Cape Cod Canal Transportation Study
10th Working Group Meeting.

Bourne, Plymouth, Sandwich, Wareham.
Sandwich Town Hall, Sandwich.
February 1st. 2018 3:30 PM to 5:30 PM.
Welcome and Introductions.

MassDOT.
- Ethan Britland – Project Manager.
- Michael Clark - Deputy Project Manager.

US Army Corps of Engineers.
- Craig Martin – Project Manager.

Study Team.
- Bill Reed, P.E. – Principal in Charge (Stantec).
- Michael Paiewonsky, AICP – Team Project Manager (Stantec).
- Fred Moseley, P.E. – Transportation Engineer (Stantec).
- Jennifer Siciliano, AICP – Public Engagement (Harriman).
- Frank Mahady – Socio-Economic (FXM Associates).
WG Meeting #10 Agenda

1. Follow Up and Summary of TDM Findings
2. Economic Analysis
3. Noise / Air Quality
4. Cost Estimates
5. Evaluation Matrix
6. Next Steps
Follow Up and Summary of Travel Demand Model Analysis
Design Understanding.

Design for future (2040) fall weekday PM peak period.

Seek further improvements for summer Saturday peak, as feasible.

Not intending to resolve all peak-season traffic problems.
Evaluation of Alternatives - Travel Demand Model.

• Combinations of improvements (known as ‘cases’) evaluated.

• Cases selected provide logical and comprehensive groups of improvements.

• Case analysis informs improvement recommendations, i.e., what to build and the best order to implement these improvements.
Travel Demand Model Case Analysis.
# 7 Cases Evaluated

## Travel Demand Model Case Improvements

<table>
<thead>
<tr>
<th>Map Location</th>
<th>Improvements</th>
<th>Case 1</th>
<th>Case 1A</th>
<th>Case 1B</th>
<th>Case 2</th>
<th>Case 2B</th>
<th>Case 3</th>
<th>Case 3A</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Scenic Highway to Rte 25 Westbound On-Ramp</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
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</tr>
<tr>
<td>B</td>
<td>Rte 6 Exit 1C Relocation</td>
<td>•</td>
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<td></td>
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<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>C</td>
<td>Rte 28 Northbound Ramp to Sandwich Road</td>
<td>•</td>
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</tr>
<tr>
<td>D</td>
<td>Bourne Rotary (Three New Signalized Intersections)</td>
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<td>•</td>
<td>•</td>
<td>•</td>
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</tr>
<tr>
<td>E</td>
<td>Belmont Circle (3 Leg Roundabout plus Signalized Intersection)</td>
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<td></td>
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<tr>
<td>F</td>
<td>Belmont Circle with Rte 25 Eastbound Fly-over</td>
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<td></td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>New Bridges (Bourne and Sagamore)</td>
<td>•</td>
<td>•</td>
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<td>•</td>
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</tr>
<tr>
<td>H</td>
<td>Rte 6 Eastbound Travel Lane from Exit 1A to Exit 2</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
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<tr>
<td>I</td>
<td>Bourne Rotary with Highway Interchange</td>
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</tbody>
</table>
Travel Demand Model Analysis – Queue and Delay Methodology.

Results presented in two separate ways:
Maximum Queue: The longest length that a backup reaches during the peak period, from the intersection approach to the last vehicle waiting in line.

Average Vehicle Delay: The average difference between the (ideal) free-flow travel time and the actual travel time measured during peak period.
2040 Future No-Build Analysis
Non-Summer PM Period.

**Legend**
- Non-Summer PM Queue Lengths

**Peak Hour Volumes**
- Main Street
  - Non-Summer PM
    - Future No-Build (875)

- Exit 3 Ramps
  - Non-Summer PM
    - Future No-Build (1,560)

- Route 25 SB
  - Non-Summer PM
    - Future No-Build (2,020)

**Bourne Rotary 2040 No-Build**

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Max Queue (feet)</th>
<th>Vehicle Delay (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Summer PM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rte 25 Southbound</td>
<td>620</td>
<td>14</td>
</tr>
<tr>
<td>Trowbridge Road</td>
<td>3,465</td>
<td>394</td>
</tr>
<tr>
<td>Rte 28 Northbound</td>
<td>1,275</td>
<td>102</td>
</tr>
<tr>
<td>Sandwich Road</td>
<td>855</td>
<td>19</td>
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</tbody>
</table>

**Belmont Circle 2040 No-Build**

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Max Queue (feet)</th>
<th>Vehicle Delay (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Summer PM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exit 3 Off Ramps</td>
<td>645</td>
<td>2</td>
</tr>
<tr>
<td>Head of Bay Road</td>
<td>1,780</td>
<td>317</td>
</tr>
<tr>
<td>Buzzards Bay Bypass</td>
<td>110</td>
<td>3</td>
</tr>
<tr>
<td>Main Street</td>
<td>1,245</td>
<td>29</td>
</tr>
<tr>
<td>Scenic Highway</td>
<td>840</td>
<td>14</td>
</tr>
</tbody>
</table>
2040 Future No-Build Analysis
Summer Saturday Period.

