

# Cost Implications of Rapid Renewal Projects

## Discussion on Total Project Cost

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# REALITY



- In general, bid prices for ABC are higher than conventional construction.
- This has discouraged some agencies from using ABC
- Bid prices are higher, but what about other project costs?

# HOW MUCH DOES ABC COST?



It depends.....

- **How fast is fast**
  - Build a bridge in a weekend: Very expensive
  - Build a bridge in a week: Expensive
  - Build a bridge in a month: Not too bad
  - Build a bridge in 2 months: 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

# MASS DOT TEST PROJECT



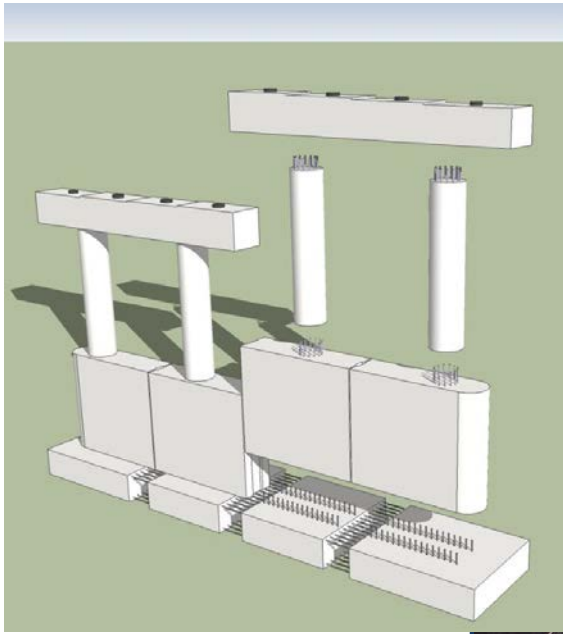
## MassDOT PBES Project

- 3 Span Bridge
  - Precast: Footings, walls, columns, pier caps, deck, approach slabs
  - Project goal:
    - Use staged (or phased) construction
    - Replace the bridge in one construction season
      - Avoid snow plowing issues during winter shutdown
- Adjacent to very similar bridge
  - Built one year previously
  - Conventional construction
  - Staged Construction

# MASS DOT TEST PROJECT



# MASS DOT TEST PROJECT



# MASS DOT TEST PROJECT



## Cost Information

- Conventional Construction Bridge
  - \$224 per square foot
- PBES Bridge
  - \$284 per square foot
- Understand that these are east coast prices
  - Prices in other regions will vary significantly
- Cost differential
  - ABC was 27% more than conventional construction

# SPEED VS. RISK



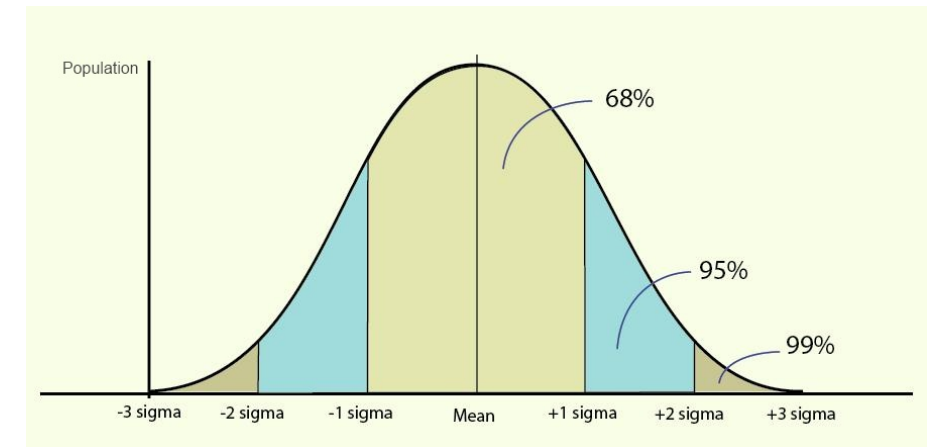
- Speed of construction affects costs
- Incentives and disincentives
  - I/Ds create **RISK** for the contractor
  - Disincentives can be high (up to 10% of the bid)
  - Failure to meet milestones = loss of \$\$
  - Tight milestones or high I/D = Higher **RISK**
- **Risk = \$\$**
- Why is it difficult to put a finger on ABC costs?
  - Contractors bid **RISK**
  - Designers do not estimate **RISK**



# RISK ANALYSIS

Risk cost = Cost of failure \* Probability of Occurrence

- Known probabilities can be managed
- Unknown probabilities are difficult to estimate
- Probabilities will vary between different contractor
  - Size and experience of staff
  - Back-up equipment
- Example
  - Weekend Disincentive Clause = \$100k
  - Probability of not finishing bridge = 10%
  - Risk factor =  $\$100k * 0.10 = \$10,000$



# HOW DO CONTRACTORS BID RISK?

Perform a risk analysis for critical features of the construction

- Determine the probability of failure for various functions
- Apply it to the disincentives

Option 1: Investigate ways to minimize risk

- Add labor
- Add equipment
- Add specialty sub-contractors
  - More experience to the team
  - Spread the risk out to more than one entity
- This all adds cost

Option 2: Bid the risk

- Increase the bid to account for risk factors

# HOW CAN OWNERS ADDRESS RISK?

Understand that I/Ds come at a price

- Pick I/Ds that are commensurate with the needs

Tight schedules come at a price

- Consider relaxing the schedule if appropriate

Risk Analysis?

