.

We will investigate the construction of a local road bridge over an interstate highway.

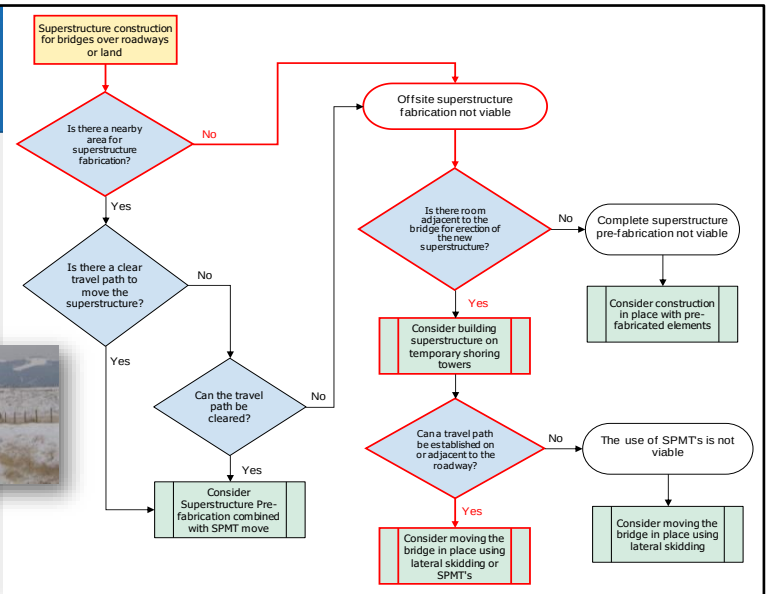
For this example, we will use the following givens:

- There is heavy traffic on the overpass road
- There is relatively light traffic on the interstate
- There is no available land nearby for a large staging area. The adjacent land is privately held and scheduled for development.

Example Project

Superstructure

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



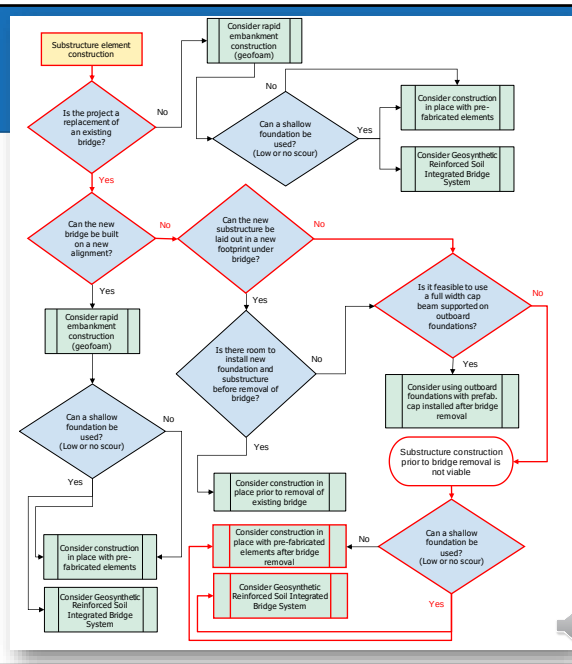
We can now go through the decision process for the superstructure.

- Step 1: Is there a nearby area for superstructure prefabrication?
    - Answer is No, Offsite prefabrication is not viable
- Step 2: Is there room adjacent to the bridge for the erection of the new superstructure?
    - Answer is yes. There is ample room adjacent to and parallel to the bridge.
    - Consider building the superstructure on temporary shoring towers
- Step 3: Can a travel path be established on the adjacent roadway?
    - Answer is yes. There are opportunities to move the bridge using SPMTs
- Conclusions:
    - It is feasible to build the bridge on shoring adjacent to the existing bridge. Once the old bridge is removed, the new bridge can be moved into place using either SPMTs or Skidding (lateral sliding)
    - As previously stated, the use of prefabricated elements, such as modular deck beams is also an option for the superstructure.

Example Project

Substructure

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



We can now go through the decision process for the substructure.

- Step 1: Is the project a replacement of an existing bridge?
  - Answer is Yes
- Step 2: Can the new bridge be built on a new alignment?
  - For this example, we will assume that this is not possible.
- Step 3: Can the new substructure be laid out in a new footprint under the bridge?
  - This involves building new substructures between the existing ones.
  - It is feasible to build new abutments between the existing abutments and the shoulder piers, but it is not feasible to do this for the center pier. Therefore, the answer is no. The designer should still consider building at least the abutments under the bridge in any case.
- Step 4: Is it feasible to use a full-width cap beam supported on outboard foundations?
  - This method involves building foundations outside the footprint of the bridge. For the center pier, this might mean building foundations and pier columns in line with the existing center pier. Once the existing pier is removed a straddle beam can be used to support the new structure. This option is often only feasible for narrow bridges. We'll assume for our case the bridge is too wide for this option. Therefore, the answer is no, full substructure construction prior to bridge removal is not viable.
- Step 5: Can a shallow foundation be used?
  - For this example, we will assume the answer is yes
- Conclusions:
  - Consider construction in place with prefabricated elements after bridge removal.
  - Consider a geosynthetic reinforced soil integrated bridge system for the abutments.

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?

The next step in a decision process is to consider and investigate traffic patterns in the area. The following data needs to be gathered in order to make a proper decision on the use of ABC:

- Hourly traffic volumes for both weekdays and weekends
- Seasonal changes in traffic volumes due to resorts, attractions, or local seasonal events
- Available detours:
  - Many agencies limit detours to state highways only. The designer may want to investigate the possibility of using local roads through outreach to the local community.
  - In some cases, local residents will take local roads even though an official detour is set up on state highways. This may play into the decision process.
- Evacuation Routes and Emergency Vehicle Routes
  - The location of hospitals, fire stations, and ambulance services should be considered.
- Impact on local businesses:
  - This is a difficult subject to quantify, but It can be factored into the decision process if there are multiple options available.

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

Cost should also be considered in any decision process. In the previous module, we discussed the potential premiums for ABC. In the early phases of a project where a decision is being made, it is not critical that this number be exact.

Is the premium on ABC the whole picture? The answer is no.

The important factor for cost analysis is to look at the total project costs, not just the bid price. We will explore the investigation of total project costs in the following slides.

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

Total project costs involve all the costs borne by the agency for the design, construction, and administration of the project.

Most designers consider the bid price to be the project cost, but this is not the case. There are significant non-bid costs that affect the total project cost. These include:

- The cost for construction inspection personnel. This can be a significant portion of the project cost. In some cases, it will exceed the cost of design.
- The cost for back-office staff that is responsible for items such as invoicing and contract management.
- The cost of a physical field office including the equipment in the office and utilities required such as electricity and communications.
- The cost of traffic flagging or RR flagging can be very significant on some projects.