PEAK HOUR VOLUMES
EXIT 3 RAMPS
SUMMER SATURDAY
Future No-Build (1,440)

PEAK HOUR VOLUMES
MAIN STREET
SUMMER SATURDAY
Future No-Build (1,295)

PEAK HOUR VOLUMES
RTE 28 SB
SUMMER SATURDAY
Future No-Build (2,825)

BOURNE ROTARY 2040 NO-BUILD

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Max Queue (feet)</th>
<th>Vehicle Delay (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rte 25 Southbound</td>
<td>9,935</td>
<td>329</td>
</tr>
<tr>
<td>Trowbridge Road</td>
<td>2,225</td>
<td>265</td>
</tr>
<tr>
<td>Rte 28 Northbound</td>
<td>3,605</td>
<td>189</td>
</tr>
<tr>
<td>Sandwich Road</td>
<td>6,430</td>
<td>135</td>
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</table>

BELMONT CIRCLE 2040 NO-BUILD

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Max Queue (feet)</th>
<th>Vehicle Delay (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exit 3 Off Ramps</td>
<td>1,025</td>
<td>3</td>
</tr>
<tr>
<td>Head of Bay Road</td>
<td>2,700</td>
<td>656</td>
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<tr>
<td>Buzzards Bay Bypass</td>
<td>305</td>
<td>11</td>
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<tr>
<td>Main Street</td>
<td>6,140</td>
<td>126</td>
</tr>
<tr>
<td>Scenic Highway</td>
<td>11,610</td>
<td>161</td>
</tr>
</tbody>
</table>
Travel Simulation Video –
Belmont Circle & Bourne Rotary
Future No-Build (Summer and Non-Summer).
Main Street, Bourne
Travel Demand Model Analysis
Summer Travel Patterns on Main Street, Bourne to Access Route 25.

- Existing and future no-build summer delay discourages travel through Belmont Circle (non-summer ok).
- These delays continue under Case 1 which does not include substantial improvements to Belmont Circle
- To access Route 25 (while avoiding Belmont Circle) some people on Main Street go west to Exit 2 (Glen Charlie Road).
Summer Travel Patterns on Main Street, Bourne to Access Route 25.

• Case 2 includes improvements to Belmont Circle (3-leg roundabout and signalized intersection).

• With these improvements, travel *eastbound* on Main Street increases to the more direct route to Route 25 via Belmont Circle.

• These additional trips dampen the overall reduction in travel delays at the Circle.
Travel Patterns - Access to Route 25 from Main Street

- Exit 2
- Case 2 & Case 3
- Future No-Build & Case 1
- Belmont Circle
- Scenic Highway
- Main Street
- Trowbridge Road
Change in Travel Patterns-Case 1 to Case 2

Access to Route 25 from Main Street.

Fall
- 100 trips
+ 100 trips

315→215 (Case 1) (Case 2)
-100 trips -32%
915→1015 (Case 1) (Case 2)
+100 trips +11%

Summer
- 225 trips
+ 225 trips

525→300 (Case 1) (Case 2)
-225 trips -43%
1295→1520 (Case 1) (Case 2)
+225 trips +17%
Summary of Travel Demand Model Findings.
Travel Demand Model
Non-Summer PM Overall Findings.

Belmont Circle and Bourne Rotary Overall Average Delays (mins)

<table>
<thead>
<tr>
<th></th>
<th>Belmont Circle</th>
<th>Bourne Rotary</th>
</tr>
</thead>
<tbody>
<tr>
<td>FUTURE (2040) NO-BUILD</td>
<td>1.2</td>
<td>0.2</td>
</tr>
<tr>
<td>CASE 1</td>
<td>2.2</td>
<td>2.3</td>
</tr>
<tr>
<td>CASE 1A</td>
<td>0.7</td>
<td>0.7</td>
</tr>
<tr>
<td>CASE 1B</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td>CASE 2</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>CASE 2B</td>
<td>0.1</td>
<td>0.3</td>
</tr>
<tr>
<td>CASE 3</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>CASE 3A</td>
<td>0.2</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Legend:
- Orange: Belmont Circle
- Yellow: Bourne Rotary
Travel Demand Model
Summer Saturday Overall Findings.

