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).
- Sudhir Murthy, P.E. – PTOE – Trans. Modeler (TrafInfo).
- 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								
Map Location	Improvements	Case 1	Case 1A	Case 1B	Case 2	Case 2B	Case 3	Case 3A
A	Scenic Highway to Rte 25 Westbound On-Ramp	●	●	●	●	●	●	●
B	Rte 6 Exit 1C Relocation	●			●	●	●	●
C	Rte 28 Northbound Ramp to Sandwich Road		●	●	●	●	●	
D	Bourne Rotary (Three New Signalized Intersections)			●	●	●	●	
E	Belmont Circle (3 Leg Roundabout plus Signalized Intersection)				●		●	●
F	Belmont Circle with Rte 25 Eastbound Fly-over					●		
G	New Bridges (Bourne and Sagamore)						●	●
H	Rte 6 Eastbound Travel Lane from Exit 1A to Exit 2						●	●
I	Bourne Rotary with Highway Interchange							●

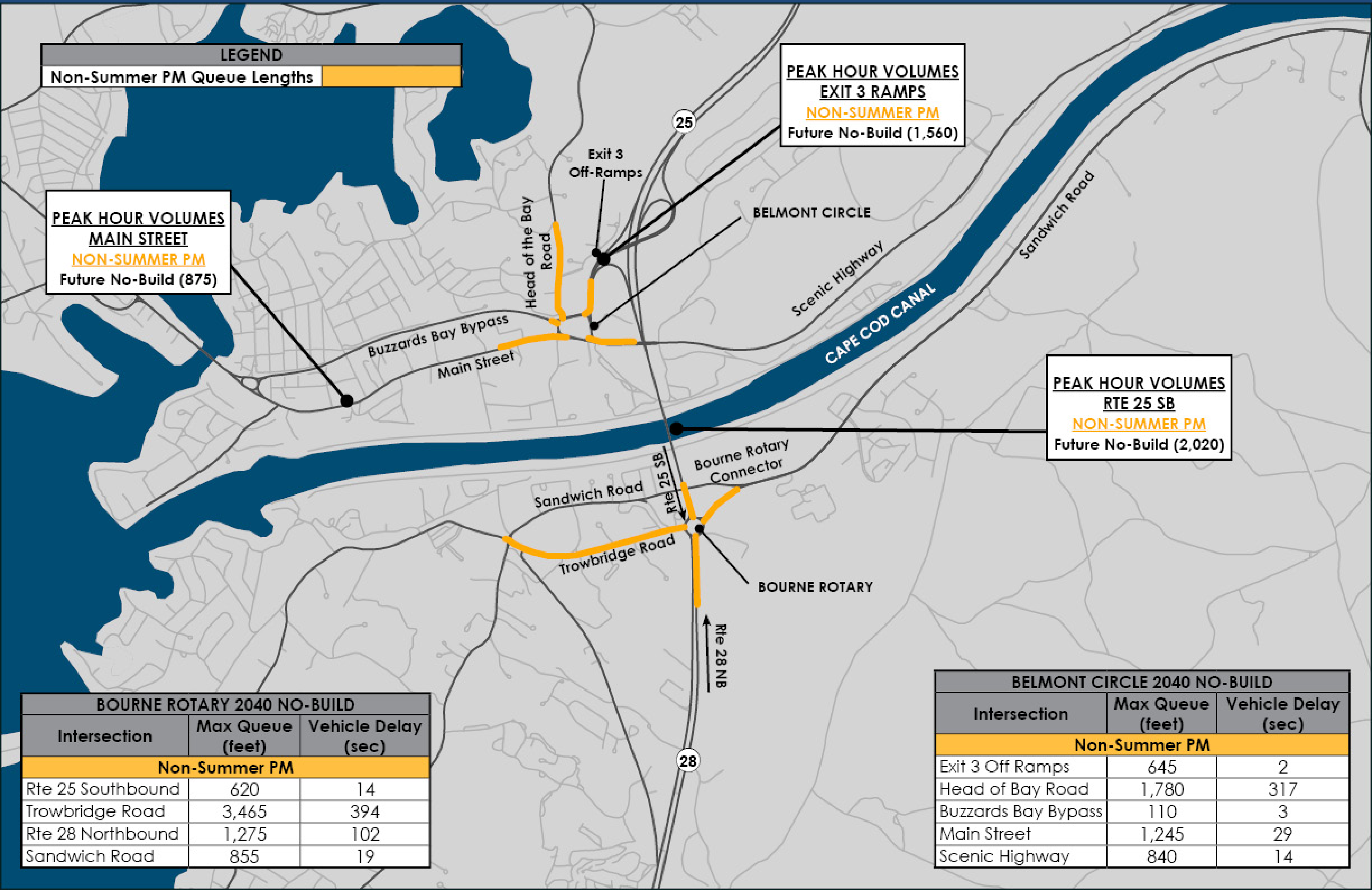
Travel Demand Model Analysis – Queue and Delay Methodology.