- Difficult for owners to estimate probabilities
- Engage a specialty construction schedule consultant

# OTHER WAYS TO REDUCE COSTS

## Simplify details

- Easier construction = lower risk of problems

## Bid a series of similar projects

- Builds up contractor experience = lower risk
- Get more efficient use out of specialized equipment
  - If it is a “one of a kind” project, you may pay for the equipment in one project
  - Some agencies have done this with SPMT projects – Doesn’t really work
  - Similar to precast girder forms

# HOW DO YOU JUSTIFY ABC?



If it costs more, why do we do it?

- Reduced user costs
  - However, you can't spend user costs
  - Good PR for the agency 😊
- Improved Safety
  - Workers and travelers 😊
- Better Durability
  - Prefabricated Elements 😊

Still...Some agencies are naturally hesitant to use ABC in this time of tight budgets.

# DO BID PRICES TELL THE WHOLE STORY?

The simple answer is NO

We need to look at **TOTAL PROJECT COSTS**

- This is the total cost to the agency to complete a project
  - Engineering costs
  - Right of Way
  - Environmental permitting
  - Traffic Management
  - Construction management
  - Safety Costs: Police details, flaggers, etc.

# FACTORING NON-BID COSTS IN DECISION MAKING



Decision makers should use both bid costs and agency costs in decision making

- There is no one ABC decision making solution
  - Some agencies need a simple process
  - Some need detailed processes
- Oregon Analytical Hierarchy Process
  - Sophisticated analysis approach
  - Includes agency costs and indirect costs
- Connecticut DOT process
  - Simplified approach to total project cost

# CONNECTICUT DOT APPROACH



Consider total project costs in the ABC decision process

- Look at traffic management options
  - Temporary structures and roadways
  - Temporary signals
  - Overbuilds to accommodate staged construction
- Look at agency costs
  - Primarily Construction Management
  - Other factors can also be added in



# WEIGHTED SCORE APPROACH



## ABC Rating

	Score	Weight Factor	Adjusted Score	Maximum Score	Adjusted Score
Average Daily Traffic	0	10	0	5	50
User Impact Reduction	0	30	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			0	Max. Score	465

<b>ABC Rating</b>	<b>0</b>
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ABC Rating Scale	
60-100	Use ABC
50-60	Consider ABC
0-50	Do not use ABC