Belmont Circle and Bourne Rotary Overall Average Delays (mins)

- **FUTURE (2040) NO-BUILD**:
  - Belmont Circle: 3.2
  - Bourne Rotary: 3.6

- **CASE 1**:
  - Belmont Circle: 2.7
  - Bourne Rotary: 3.8

- **CASE 1A**:
  - Belmont Circle: 2.3
  - Bourne Rotary: 3.1

- **CASE 1B**:
  - Belmont Circle: 2.3
  - Bourne Rotary: 2.8

- **CASE 2**:
  - Belmont Circle: 2.8
  - Bourne Rotary: 1.5

- **CASE 2B**:
  - Belmont Circle: 5.6
  - Bourne Rotary: 1.1

- **CASE 3**:
  - Belmont Circle: 4.2
  - Bourne Rotary: 3.7

- **CASE 3A**:
  - Belmont Circle: 3.7
  - Bourne Rotary: 0
Travel Demand Model
Sagamore Bridge Overall Findings.

Sagamore Bridge Total Delay (mins)

ROUTE 3 SOUTHBOUND

<table>
<thead>
<tr>
<th></th>
<th>FUTURE (2040) NO-BUILD</th>
<th>CASE 1</th>
<th>CASE 3A</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>14.8</td>
<td>14.9</td>
<td>7.7</td>
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<tr>
<td></td>
<td>7.6</td>
<td>0.3</td>
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ROUTE 6 WESTBOUND

<table>
<thead>
<tr>
<th></th>
<th>FUTURE (2040) NO-BUILD</th>
<th>CASE 1</th>
<th>CASE 3A</th>
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<tr>
<td></td>
<td>13.5</td>
<td>3.0</td>
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<td>0.1</td>
</tr>
<tr>
<td></td>
<td>0.1</td>
<td>0.1</td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- Summer Saturday
- Non-Summer PM
Travel Model Case 1

Summary of Findings – Sagamore Bridge.

**SAGAMORE BRIDGE 2040 NO-BUILD**

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Max Queue (feet)</th>
<th>Vehicle Delay (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer Saturday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rte 3 SB</td>
<td>24,464</td>
<td>887</td>
</tr>
<tr>
<td>Rte 6 WB</td>
<td>25,029</td>
<td>812</td>
</tr>
<tr>
<td>Non-Summer PM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rte 3 SB</td>
<td>8,476</td>
<td>460</td>
</tr>
<tr>
<td>Rte 6 WB</td>
<td>7,967</td>
<td>178</td>
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</table>

**SAGAMORE BRIDGE CASE 1**

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Max Queue (feet)</th>
<th>Vehicle Delay (sec)</th>
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<tbody>
<tr>
<td>Summer Saturday</td>
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<tr>
<td>Rte 3 SB</td>
<td>24,826</td>
<td>895</td>
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<tr>
<td>Rte 6 WB</td>
<td>10,037</td>
<td>210</td>
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<tr>
<td>Non-Summer PM</td>
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<td></td>
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<tr>
<td>Rte 3 SB</td>
<td>4,090</td>
<td>453</td>
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<tr>
<td>Rte 6 WB</td>
<td>0</td>
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Travel Model Case 3A
Sagamore Bridge Approaches.

**Legend**
- Summer Saturday Queue Lengths
- Non-Summer PM Queue Lengths
- Case 3A Improvements

**Sagamore Bridge Case 3A**

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Max Queue (feet)</th>
<th>Vehicle Delay (sec)</th>
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<tbody>
<tr>
<td>Rte 3 SB</td>
<td>991</td>
<td>16</td>
</tr>
<tr>
<td>Rte 6 WB</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td><strong>Non-Summer PM</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rte 3 SB</td>
<td>489</td>
<td>14</td>
</tr>
<tr>
<td>Rte 6 WB</td>
<td>0</td>
<td>6</td>
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Travel Simulation Videos (Summer & Non-Summer)  
Belmont Circle & Bourne Rotary  
Mid-Term Improvements.
Travel Demand Model
Findings for Mid-Term Improvements.

• Notable reductions in delay during the non-summer period can be achieved at Belmont Circle and Bourne Rotary with mid-term improvements (specifically Case 1B and Case 2).