By reducing the overall project schedule through the use of ABC, all of these non-bid costs can be reduced, which can offset the premium paid for ABC in the bid. We will explore this further in the module.

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

There are other ways to save costs through the use of ABC. These include:

- Maintenance of traffic costs:
  - The cost of staging barriers and temporary traffic control can be eliminated if a reasonable detour can be employed combined with the use of ABC.
- Overbuild:
  - In some cases, the new bridges are built wider than required to accommodate staged or phased construction. The cost of overbuilds can be eliminated if a reasonable detour can be employed combined with the use of ABC. It is also important to understand that overbuilds will increase future maintenance costs as well.
- Temporary Bridges
  - In many cases, temporary bridges can be eliminated with a detour and a short-term closure. This represents a significant cost savings potential.

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)

Let's see some examples

Now that we have the data to perform a decision process, we need to decide which process to use. Each agency either has or should develop an ABC decision process that is tailored to its needs. It is recommended that each agency develop a process and make it a standard part of the project development/scoping process.

There are several different types of processes that are currently in use in the United States. Each is different, but that is ok since each state has different priorities and goals. The common forms of decision processes include:

- Simple checklists
- Weighted scoring algorithms
- Complex decision-making tools

What works in one agency may not be acceptable to another agency. The goal of this training is to explore these common methods that can be considered.

Utah DOT Decision Matrix

Weighted score algorithm

- 8 factors are scored on a 0-5 basis
- Multiplied by weight factors
- Total is used as an ABC decision score

ABC RATING SCORE FACTORS AND WEIGHTS

	Score	Weight Factor	Adjusted Score	Maximum Score	Adjusted Score
Average Daily Traffic	1	10	10	5	50
Delay/Detour Time	5	10	50	5	50
Bridge Classification	1	5	5	5	25
User Costs	4	10	40	5	50
Economy of Scale	0	3	0	3	9
Use of Typical Details	3	3	9	5	15
Safety	3	10	30	5	50
Railroad Impacts	0	5	0	5	25
		Total Score	144	Max. Score	274

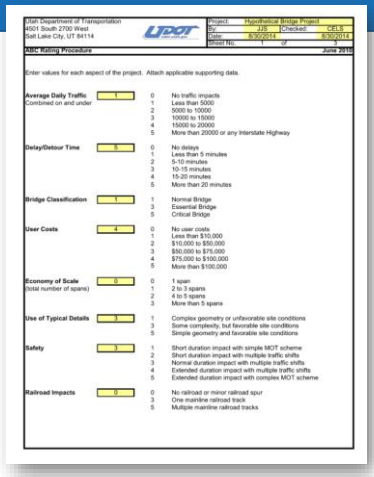
ABC Rating Score: 53

ABC Rating Score = (Total Score)/(Max. Score)*100
The ABC Rating Score is driven by the four most heavily weighted factors: Average Daily Traffic, Delay/Detour Time, User Costs and Safety.

Cost Considerations:
Calculate the following costs for use in determining the lowest total project cost

TOTAL PROJECT COST EVALUATION

	Alternative #1	Alternative #2
Construction Costs	$2,500,000	$3,000,000
User Costs	$1,000,000	$250,000
Total Project Cost	**$3,500,000**	**$3,250,000**


Utah Department of Transportation
4501 South 2700 West
Salt Lake City, UT 84114

UDOT

Project:	Hyrd/Hstrical Bridge Project		
By:	JJS	Checked:	CELS
Date:	8/30/2014		8/30/2014
Sheet No:	1	of	1

ABC Rating Procedure — **June 2010**

Enter values for each aspect of the project. Attach applicable supporting data.

Average Daily Traffic Combined on and under	1	0	No traffic impacts
		1	Less than 5000
		2	5000 to 10000
		3	10000 to 15000
		4	15000 to 20000
		5	More than 20000 or any Interstate Highway
Delay/Detour Time	5	0	No delays
		1	Less than 5 minutes
		2	5-10 minutes
		3	10-15 minutes
		4	15-20 minutes
		5	More than 20 minutes
Bridge Classification	1	1	Normal Bridge
		3	Essential Bridge
		5	Critical Bridge
User Costs	4	0	No user costs
		1	Less than $10,000
		2	$10,000 to $50,000
		3	$50,000 to $75,000
		4	$75,000 to $100,000
		5	More than $100,000
Economy of Scale (total number of spans)	0	0	1 span
		1	2 to 3 spans
		2	4 to 5 spans
		3	More than 5 spans
Use of Typical Details	3	1	Complex geometry or unfavorable site conditions
		3	Some complexity, but favorable site conditions
		5	Simple geometry and favorable site conditions
Safety	3	1	Short duration impact with simple MOT scheme
		2	Short duration impact with multiple traffic shifts
		3	Normal duration impact with multiple traffic shifts
		4	Extended duration impact with multiple traffic shifts
		5	Extended duration impact with complex MOT scheme
Railroad Impacts	0	0	No railroad or minor railroad spur
		3	One mainline railroad track
		5	Multiple mainline railroad tracks

We will start with the Utah decision process, which involves the use of a weighted score algorithm. Eight factors are considered in this process. Each factor is multiplied by a pre-determined weight factor and totaled to come up with an ABC score. Factors include:

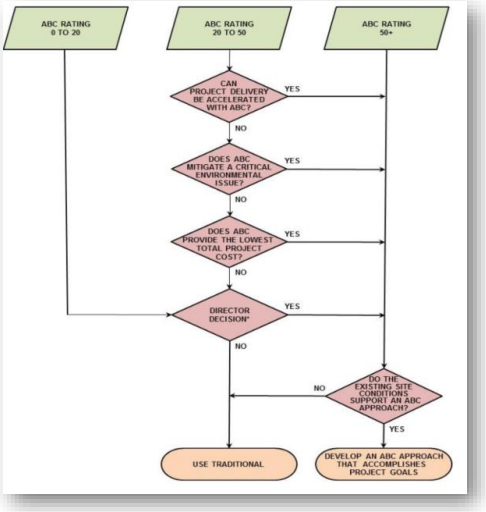
- Average daily traffic:
  - A measure of the highway volume and level of impact that the project will have on travelers
- Delay/detour time
  - A measure of the significance of the potential detour
- Bridge classification
  - A measure of the importance of the bridge
- User costs
  - A measure of the financial impact on travelers
- Economy of scale
  - A measure of ways to reduce costs through repetition
- Use of typical details
  - A measure of the complexity of the design
- Safety
  - A measure of the complexity of a potential work zone set-up
- Railroad impacts
  - A measure of the impacts on railroads
  - Note that this is only scored if the bridge crosses a railroad.