# PROJECT EXAMPLE



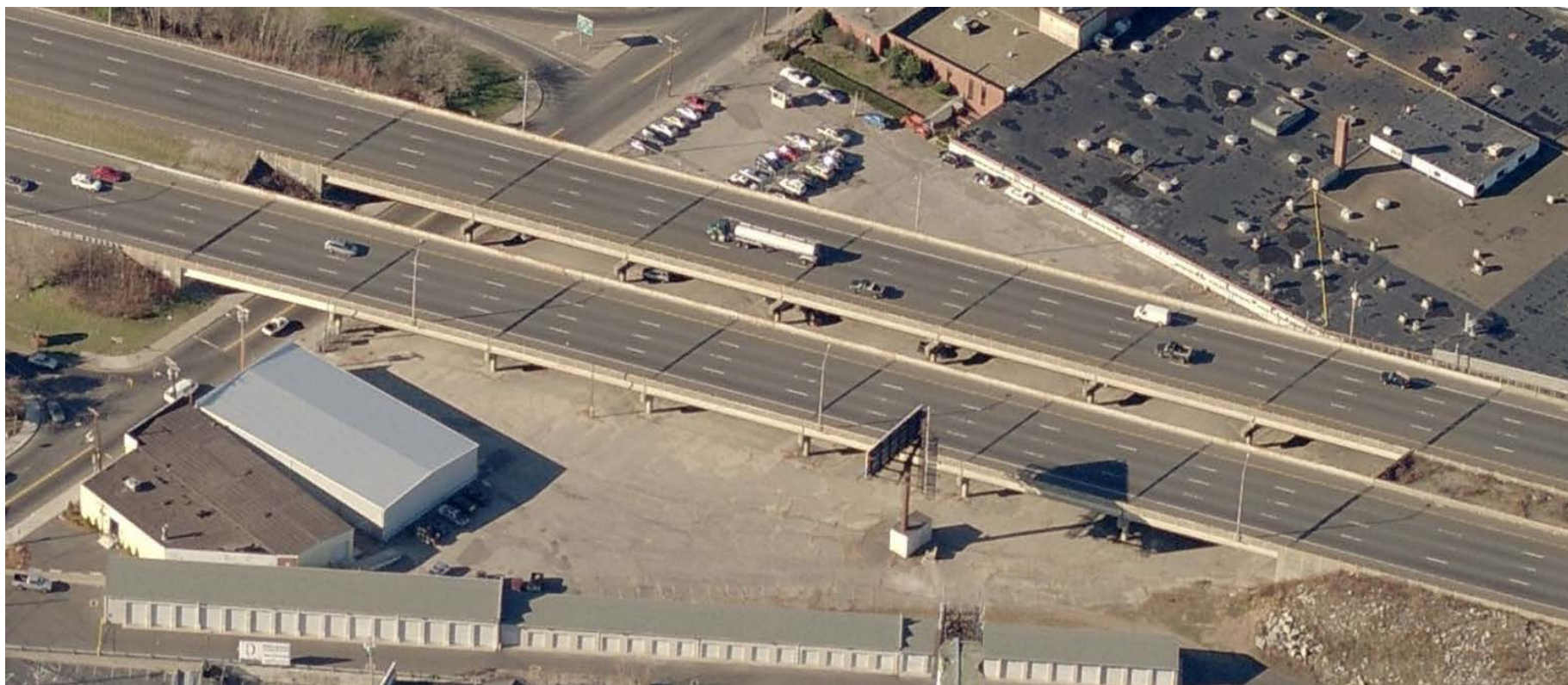
## CTDOT Design/Build Project



Capitol Avenue  
Bridges

Lindley Street  
Bridges

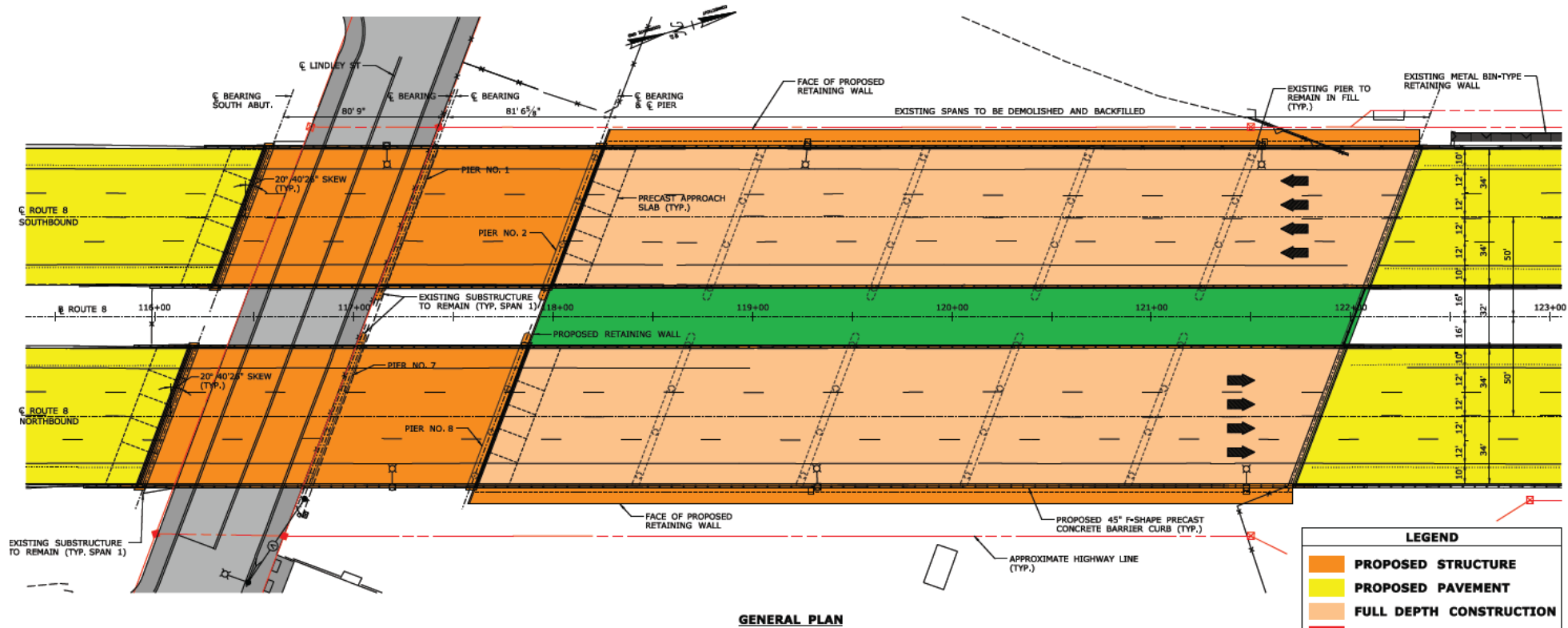
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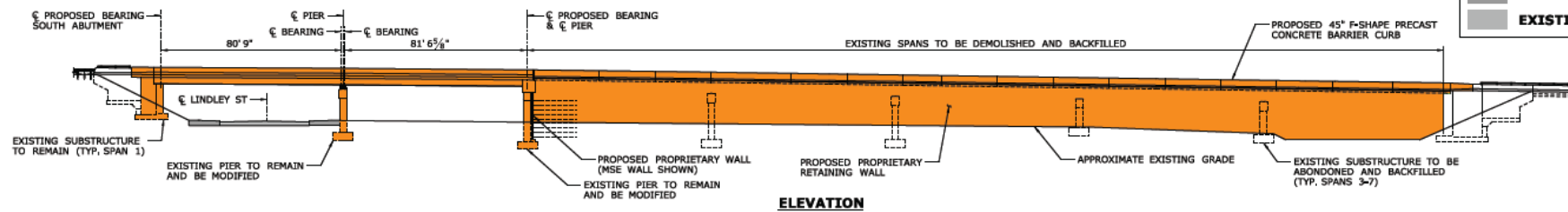
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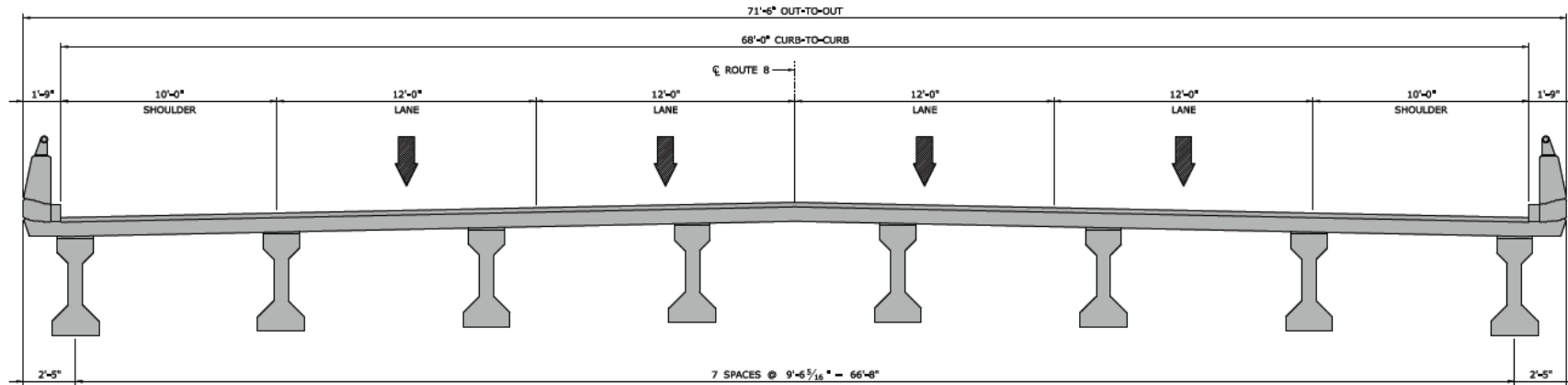
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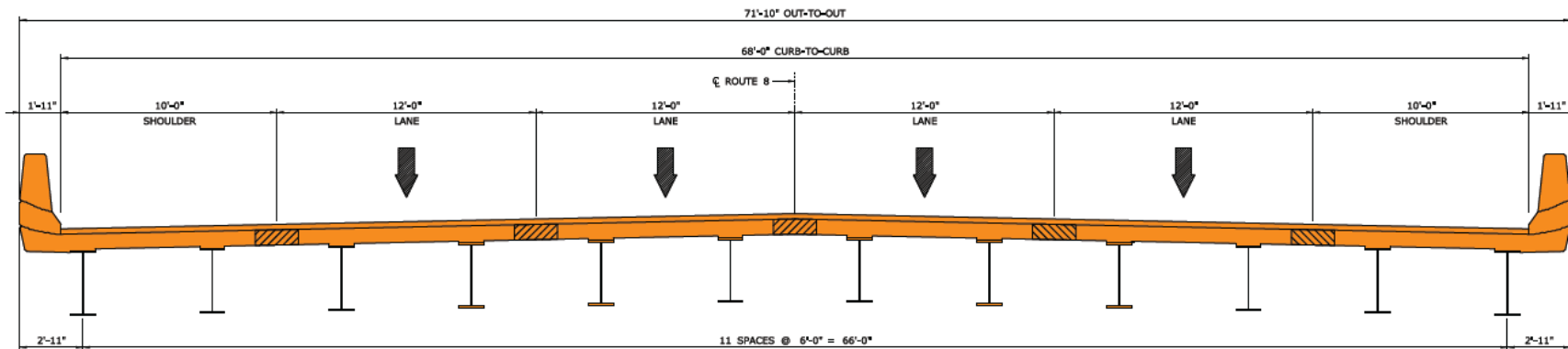
LEGEND	
<span style="display:inline-block; width:15px; height:15px; background-color:orange;"></span>	PROPOSED STRUCTURE
<span style="display:inline-block; width:15px; height:15px; background-color:yellow;"></span>	PROPOSED PAVEMENT
<span style="display:inline-block; width:15px; height:15px; background-color:lightorange;"></span>	FULL DEPTH CONSTRUCTION
<span style="display:inline-block; width:15px; height:15px; background-color:red;"></span>	PROPERTY LINES
<span style="display:inline-block; width:15px; height:15px; background-color:green;"></span>	FILL
<span style="display:inline-block; width:15px; height:15px; background-color:gray;"></span>	EXISTING SIDEWALK
<span style="display:inline-block; width:15px; height:15px; background-color:lightgray;"></span>	EXISTING ROADWAY