• More modest delay reductions can be achieved at Belmont Circle and Bourne Rotary under Case 1B and Case 2 during the summer peak periods.
Travel Demand Model
Findings for Mid-Term Improvements.

• Case 2B (Belmont Circle with Fly-over ramp to Scenic Hwy) overall not effective due to extended queues at Head of Bay Road and Buzzards Bay Bypass.

• Fly-over ramp is effective at reducing queues on Route 25 exit ramp to Belmont Circle. However, more free-flow condition in roundabout hinders vehicles entering from Head of the Bay Road and Buzzards Bay Bypass.
Travel Simulation Videos (Summer & Non-Summer)  
Belmont Circle and Bourne Rotary  
Long-Term Improvements.
Travel Demand Model

Findings for Long-Term Improvements.

• Case 3A - Construction of highway interchange at Bourne Rotary (concurrent with new Bourne Bridge) would be necessary to reduce summer delay.

• Traffic volumes increase substantially with new bridge in place (+725/+705 compared to future no-build and Case 2).

• This additional traffic would overwhelm mid-term improvements at Bourne Rotary (3 signalized intersections).
Travel Demand Model

Findings for Long-Term Improvements.

- Case 3A - Delay reduction along Route 3/Route 6 corridor with Exit 1C relocation and additional new Route 6 eastbound lane.

- Relocation of Route 6 Exit 1C would be required when Sagamore Bridge replaced due to higher profile.
Economic Analysis.
Economic Analysis: Approach and Methods.

- Assess annual travel time savings for each Case compared to Future No-Build.
  - All Trips.
  - Commuting Trips.
  - Peak Seasonal Trips.
- Estimate the monetary value to users of travel time savings.
- Compare monetary value of travel time savings to monetary value of annualized construction costs.

Travel time savings enhance personal satisfaction and business productivity, and can expand labor, freight, and visitor markets.
Economic Analysis: Approach and Methods.

- Estimate the $ value of travel time benefits:
  - Commuters,
  - Peak seasonal visitors,
  - Non-business local travelers,
  - Goods movements (trucks).

- Compare the $ value of annualized user benefits to annualized construction costs.
Annual Vehicle Hour Savings: All Trip Types.

Annual Vehicle Hour Savings Compared to No Build: All Trip Types (000’s)

- CASE 1: 540
- CASE 1A: 660
- CASE 1B: 860
- CASE 2: 1,100
- CASE 2B: 1,300
- CASE 3: 1,300
- CASE 3A: 1,400
Annual Vehicle Hour Savings Compared to No-build: Peak Hours Weekdays (Commuters) (000’s)

- CASE 1: 389
- CASE 1A: 382
- CASE 1B: 487
- CASE 2: 689
- CASE 2B: 801
- CASE 3: 503
- CASE 3A: 540
Annual Vehicle Hour Savings Compared to No-build: Peak Summer Weekend Days (Compared to No-Build)(000’s)

- CASE 1: 149
- CASE 1A: 193
- CASE 1B: 271
- CASE 2: 184
- CASE 2B: 231
- CASE 3: 265
- CASE 3A: 302
Annual Vehicle Hour Savings: Overall Comparison.

Annual Vehicle Hour Savings Compared to No-build (000’s)

<table>
<thead>
<tr>
<th>CASE</th>
<th>Annual Vehicle Hour Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>CASE 1</td>
<td>538 (All Trips), 149 (Summer Weekends), 389 (AM&amp;PM Commutes)</td>
</tr>
<tr>
<td>CASE 1A</td>
<td>659 (All Trips), 193 (Summer Weekends), 383 (AM&amp;PM Commutes)</td>
</tr>
<tr>
<td>CASE 1B</td>
<td>861 (All Trips), 271 (Summer Weekends), 487 (AM&amp;PM Commutes)</td>
</tr>
<tr>
<td>CASE 2</td>
<td>1,071 (All Trips), 184 (Summer Weekends), 689 (AM&amp;PM Commutes)</td>
</tr>
<tr>
<td>CASE 2B</td>
<td>1,290 (All Trips), 231 (Summer Weekends), 801 (AM&amp;PM Commutes)</td>
</tr>
<tr>
<td>CASE 3</td>
<td>1,306 (All Trips), 265 (Summer Weekends), 503 (AM&amp;PM Commutes)</td>
</tr>
<tr>
<td>CASE 3A</td>
<td>1,390 (All Trips), 302 (Summer Weekends), 539 (AM&amp;PM Commutes)</td>
</tr>
</tbody>
</table>
Annual Value of Travel Time: All Users

Annual Value of Travel Time Savings:
All Users ($ million)

CASE 1: $19.4
CASE 1A: $22.4
CASE 1B: $29.2
CASE 2: $37.1
CASE 2B: $44.3
CASE 3: $40.6
CASE 3A: $43.3
Annual Value of Vehicle Hour Savings Compared to Annualized Construction Costs.