The estimated project cost is determined for each alternative along with the user cost impacts for each. These two are totaled and used in the next step of the process.

Utah DOT Decision Matrix

Decision Process

- If the rating is greater than 20
  - Consider ABC
- If it is greater than 50
  - Most likely ABC



Once the scores and costs are determined, a final decision can be made.

If the ABC score is less than 20, then the decision is either no or deferred to the Director.

If the score is greater than 50, ABC is used if the site conditions are favorable

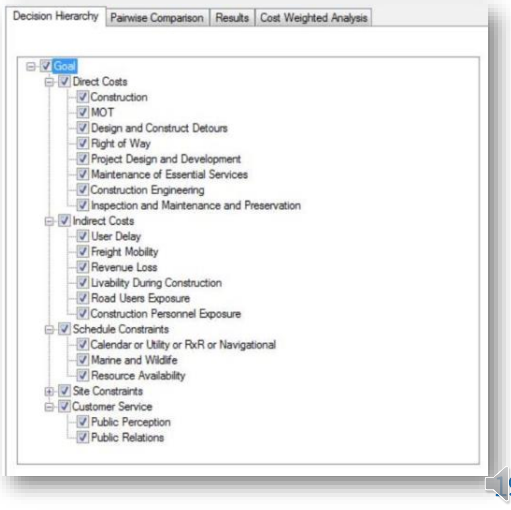
If the score is between 20 and 50, several more factors are considered:

- Can the project be accelerated with ABC?
- Does ABC mitigate critical environmental issues?
- Does ABC provide the lowest total project cost?
  - This is where the previous calculation on cost is used.
  - Utah DOT uses the cost of the construction plus the user impact cost to compute a total project cost that is used in this decision step.

Oregon DOT Decision Process

Analytical Hierarchy Process

- This is a detailed decision-making tool
- Compares conventional construction to ABC
- Includes non-bid cost analysis
- Decision hierarchy



The Oregon DOT ABC decision process is an example of a process that is more in-depth. This process, known as the Analytical Hierarchy Process (AHP), is a more detailed decision-making tool that can be used by agencies that need more substantial justification for the use of ABC.

The process compares one option against another, typically conventional construction versus ABC. It could also be used to compare two ABC options.

It does factor in non-bid costs (direct costs), which is a plus.

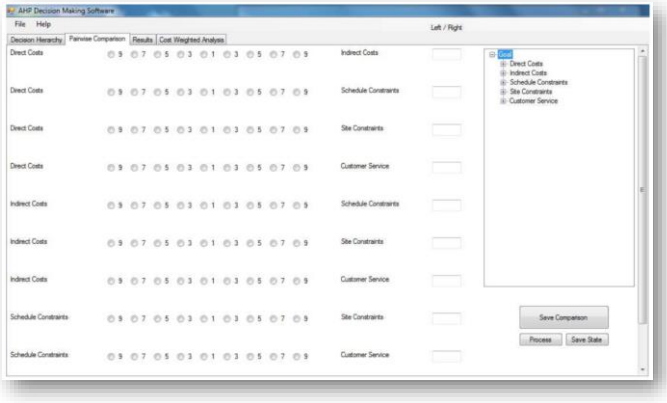
The graphic on the right shows the decision hierarchy that is used in the process. I will not be going into the process in great detail today, but there is a detailed training webinar that is available on the FIU ABC UTC website. Simply search FIU ABC and look for the webinar archives.

In the following slides, we will cover the highlights of the process.

Oregon DOT Decision Process

Analytical Hierarchy Process

- Pairwise comparison

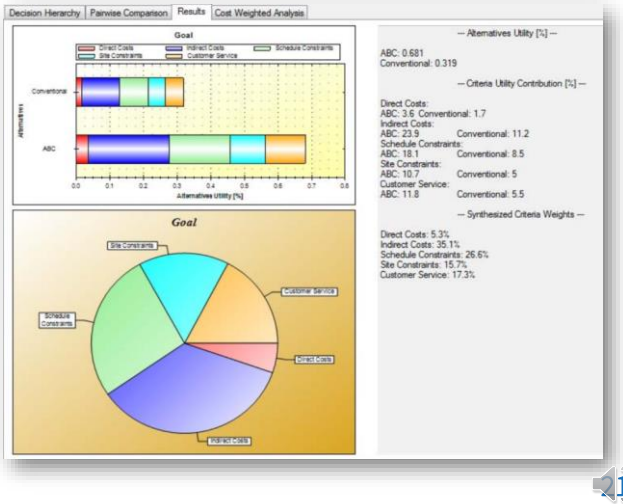


This screenshot shows the pairwise comparison that is the heart of the AHP process. For any given criteria, the user is asked to compare the importance of one variable to another. This may seem like a subjective approach, and it is; however, through the comparison of many variables, the software can paint a picture of the whole project comparison.

Oregon DOT Decision Process

Analytical Hierarchy Process

- Results

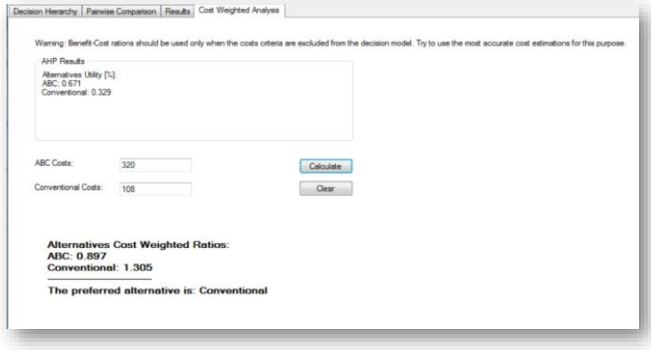


This screenshot shows the results of the various pairwise comparisons in the AHP process.