# PROJECT EXAMPLE



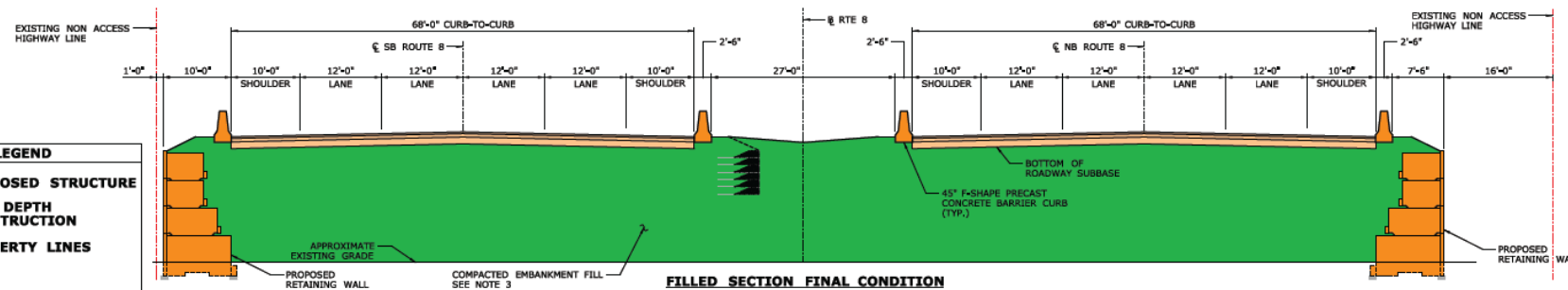
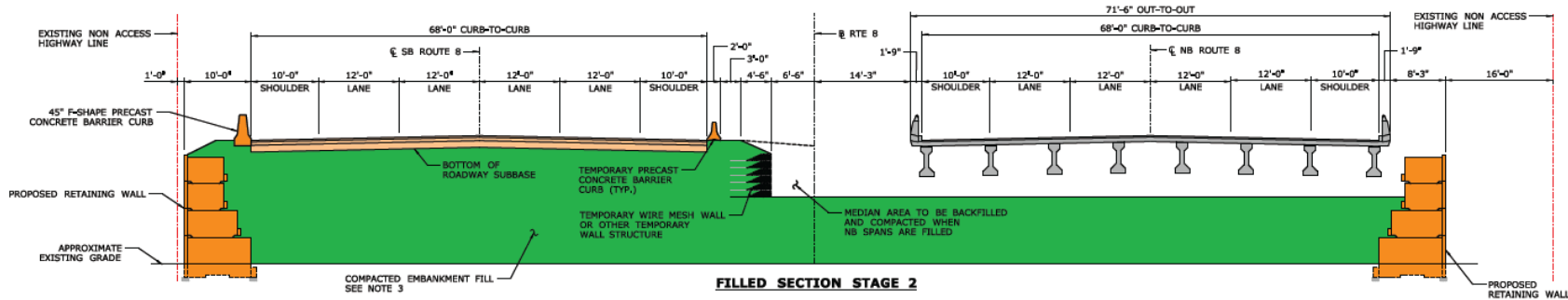
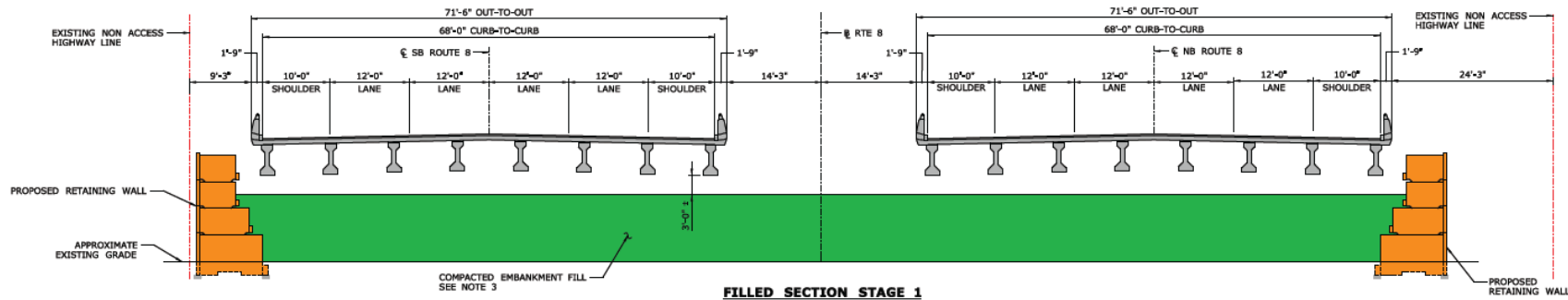
**EXISTING CROSS SECTION**