Value of Annual Vehicle Hour Savings Compared to Annualized Construction Costs ($ million)

- **Annual User Benefits**
- **Annualized Construction Costs**

<table>
<thead>
<tr>
<th>CASE 1</th>
<th>CASE 1A</th>
<th>CASE 1B</th>
<th>CASE 2</th>
<th>CASE 2B</th>
<th>CASE 3</th>
<th>CASE 3A</th>
</tr>
</thead>
<tbody>
<tr>
<td>$19.4</td>
<td>$22.5</td>
<td>$29.2</td>
<td>$37.1</td>
<td>$44.3</td>
<td>$40.6</td>
<td>$43.3</td>
</tr>
<tr>
<td>$3.8</td>
<td>$1.1</td>
<td>$3.2</td>
<td>$8.6</td>
<td>$9.4</td>
<td>$12.0</td>
<td>$16.2</td>
</tr>
</tbody>
</table>
Benefit Cost Ratios.

Ratio of Annual Travel Time Savings to Annualized Construction Cost

For Example: Case 1

Benefit = $19.4 million
Divided by Cost = $3.8
Ratio = 5.1
Highway Noise.
Preliminary Highway Noise Analysis – Methodology.

• Based on potential location of roadways and traffic volume forecasts.

• Developed for Cases 2 and 3A (representing most elements of potential mid-term and long-term improvements).

• Compared existing to potential future (2040) sound levels.

• More detailed noise study, including on-site noise measurements and modeling, would be conducted for future environmental documents.
Preliminary Highway Noise Analysis – Methodology.

- Results reported in average decibel changes (dBA) as either increase or decrease for loudest period of day.
- 0 – 3 dBA increase is not noticeable.
- 3-5 dBA increase is noticeable in neighborhood setting.
- 10 dBA increase is perceived as ‘twice as loud’ and considered a significant increase by MassDOT/FHWA regulations.
Preliminary Highway Noise Analysis.

Change in average decibel (dBA) from existing to future build:

- **Case 2**
- **Case 3A**
- **Noise Increase**
- **Noise Decrease**

- **4-6 Non-Summer PM**
- **1-2 Non-Summer PM**
- **0 Non-Summer PM**
- **1 Non-Summer PM**
- **1-3 Non-Summer PM**
- **1 Non-Summer PM**
- **1 Non-Summer PM**
- **1 Non-Summer PM**
- **1 Non-Summer PM**
- **1-3 Non-Summer PM**
- **1 Non-Summer PM**
- **1 Non-Summer PM**
- **1 Non-Summer PM**
- **1 Non-Summer PM**
- **1 Non-Summer PM**
Preliminary Highway Noise Analysis – Results.

• Overall very minor change in noise levels (not perceptible) for residents in focus area.

• Due to forecast traffic increases, Head of the Bay Road residents may experience modest increase (4-6 dBA) in noise levels during afternoon peak period.
Air Quality.
Preliminary Air Quality Evaluation.

• Study Area currently in ‘Attainment’ for federal air quality standards.
• Evaluated Mid-Term Case 2 and Long-Term Case 3A for summer peak period.
• Qualitative analysis of Carbon Monoxide (CO), Mobile Source Air Toxics (MSAT), & Greenhouse Gas (GHG).
• Future environmental study will include a more detailed air quality evaluation in accordance with FHWA and U.S. EPA standards.
Preliminary Air Quality Analysis.

**Carbon Monoxide (CO)** – Minor summertime increase at intersections due to higher traffic volumes.

**Mobile Source Air Toxics (MSAT)** – Reduction forecast (Nationwide 90% reduction 2010 – 2050 due to improve emissions standards).

**Greenhouse Gases** - Decrease forecast due to reduction in queueing during summer.
Conceptual Cost Estimates.
Conceptual Cost Estimates Methodology.

• Based on MassDOT Unit Costs.
• Costs increased 3.5% per year to estimate future year costs.
• Additional costs (30% or 40%) added for unknown contingencies such as:
  • Land Acquisition,
  • Environmental & Traffic Mitigation,
  • Retaining Walls.
• Does not include design or construction engineering costs.
Conceptual Cost Estimates
Short-Term Bike/Ped. Improvements.