Oregon DOT Decision Process

Analytical Hierarchy Process

- Results

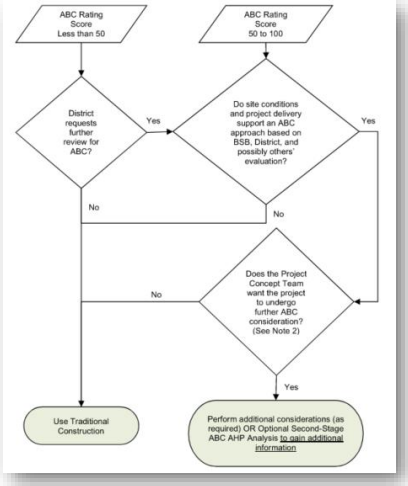


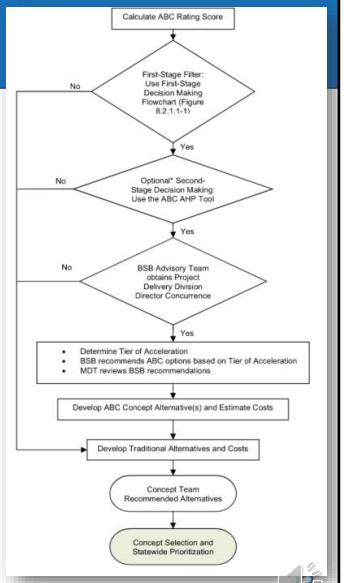
This screenshot shows the cost weighted analysis of the AHP process.

Iowa Decision Matrix

Multi-stage process

- First-stage
  - Calculate a rating score using a weighted score algorithm
  - Followed by a simple flowchart
- Optional second stage
  - Use the Oregon AHP tool
- Final approval by an advisory team





Iowa DOT uses a two-stage decision process.

In the first stage, a rating score is calculated using a weighted scoring algorithm that is similar to the Utah method. That score is used in a simple flowchart. If ABC looks favorable, then additional considerations are taken into account in the decision process.

There is an optional second stage to the process that involves using the Oregon Analytical Hierarchy Process (AHP). Unfortunately, the Oregon AHP has been discontinued by the Oregon DOT, therefore updates to the process are not likely.

Massachusetts Process

Weighted score process

- Scoring based on several factors
- Weights assigned to:
  - Highway: 60%
  - Other factors: 40%

Highway Evaluation Value

ADT Value	
ADT (I-29)	*Value*
<1000	1
1000-4999	2
5000-9999	3
10000-19999	4
≥20000	5

Detour Value	
Detour (I-19)	*Value*
0-1 KM	1
2-3 KM	2
4-5 KM	3
6-9 KM	4
10+ KM	5

Classification Value	
Class (I-26)	*Value*
09, 19	1
08	2
07, 17	3
06, 16	4
01, 02, 11, 12, 14	5

Note: Items 29, 19 and 26 shall be taken from the SIA.

Highway Evaluation Value = (ADT value + Detour value + Classification value) / 3.0

Highway Evaluation Value (A) = ☐

Other Factors Value

a). Is it an Emergency Replacement? (2 Points if YES; 0 Points if NO) ☐

a). Is the Bridge over an active and busy RR or Navigation Channel? (2 Points if YES; 0 Points if NO) ☐

c). Is the Bridge on Evacuation Route? (1 Point if YES; 0 Points if NO) ☐

Other Factors Value = (a + b + c)

Other Factors Value (B) = ☐

PRELIMINARY DECISION VALUE = 2 x [0.6(A) + 0.4(B)]

PRELIMINARY DECISION VALUE = ☐

Massachusetts uses a weighted scoring method based on several factors:

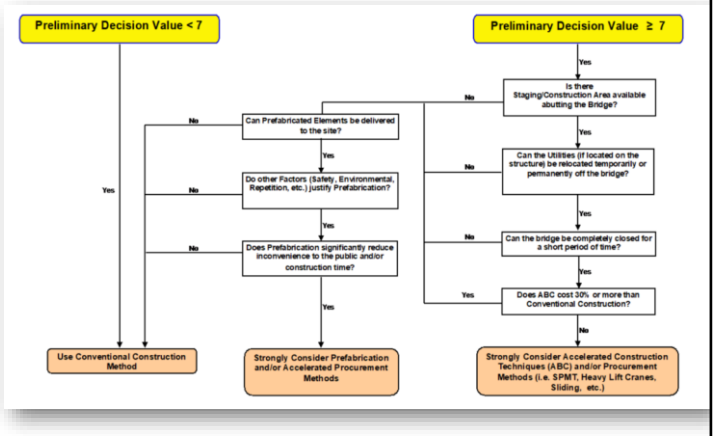
- ADT
- Detour length
- Classification of the roadway
- Emergency replacement
- Feature crossed
- Evacuation routes

Weights are assigned to each factor, they are input into a pre-described equation, and a preliminary decision value is calculated.

Massachusetts Process

Weighted score process

- Final score is applied to a simple flow chart

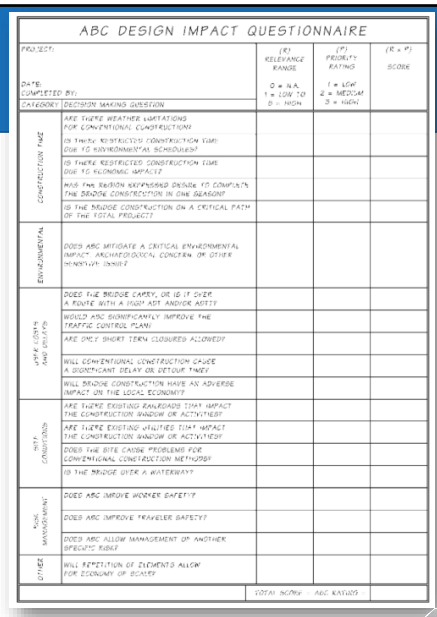


Once the preliminary decision value is determined, the flowchart shown on the right is used to arrive at a recommended decision.

Washington Process

Scoring Questionnaire

- Relevance * Priority rating
- Criteria
  - Construction time
  - Environmental
  - User costs
  - Site conditions
  - Risk management
  - Other