**PROPOSED CROSS SECTION**

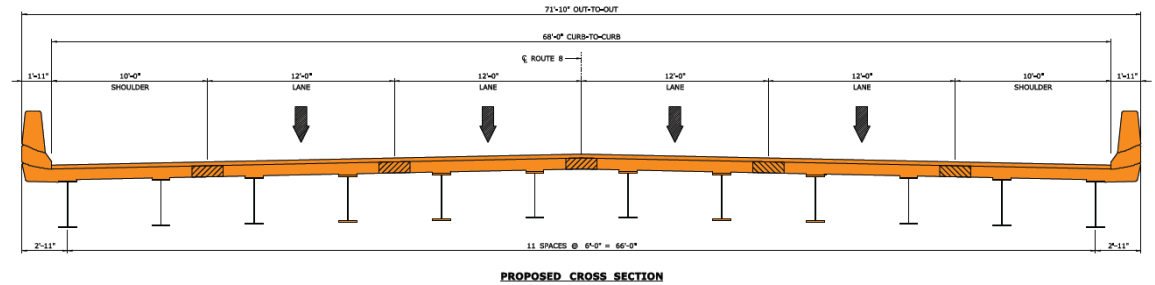
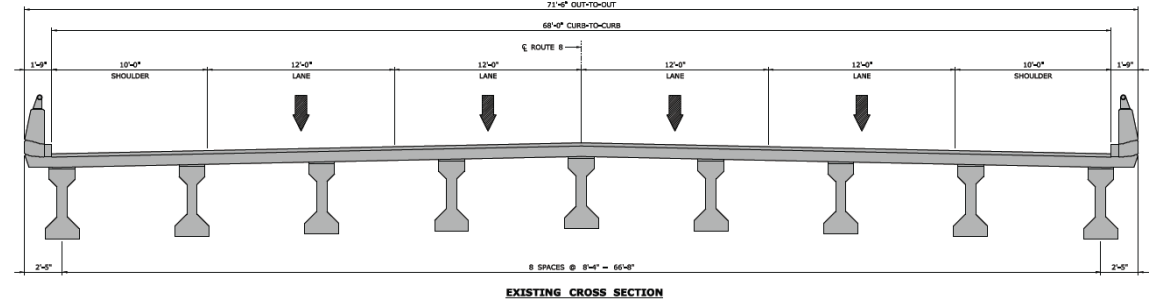
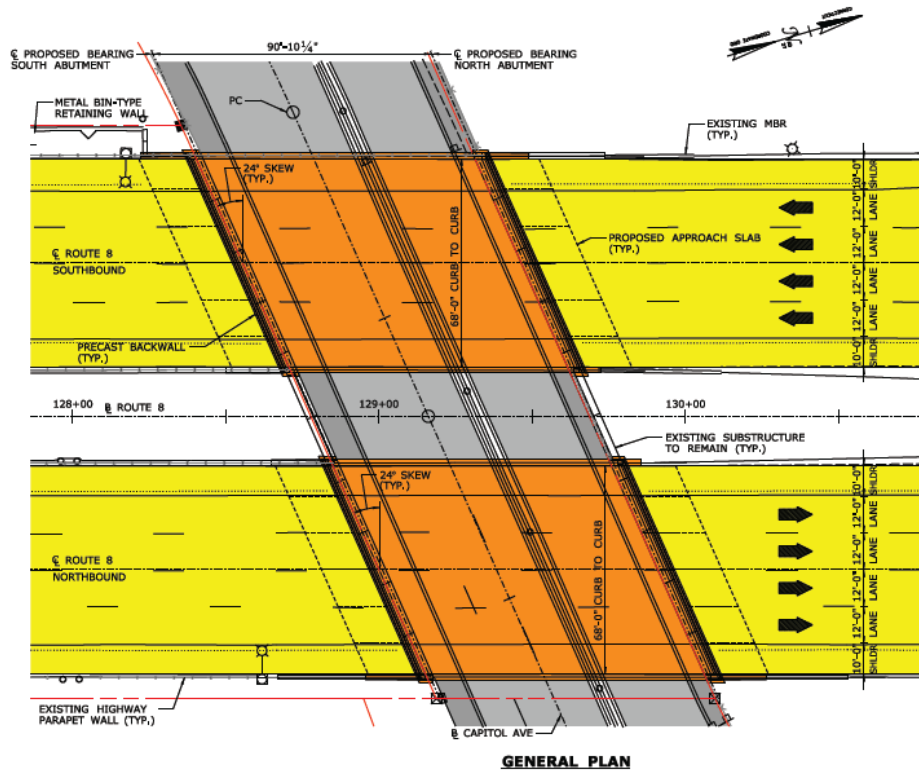
LEGEND	
	EXISTING STRUCTURE
	PROPOSED STRUCTURE