- New ADA-compliant connections to the Canal Bikeway.
- Sagamore Bridge approaches (including Adams Street complete street improvements).
- Bourne Bridge approaches (south of canal completed in 2017).
Potential New Connections to Canal Bikeway.

- Old Bridge Road – Bourne.
- Pleasant Street – Bourne.
- Bourne Ball Field – Bourne.

CONCEPTUAL COST ESTIMATE:
2017: $25,000 – $50,000 per location.

Accessible Trail Connection
Bicycle/Pedestrian Access:
Sagamore Bridge Approaches & Adams Street
Complete Street Improvements.

CONCEPTUAL COST ESTIMATE:
2017: $3.9 M
Bicycle/Pedestrian Access:
Bourne Bridge (North of Canal)

- RECONSTRUCT AND WIDEN SIDEWALK
- ADD LANE STRIPING AND SIGNAGE

CONCEPTUAL COST ESTIMATE:
2017: $800,000

SIDEWALK IMPROVEMENTS SOUTH OF CANAL COMPLETED BY MASSDOT in 2017.
Conceptual Cost Estimates, Short-Term – Geometric Intersections Improvements.

Enhanced Signal Timing / Adaptive Signals.
- Scenic Hwy/Canal Road/State Road, Bourne.
- Nightingale Road/Scenic Hwy, Bourne.

Improved Intersection Geometry
- Route 6A at Cranberry Hwy/Sandwich Road.
- Route 130 at Cotuit Road.
- Sandwich Road at Bourne Rotary Connector.
Conceptual Cost Estimates

Intersections.

CONCEPTUAL COST ESTIMATE:

ADAPTIVE SIGNALS – 2017: $50,000 PER LOCATION.
Proposed: Add exclusive left-turn lanes on westbound approach. ADA-compliant sidewalks and crosswalk on all approaches.
Proposed: Signalized Intersection.
ADA-compliant sidewalks and crosswalk on all approaches.
Sandwich Rd/Bourne Rotary Connector, Bourne ‘Florida T’ Intersection.

**Proposed:** Signalized Intersection. Connector to Sandwich Road through lane. ADA-compliant sidewalks and crosswalk on all approaches.
Conceptual Cost Estimate—Multi-Modal Center Route 6 at Route 130 Park & Ride Lot.

CONCEPTUAL COST ESTIMATE: 2017: $3.6 Million

Potential Location for a 100-space Park and Ride Lot

Secure Bike Storage Area

CONNECTION TO FUTURE SERVICE ROAD BIKE PATH AND BUS ROUTE
Conceptual Cost Estimates
Mid-Term Roadway.

• Scenic Hwy Westbound to Route 25 Westbound Ramp.
• Route 28 Northbound to Sandwich Road Ramp.
• Belmont Circle - 3-Leg Roundabout with Signalized Intersection.
• Bourne Rotary – 3 Signalized Intersections.
Conceptual Cost Estimates
Mid-Term Roadway.

- Belmont Circle 3-Leg Roundabout with Signalized Intersection
- Scenic Highway WB to Route 25 WB Ramp
- Bourne Rotary with 3 Signalized Intersections
- Route 28 NB to Sandwich Road Ramp
Scenic Highway Westbound to Route 25 Westbound Ramp.

CONCEPTUAL COST ESTIMATE:
2017: $6.4 Million
2030: $10 Million
2040: $14 Million
Route 28 Northbound to Sandwich Road Eastbound Ramp.

CONCEPTUAL COST ESTIMATE:
2017: $7 Million
2030: $10 Million
2040: $15 Million

INCLUDES COST OF SANDWICH AT BOURNE ROTARY CONNECTOR INTERSECTION AND HIGH SCHOOL DRIVE RELOCATION
Bourne Rotary Reconstruction (3 Signalized Intersections).

CONCEPTUAL COST ESTIMATE:
2017: $34 Million
2030: $52 Million
2040: $73 Million
Belmont Circle Reconstruction (3-Leg Roundabout with Signalized Intersection).

CONCEPTUAL COST ESTIMATE:
2017: $26 Million
2030: $40 Million
2040: $56 Million

DOES NOT INCLUDE COST OF SCENIC HWY RAMP TO ROUTE 25.
Route 6 Exit 1C Relocation.

CONCEPTUAL COST ESTIMATE:
2017: $41 Million
2030: $64 Million
2040: $91 Million
Route 6 – Additional Eastbound Lane
Sagamore Bridge to Exit 2.