ABC DESIGN IMPACT QUESTIONNAIRE

PROJECT: DATE: COMPLETED BY:		(R) RELEVANCE RANGE 0 = N.A. 1 = LOW TO 3 = HIGH	(P) PRIORITY RATING 1 = LOW 2 = MEDIUM 3 = HIGH	(R x P) SCORE
CATEGORY	DECISION MAKING QUESTION			
CONSTRUCTION TIME	ARE THERE WEATHER LIMITATIONS FOR CONVENTIONAL CONSTRUCTION?			
	IS THERE RESTRICTED CONSTRUCTION TIME DUE TO ENVIRONMENTAL SCHEDULES?			
	IS THERE RESTRICTED CONSTRUCTION TIME DUE TO ECONOMIC IMPACTS?			
	HAS THE BUDGET EXPENDED DEEMED TO COMPLETE THE BRIDGE CONSTRUCTION IN ONE SEASON?			
	IS THE BRIDGE CONSTRUCTION ON A CRITICAL PATH OF THE TOTAL PROJECT?			
ENVIRONMENTAL	DOES ABC MITIGATE A CRITICAL ENVIRONMENTAL IMPACT, ARCHAEOLOGICAL CONCERN, OR OTHER SENSITIVE ISSUES?			
USER COSTS AND DETOUR	DOES THE BRIDGE CARRY, OR IS IT OVER A ROUTE WITH A HIGH ADT AND/OR ADTT?			
	WOULD ABC SIGNIFICANTLY IMPROVE THE TRAFFIC CONTROL PLAN?			
	ARE ONLY SHORT TERM CLOSURES ALLOWED?			
	WILL CONVENTIONAL CONSTRUCTION CAUSE A SIGNIFICANT DELAY OR DETOUR TIME?			
	WILL BRIDGE CONSTRUCTION HAVE AN ADVERSE IMPACT ON THE LOCAL ECONOMY?			
SITE CONDITIONS	ARE THERE EXISTING RAILROADS THAT IMPACT THE CONSTRUCTION WINDOW OR ACTIVITIES?			
	ARE THERE EXISTING UTILITIES THAT IMPACT THE CONSTRUCTION WINDOW OR ACTIVITIES?			
	DOES THE SITE CAUSE PROBLEMS FOR CONVENTIONAL CONSTRUCTION METHODS?			
	IS THE BRIDGE OVER A WATERWAY?			
RISK MANAGEMENT	DOES ABC IMPROVE WORKER SAFETY?			
	DOES ABC IMPROVE TRAVELER SAFETY?			
	DOES ABC ALLOW MANAGEMENT OF ANOTHER SPECIFIC RISK?			
OTHER	WILL REPETITION OF ELEMENTS ALLOW FOR ECONOMY OF SCALE?			
		TOTAL SCORE - ABC RATING		

Washington State DOT uses another form of a weighted scoring method. Several factors are scored and multiplied by a “relevance factor”. The weighted scores are then totaled.

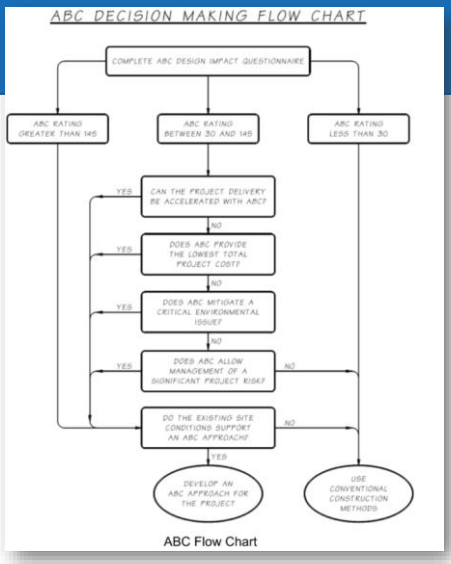
The scoring criteria include:

- Construction time
- Environmental
- User costs
- Site Conditions
- Risk Management
- Other

Washington Process

Decision Flow Chart

- ABC rating is used to enter the chart
- Less than 30:
  - Use conventional construction
- Greater than 145:
  - ABC is a likely outcome
- 30-145:
  - Evaluate the decision using a prescribed list of criteria



ABC Flow Chart

The ABC rating previously calculated is used to enter the chart

If the rating is less than 30, conventional construction will be used.

If the rating is greater than 145, ABC is a likely outcome.

If the rating is between 30 and 145, the decision is further evaluated based on a prescribed list of criteria.

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

There is no one ABC decision process that works for all. Each state has specific needs for justification of its decisions to go with ABC. As we have just seen, many states are using similar processes.

For this training, we are recommending the use of the Connecticut DOT ABC decision matrix (or something similar to it). The reason for this recommendation is:

- It is a relatively simple process
- It uses a more detailed calculation of roadway user impacts for detours, lane reductions, and one-way alternating traffic
- It factors in total project costs including non-bid costs

In the following slides, we will go into more detail on the CTDOT process and why we are recommending it.

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 $$

Some agencies calculate user costs for use in their decision-making process for ABC. User costs are a good tool for justifying the use of ABC, because it accounts for the impact of roadway construction on drivers and vehicles. It is a valuable tool for calculating disincentive provisions in ABC contracts.

The problem with user costs is that you cannot spend them. It is not a real cost to the agency. I like to refer to user cost dollars as Monopoly money with regard to agency and project management.

Another issue with user costs is that the calculations can vary widely from agency to agency. FHWA has recommendations for calculating user costs, which can be used.

In an ABC decision-making process, the important aspect to consider is the impact of ABC on road users, not necessarily the dollar value.

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

The Connecticut DOT approach to user impacts involves a calculation of the ratio of roadway user impacts, comparing ABC impacts and conventional construction impacts. The Connecticut approach calculates impacts in vehicle-days, not in actual dollars. The impacts are totaled for both travelers on the bridge and travelers below the bridge for both ABC and conventional construction. From there, a ratio of the two numbers is calculated which represents a percent increase or reduction in roadway user impacts with ABC. This value is then used in the decision process.

The key factor needed to do this analysis includes the average daily traffic for all roadways and the delay times 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

The Connecticut DOT decision process includes investigating ways to offset ABC costs with other cost savings. There are several ways to save costs with ABC.

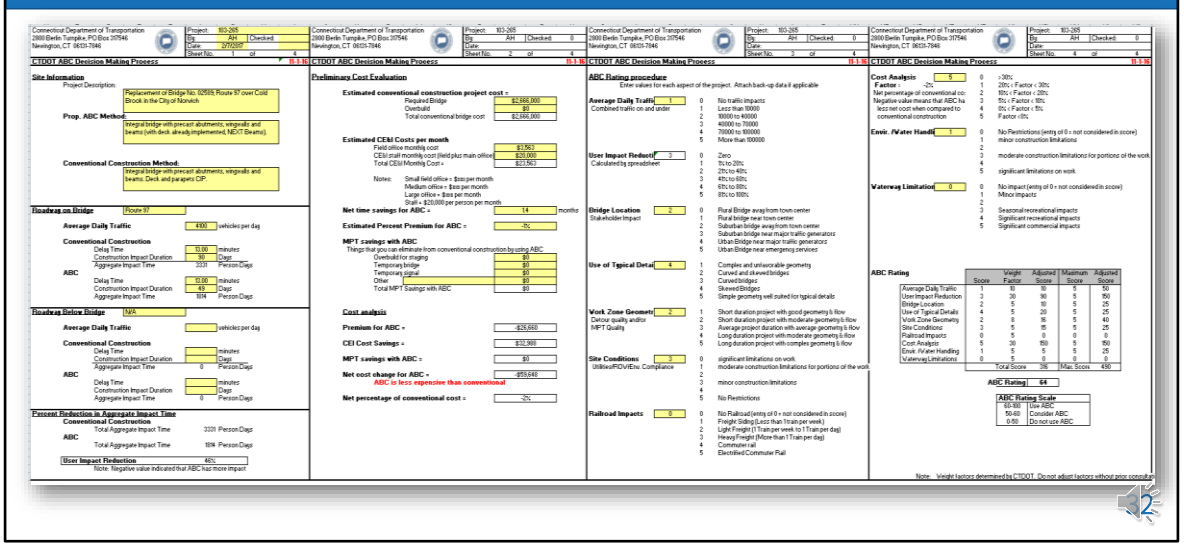
The first is reduced construction management costs, which are affected by an overall project duration reduction. Note that these savings are not in the bid. These include:

- Reduction in hours for field inspectors by reducing overall construction days
- Similar reduction in back-office staff time
- Reduction in the rental or leasing of field office space

The second way to offset ABC costs is through reduced traffic management costs through the use of a short-duration detour. These include:

- Elimination of temporary traffic signals
- Reduction in flagging and police details
- Elimination of staged or phased construction
- Elimination of temporary bridges
- Elimination of overbuilds: In some cases, the new bridge will be built wider than necessary in order to accommodate the second or third stage of construction. This can be eliminated with ABC and a full closure.

CTDOT ABC Decision Matrix



This slide shows the Connecticut DOT ABC decision matrix. It is a four-page spreadsheet. The yellow boxes are the input areas. The remainder of the spreadsheet includes the results.

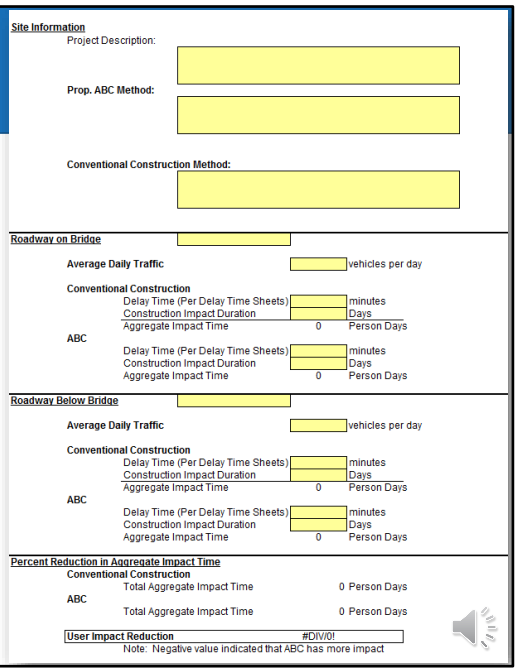
There are several tabs at the bottom of the spreadsheet that are used for supplementary calculations. These include:

- Calculation of delay time for detours
- Calculation of delay time for one-way alternating traffic
- Calculation of delay times for lane reductions

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



The first page contains project information and the calculation of roadway user impact ratios. The input areas include:

Site Information and Preliminary Road User Impact Analysis

The site information box identifies the project description and the potential type of ABC methodology. If more than one form of ABC is feasible, a separate decision matrix should be completed for each. The type of conventional construction should also be identified in order to properly compare impacts to the selected ABC methodology.

Preliminary road user impacts are assessed by estimating and comparing the road user delay time for conventional construction to a proposed ABC construction methodology. Aggregate road user impact time is calculated in the form of person-days.

The comparison between the selected ABC methodology and conventional construction methodology in road user impact is calculated in the spreadsheet as a "User Impact Reduction", which is a percent reduction (or increase) in road user impacts. A negative value would mean that the proposed ABC methodology would have more user Impacts than conventional construction.

User impacts are calculated for both traffic on the bridge and under the bridge. Input includes:

- ADT: The number of vehicles traveling on and under the bridge
- Delay time per vehicle: The average delay for each vehicle
- Construction Impact duration: The length of time for the construction

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.

7

This slide shows the supplementary spreadsheet tab for calculation of delay time for projects where alternating one-way traffic is being considered. The input is the estimated cycle time for the one-way alternating traffic signal. If this value is not known at the time of this analysis, an estimated value can be entered based on the ADT.

The average delay time is simply one-half of the total cycle time. This is based on the fact that a typical car will spend one-half of a cycle at the signal. Some vehicles will get lucky and approach the light when it is green and have no measurable delay. Some vehicles will approach the light when it goes red and will need to wait for the entire cycle. The average vehicle will be between these two scenarios.

Detour Length Delay
(Supplementary Spreadsheet)

Traffic Delay Calculation Recommendations Key

	Input areas
	Calculations and results

Detour Delays

Detour Segment 1 Length		miles
Segment 1 speed limit		mph
Segment 1 Congestion Factor		See Note 1
Segment 1 Time	#DIV/0!	minutes
Detour Segment 2 Length		miles
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

Comments

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.

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.

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

This slide shows the supplementary spreadsheet tab for the calculation of delay time for projects where detours are being considered. The approach is to break up the detour into segments and calculate the travel time for each segment.

The input for each segment is the length of each segment, the segment speed limit (not the anticipated speed), and the segment congestion factor. The congestion factor is based on a table in the spreadsheet (shown on the right). The congestion factor is a function of the roadway conditions at the bridge site and the roadway conditions for the segment under investigation. This factor will account for the possibility of traffic moving below the speed limit through each segment.

If the roadways have varying levels of traffic volume, the user of this spreadsheet can calculate different delay times for both peak and off-peak detours. From there, an average delay time can be calculated. It is generally the total delay time for all drivers, divided by the total number of vehicles.

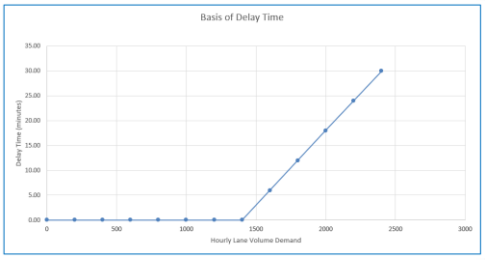
Delays at stop signs or signals are input. It is assumed that the average delay time is 1 minute per signal or stop sign. This can be adjusted if the user has better information.