# PROJECT EXAMPLE



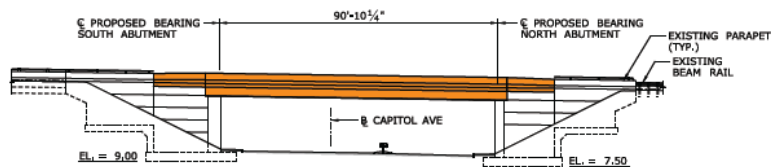
LEGEND	
	PROPOSED STRUCTURE
	FULL DEPTH CONSTRUCTION
	PROPERTY LINES
	FILL
	EXISTING STRUCTURE

# PROJECT EXAMPLE



LEGEND	
	EXISTING STRUCTURE
	PROPOSED STRUCTURE

LEGEND	
	PROPOSED STRUCTURE
	PROPOSED OVERLAY
	PROPERTY LINES
	EXISTING SIDEWALK
	EXISTING ROADWAY





# TRAFFIC MANAGEMENT

Northern  
Crossover

Work Zones

Southern  
Crossover



# DECISION PROCESS



## CTDOT Decision Spreadsheet

# PROJECT EXAMPLE



**Anguilla  
Brook  
Road**

**Anguilla  
Brook**

**U.S. Route 234  
(Pequot Trail)**