CONCEPTUAL COST ESTIMATE:
2017: $42 Million
2030: $65 Million
2040: $92 Million
Bourne Rotary Highway Interchange.

CONCEPTUAL COST ESTIMATE:
2017: $87 Million
2030: $136 Million
2040: $191 Million

DOES NOT INCLUDE COST OF SIGNALIZED INTERSECTIONS.
## Summary of Conceptual Cost Estimates

<table>
<thead>
<tr>
<th>Alternatives</th>
<th>2017</th>
<th>2030</th>
<th>2040</th>
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</thead>
<tbody>
<tr>
<td>Scenic Highway to Route 25 WB Ramp</td>
<td>$6</td>
<td>$10</td>
<td>$14</td>
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<tr>
<td>Route 6 Exit 1C Relocation</td>
<td>$41</td>
<td>$64</td>
<td>$91</td>
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<tr>
<td>Rte 28 NB to Sandwich Road Ramp</td>
<td>$7</td>
<td>$10</td>
<td>$15</td>
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<tr>
<td>Bourne Rotary Reconstruction</td>
<td>$34</td>
<td>$52</td>
<td>$73</td>
</tr>
<tr>
<td>Belmont Circle Reconstruction</td>
<td>$26</td>
<td>$40</td>
<td>$56</td>
</tr>
<tr>
<td>Belmont Circle Reconstruction with Rte 25 Fly-over to Scenic Highway</td>
<td>$36</td>
<td>$56</td>
<td>$80</td>
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<tr>
<td>Route 6 EB Travel Lane</td>
<td>$42</td>
<td>$65</td>
<td>$92</td>
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<tr>
<td>Bourne Rotary Interchange</td>
<td>$87</td>
<td>$136</td>
<td>$191</td>
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# Summary of Conceptual Cost Estimates by Case

<table>
<thead>
<tr>
<th>Cases</th>
<th>2017</th>
<th>2030</th>
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<tbody>
<tr>
<td>Case 1</td>
<td>$47</td>
<td>$74</td>
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<td>Case 1A</td>
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<td>Case 1B</td>
<td>$40</td>
<td>$63</td>
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<td>Case 2</td>
<td>$107</td>
<td>$166</td>
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<tr>
<td>Case 2B</td>
<td>$117</td>
<td>$183</td>
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<td>Case 3</td>
<td>$149</td>
<td>$231</td>
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<tr>
<td>Case 3A</td>
<td>$202</td>
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Matrix of Benefits and Impacts of each TDM Case.
## Matrix of Benefits and Impacts of Cases

<table>
<thead>
<tr>
<th>Alternatives Traffic Operations Evaluation Matrix Legend</th>
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<tbody>
<tr>
<td>Minor</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>Benefits</td>
</tr>
<tr>
<td>Impacts</td>
</tr>
<tr>
<td>Neutral (no impact or resource not present)</td>
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</table>
## Matrix of Case Analysis – Benefit/Impact Definitions

<table>
<thead>
<tr>
<th>Category</th>
<th>Benefit Levels</th>
<th>Impact Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety</td>
<td>§ 1 minor or no benefit</td>
<td>§ 1 minor or no benefit</td>
</tr>
<tr>
<td>Emergency Vehicle Response Time</td>
<td>Moderate Benefit</td>
<td>Substantial Improvement</td>
</tr>
<tr>
<td>Bicycle/Pedestrian (facilities or access)</td>
<td>Moderate Benefit</td>
<td>Substantial Improvement</td>
</tr>
<tr>
<td>Wetlands</td>
<td>§ 1 &gt; 5,000 SF of wetlands</td>
<td>§ 1 &gt; 1 acre of Wetlands</td>
</tr>
<tr>
<td>Rare Species</td>
<td>§ 1 &gt; 1 acre of work in rare species habitat</td>
<td>Requires a Conservation Management Permit</td>
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<tr>
<td>Area of Critical Environmental Concern (ACEC)</td>
<td>§ 1 Impacts land within ACEC</td>
<td>§ 1 Impacts wetlands within ACEC</td>
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<tr>
<td>100-Year Floodplain</td>
<td>§ 1 Moderate fill within 100-year floodplain</td>
<td>§ 1 Substantial fill within 100-year floodplain</td>
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<tr>
<td>Water Supply Protection Areas</td>
<td>§ 1 Impact to land in DEP IWPA or Zone II</td>
<td>§ 1 Impact to land in DEP Zone I or ORW</td>
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<tr>
<td>Air Quality/Public Health</td>
<td>§ 1 Modest reductions in idle time/queueing</td>
<td>§ 1 Substantial reductions in idle time/queueing</td>
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<tr>
<td>Open Space</td>
<td>§ 1 Acquisition of open space land</td>
<td>§ 1 Acquisition of open space affecting recreational facilities</td>
</tr>
<tr>
<td>Historic Resources</td>
<td>§ 1 Impacts historic parcel or historic district</td>
<td>§ 1 Adverse Effect on historic property</td>
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<tr>
<td>Land Use/Economic Development</td>
<td>§ 1 Modest impact to residential or commercial property</td>
<td>§ 1 Substantial impact to residential or commercial property</td>
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# Matrix of Case Analysis – Future No-Build & Case 1