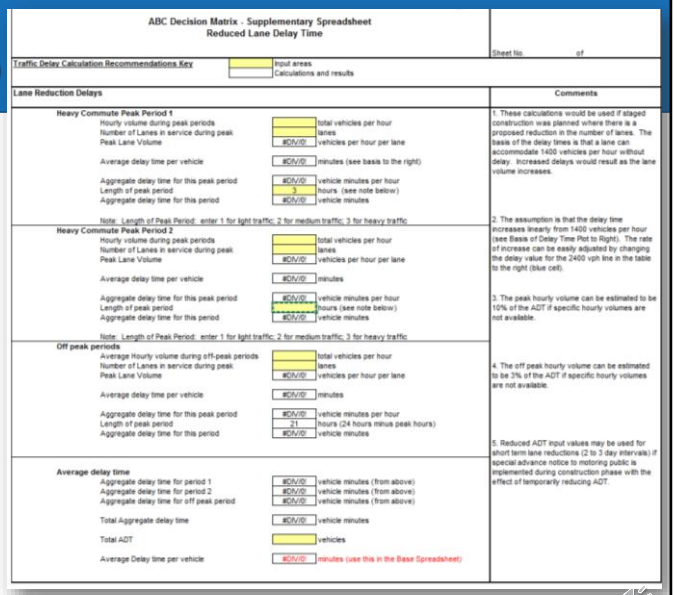
In the following slides, we will go through an example of this process.

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: Input areas; Calculations and results

Lane Reduction Delays			Comments
Heavy Commute Peak Period 1			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.
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			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).
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			3. The peak hourly volume can be estimated to be 10% of the ADT if specific hourly volumes are not available.
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	4. The off peak hourly volume can be estimated to be 3% of the ADT if specific hourly volumes are not available.
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			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.
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)	

This slide shows the supplementary spreadsheet tab for the calculation of delay time for projects where lane reductions are proposed. The approach is to break up the calculation into periods (peak vs, off-peak).

The input for each period is:

- The hourly volume for the period
- The number of lanes that will be open during the period
- The duration of the period
- The total ADT for the day under consideration

The spreadsheet calculates the aggregate delay time based on the input. The calculations are based on the graph shown on the left. It assumes that there is no impact for hourly lane volumes less than 1400 vph. For volumes over this, the delay increases linearly as the lane volume increases. This plot was developed by the CTDOT Traffic Engineering office.

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!

This slide shows the input screen for the preliminary cost evaluation (Sheet 2). The purpose of this sheet is to determine the effect of ABC on the OVERALL cost of the bridge. The overall cost is both the bid price and the cost of managing the project (CE&I costs), which can be a major factor in the overall cost of the project. The comparison is made between the total project costs for each construction method. The result is given as a percent increase (or decrease) in total project costs with ABC. A negative value means that ABC has a less overall cost when compared to conventional construction.

The input is as follows:

- Estimated conventional construction project cost including any overbuild requirements
- Estimated Construction Engineering and Inspection costs per month including field office rental and back-office staff
- Net time savings: This is the estimated total project time savings with ABC
- Estimated cost premium of ABC: Increase in cost when compared to conventional construction
- Maintenance and Protection of Traffic (MPT) costs savings with ABC

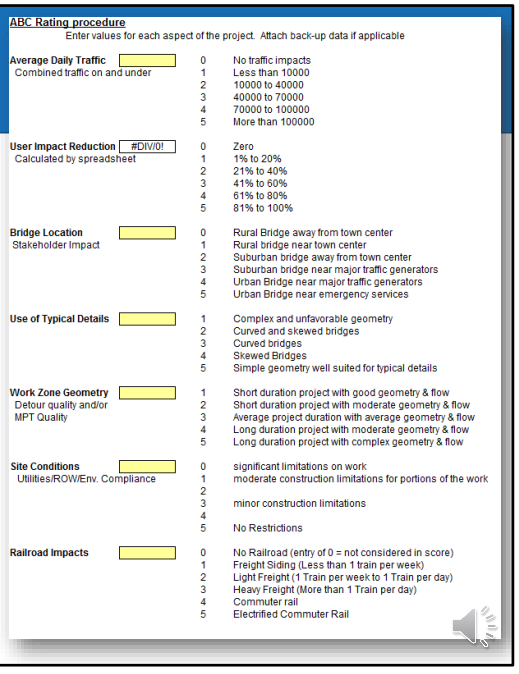
With this data, the spreadsheet will calculate a cost increase or decrease with ABC by taking the ABC premium and subtracting all savings associated with switching to ABC. The result is reported as a net increase or decrease over conventional construction. This value is later used on the subsequent sheets.

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

Sheet 3 of the matrix includes input on the specified criteria that are used for the ABC decision process. The recommended input values are noted on the right of each input. These include:

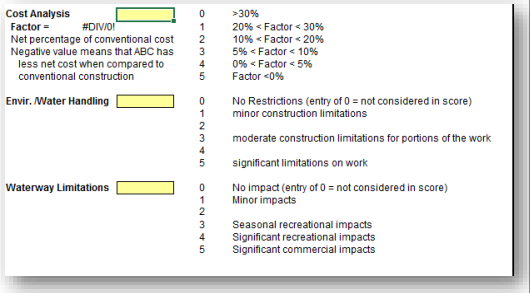
- Average daily traffic
- User impact reduction (automatically transferred from the first sheet)
- Bridge Location: A measure of impact on the local town/city
- Use of typical details: A measure of the potential for simple details
- Work Zone Geometry: A measure of the quality of the work zone set-up
- Site conditions: A measure of the complexity of the site
- Railroad impacts: A measure of the complexity of working over and around railroads. Note that if a zero is entered this criterion is neglected in the analysis.

Users of this spreadsheet can download a file from CTDOT that describes each of these criteria in more detail.

Search: "CTDOT ABC Decision Process"

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

Sheet 4 of the matrix includes more input on the specified criteria that are used for the ABC decision process. The recommended input values are noted on the right of each input. These include:

- Cost analysis: The cost percentage is carried forward from sheet 2. The user then inputs a value based on the percentage calculated.
- Environmental/Water Handling: A measure of the complexity of work in and around water or wetlands
- Waterway Limitations: A measure of the complexity of managing river traffic.

Note that if a zero is entered for the last two items, these criteria are neglected in the analysis.

Again, users of this spreadsheet can download a file from CTDOT that describes each of these criteria in more detail.