**Bridge No.  
02934**

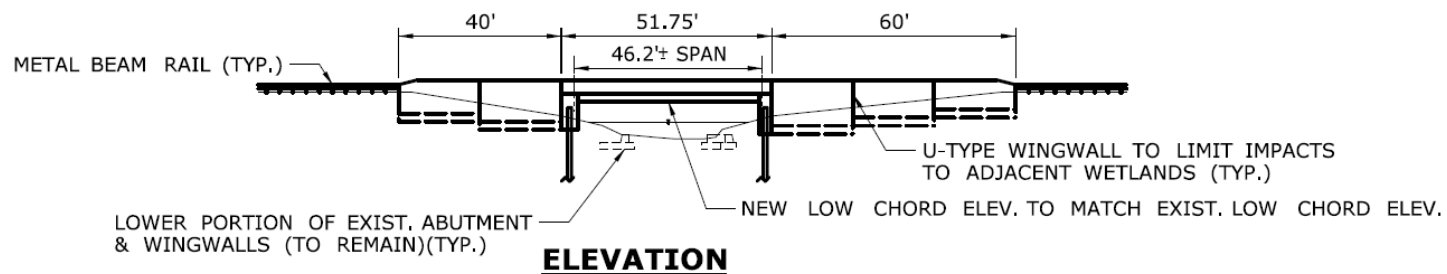
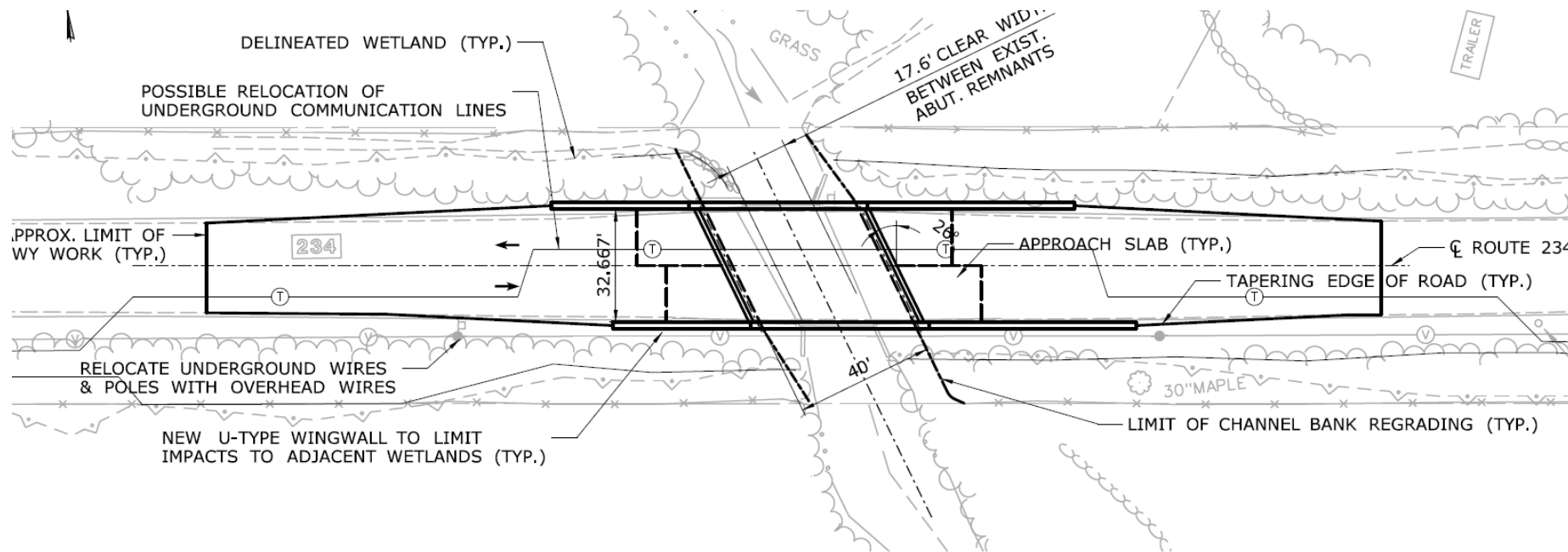
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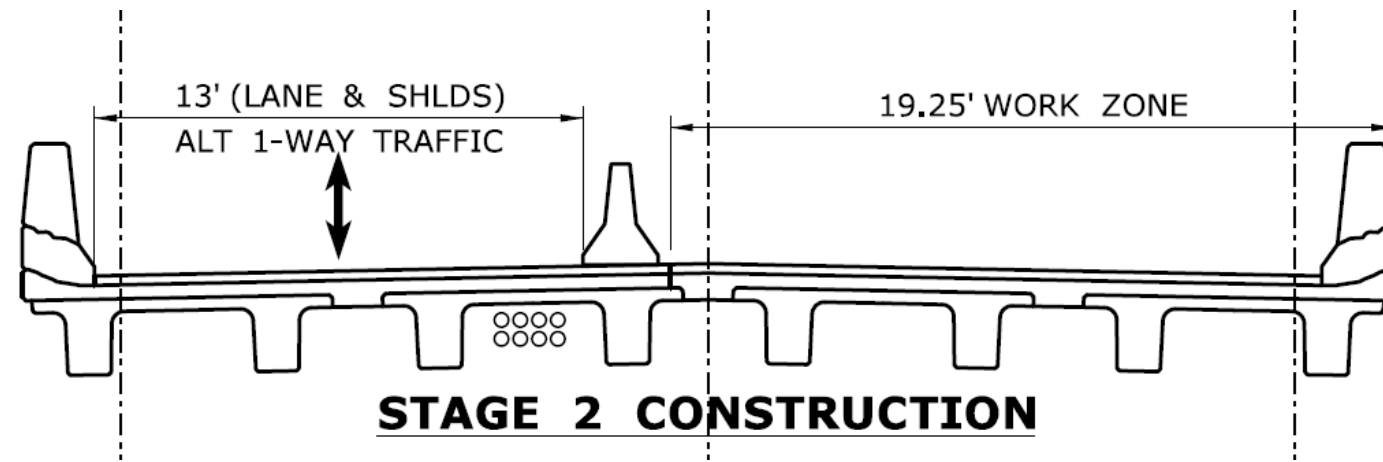
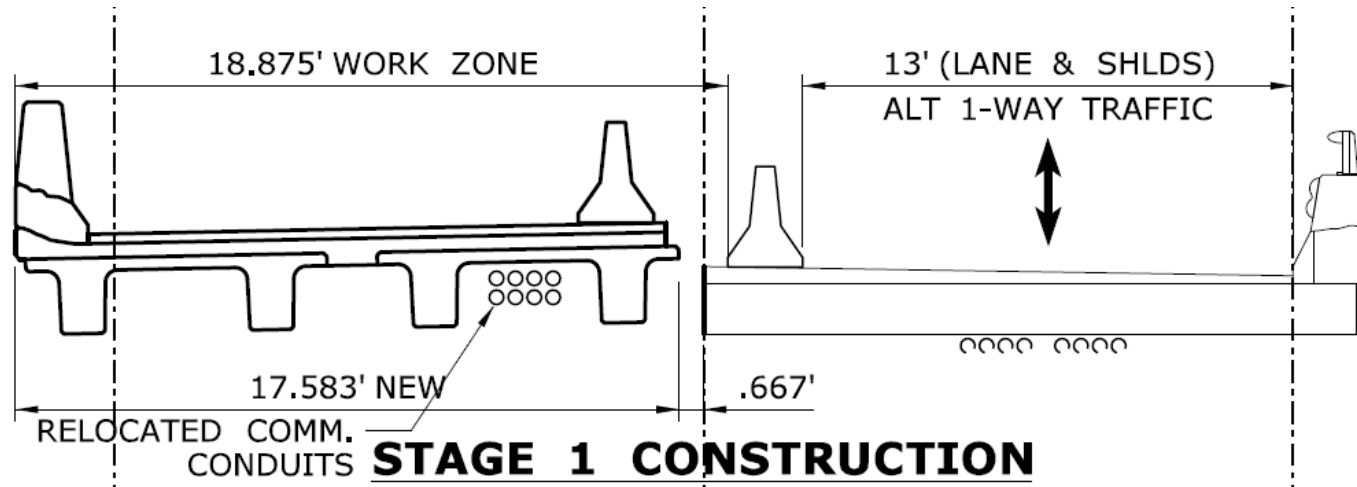
# PROJECT EXAMPLE



# PROJECT EXAMPLE



# PROJECT EXAMPLE



# DECISION PROCESS



## CTDOT Decision Spreadsheet



# CONCLUSIONS



- ABC Costs depend on many factors
- Significant factors
  - Speed of construction
  - Incentive/Disincentive Clauses
  - Risk
- Bid prices do not tell the whole story
  - Consider non-bid costs in ABC decision making