<table>
<thead>
<tr>
<th>Category</th>
<th>2040 Future No Build</th>
<th>Case 1</th>
<th>Data/ % change from 2040 No-Build</th>
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<td>Rating</td>
<td>Data</td>
<td>Rating</td>
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<td>Traffic</td>
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<tr>
<td>Vehicle Hours Traveled</td>
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<td>Summer Sat</td>
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<td>Fall PM</td>
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<tr>
<td>Average Delay (min.)</td>
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<td>Summer Sat</td>
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<td>🟢</td>
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<tr>
<td>Fall PM</td>
<td>🟤</td>
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<tr>
<td>Travel Time (min.)</td>
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<tr>
<td>Summer Sat</td>
<td>🟤</td>
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<tr>
<td>Fall PM</td>
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<tr>
<td>Safety</td>
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<td>Emerg. Response Time</td>
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<tr>
<td>Bike / Ped</td>
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<td>Safety/ New Facilities</td>
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<tr>
<td>Environmental</td>
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<tr>
<td>Wetlands</td>
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<tr>
<td>Rare Species</td>
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<td>100-year Floodplain</td>
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<td>Water Supply (Zone I/II, IWPA)</td>
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<td>Community</td>
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<td>Open Space</td>
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<tr>
<td>Economic Impact</td>
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<tr>
<td>Cost ($ millions)</td>
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</table>
Key Findings.
Key Findings - Traffic.

- Notable reduction in non-summer delay at Belmont Circle and Bourne Rotary can be achieved with Mid-Term improvements (Case 1B/Case 2).

- Overall improvements can be split into less costly projects each providing independent benefit. For example:
  - Scenic Hwy to Route 25 ramp.
  - Route 28 north to Sandwich Road ramp.
  - 3-signalized intersections at Bourne Rotary.

- No wasted investment in transportation dollars.
Key Findings - Traffic.

- Long-Term Case 3A (new Canal bridges with Bourne Rotary interchange and new Route 6 eastbound lane) would address most long-term delay locations. Belmont Circle would maintain some summer delay.

- Overall, no wasted investment in transportation dollars because each successive improvement can be built without substantially changing prior improvements.
Key Findings - Environmental.

- Modest potential impact to environmental and social resources.
  - No residential / commercial property structure takings. Minor land takings but no relocations.
  - Modest land taking at Bourne Rotary for Case 3A Interchange
  - Modest wetland impact at Belmont Circle.
  - No or minor air & noise impact.
  - No significant environmental document required. No major wetlands permits.
Key Findings - Environmental.

- Relocation of Route 6 Exit 1C would result in major impact to rare species habitat. Project will require a Conservation Management Permit (CMP) with substantial habitat mitigation.
  - Wildlife studies.
  - Land acquisition/conservation.
  - Wildlife tunnels.
Key Findings - Economics.

• Improvements would result in substantial reduction in annual travel time for residents and visitors compared to future no-build.
• Value ($) of this time savings far exceeds the annualized construction cost.
Schedule and Next Steps.
Next Steps.

• Working Group Meeting Late February 2018 (including Draft Recommendations).
• Distribution of Draft Study Report.
• Final Public Meeting (March 2018).
# Study Schedule

<table>
<thead>
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<th></th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
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<tr>
<td><strong>TASK 3 Alternatives Development</strong></td>
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<td>Public Meeting</td>
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<td>Mobility/Accessibility Analysis</td>
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<td>Environmental Effects Analysis</td>
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<td>Community Effects/TitleVI/EJ</td>
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<td>Cost Analysis</td>
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<tr>
<td>Working Group Meeting</td>
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Questions?

Comments and feedback can be emailed to: Ethan Britland - ethan.britland@state.ma.us.
End of Presentation.