Search: "CTDOT ABC Decision Process"

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

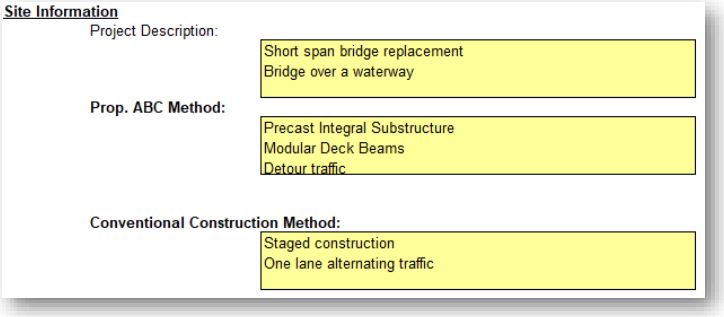
Sheet 4 contains the final results of the ABC rating process. This is presented in a rating table showing the scores and the weight factor for each score.

The purpose of the ABC rating table is to compute a comparative rating for the ABC project methodology under evaluation. The rating table compiles all selected or computed rating measures, multiplies the rating measures by predetermined weighting factors, sums all weighted measures, and then divides the sum of all weighted measures by a theoretical maximum rating score yielding a final comparative rating on a scale of 1 to 100.

Project ABC methodology ratings of 60 to 100 are considered good candidates for ABC use. Project ABC ratings of 50 to 60 are considered marginal for ABC implementation. Project ABC ratings of less than 50 are not generally considered good candidates for ABC implementation.

Weight factors are locked in the spreadsheet for uniformity in approach but could be adjusted over time if the ABC matrix recommendation is found to need adjustment. User Impact reduction and ABC/conventional cost comparison factor are considered most significant in the comparative analysis and were, therefore, most heavily weighted in the Matrix Rating table.

Decision Matrix Example



CTDOT ABC Matrix Screen Shot

The best way to demonstrate a process is through an example. This example is for a short-span bridge replacement over a waterway.

The proposed ABC method is:

- Precast concrete integral abutments
- Modular deck beam elements
- Detour traffic

The conventional construction approach for comparison is:

- Staged construction
- One-way alternating traffic through the work zone.

The ADT for the site is 7000.

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

This slide shows the results of the analysis for the one-way alternating traffic pattern that is proposed for the conventional construction option.

The estimated cycle time is set at 2 minutes based on the values shown below the input area. This value can be adjusted if a traffic analysis was completed or if there are unusual circumstances. For example, if the work zone was very long, it may require a much longer cycle to clear traffic through the work zone before changing the signal.

Again, the result is divided by two since not all vehicles will experience the total cycle time.

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
Number of Stops along detour	3	stop signs or signals
Delays at stop signs	3.00	minutes
Aggregate Detour Time	8.47	minutes (use this in the Base Spreadsheet)

Assumptions

Delay Time per stop 1.00 minutes

CTDOT ABC Matrix – Detour Traffic Analysis Screen Shot

This slide shows the results of the analysis for the traffic detour that is proposed for the ABC option.

The user broke the detour up into three segments. For each segment, the input consists of the segment length, segment speed limit, and the congestion factor.

The intent of this process is to complete a basic analysis of the detour since this process is normally completed in preliminary design. For complex detours, a more sophisticated analysis (potentially including origin/destination analysis) can be done at later stages of the design process.

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

This slide shows the input and results for the user impact analysis.

Conventional Construction:

- The delay for one-way alternating traffic was previously calculated as 1 minute per vehicle.
- The user estimated a construction duration of approximately 2 years (one per stage) which equals 700 days.
- The aggregate impact time for conventional construction is calculated as 3405 person (or vehicle) days.

ABC:

- The average delay time for the proposed detour was previously calculated as 8.47 minutes.
- The user estimated the total number of detour days as 30 days.
- The aggregate impact time for ABC construction is calculated as 1235 person (or vehicle) days.

Results:

- The spreadsheet calculated the user impact reduction as 64%, meaning that ABC reduced impacts to users by 36%

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	
Cost analysis		
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

This slide shows the input for the cost analysis. The following are the inputs:

- The estimated construction cost for conventional construction was $2,000,000
- No overbuild was required for staged construction
- The monthly costs for a field office was estimated at $2000.
- Construction Engineering and Inspection costs were estimated at $40,000 per month (1 inspector plus back-office staff)
- The estimated overall net time savings with ABC was 12 months.
- Maintenance and Protection of Traffic Cost savings included the cost of a temporary signal and barriers for staged construction was $40,000

Based on this input, the net cost change for ABC was -$144,000, which means that **ABC is less expensive than conventional construction when TOTAL project costs are considered.**

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	1	0	No traffic impacts
Combined traffic on and under		1	Less than 10000
		2	10000 to 40000
		3	40000 to 70000
		4	70000 to 100000
		5	More than 100000
User Impact Reduction	4	0	Zero
Calculated by spreadsheet		1	1% to 20%
		2	21% to 40%
		3	41% to 60%
		4	61% to 80%
		5	81% to 100%
Bridge Location	3	0	Rural Bridge away from town center
Stakeholder Impact		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	3	1	Short duration project with good geometry & flow
Detour quality and/or		2	Short duration project with moderate geometry & flow
MPT Quality		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	0	significant limitations on work
Utilities/ROW/Env. Compliance		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

This slide shows the input for the various criteria used in the analysis. The explanation is shown to the right for each answer.

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

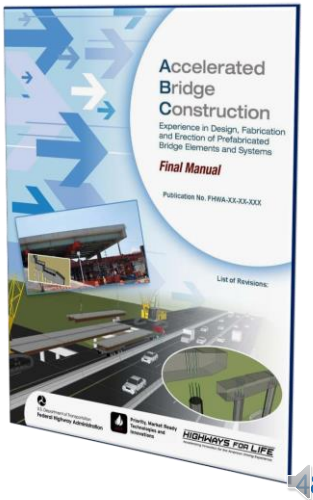
This slide shows the input for the remainder of the various criteria used in the analysis. The explanation is shown to the right for each answer.

Also shown are the results of the ABC decision process. The overall score for this example was 76 out of 100, which means that this bridge is a good candidate for an ABC project. Note that even if the score had been below 60, ABC might have been chosen, since it is actually the lower-cost option when total project costs are considered.

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

In this module we covered the various subjects that play into an ABC decision process. These include:

- Type of ABC that is appropriate for a specific site
- Traffic patterns and detours
- TOTAL PROJECT COSTS

The FHWA ABC manual is a good resource for more information on this subject.

The key takeaway from this training is that there is no one process that works for all agencies. Each agency should develop a process that works for them.

A recommended approach to ABC decision-making was presented. This method accounts for road user impacts and total project costs.

End of Module 3

Available ABC Program Management Modules

1. Recommended Approach to Implementing ABC in a Transportation Agency
2. ABC Time and Cost Estimating
3. ABC Decision Making Processes