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.

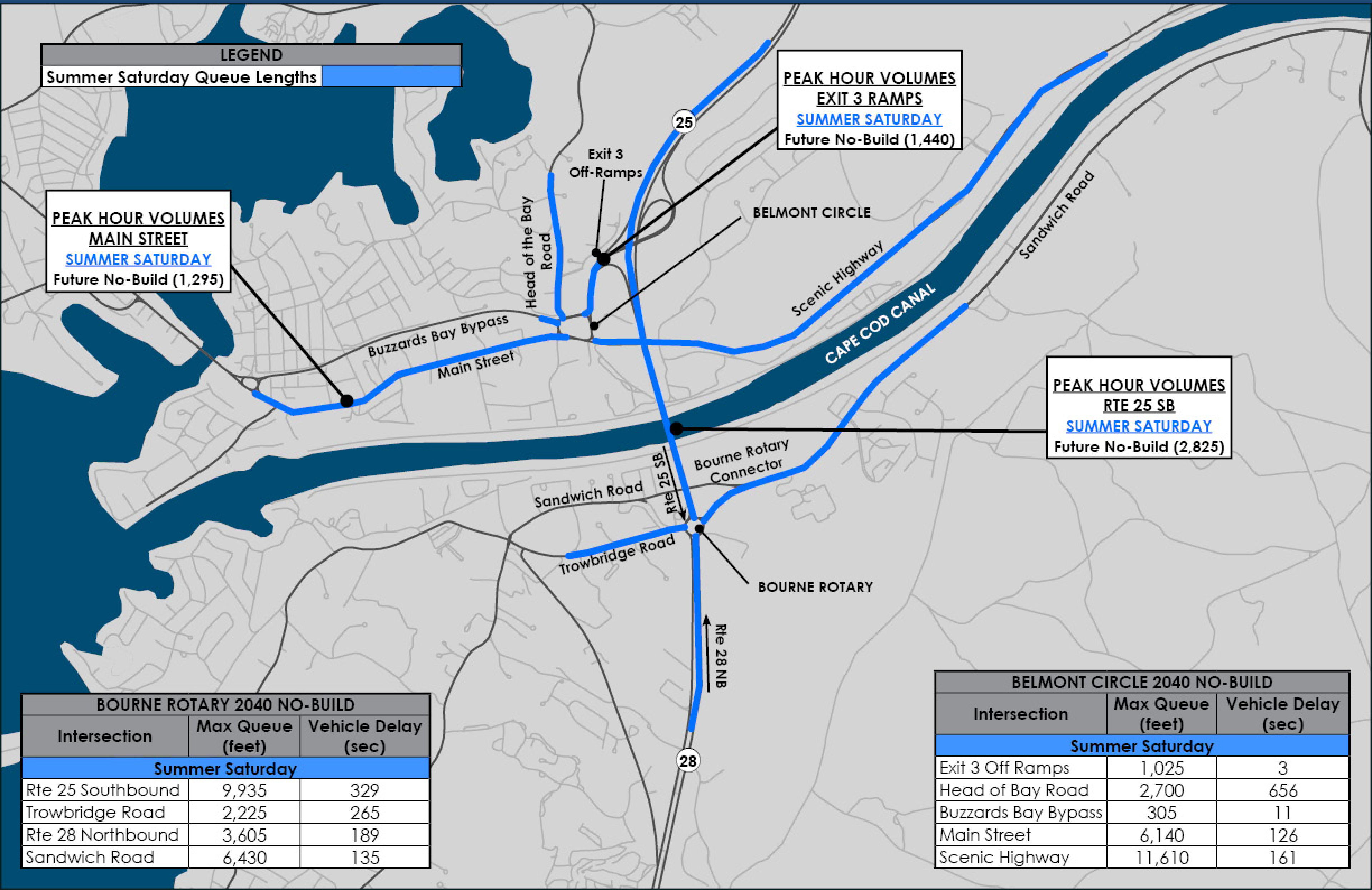
2040 Future No-Build Analysis
Non-Summer PM Period.



BOURNE ROTARY 2040 NO-BUILD		
Intersection	Max Queue (feet)	Vehicle Delay (sec)
Non-Summer PM		
Rte 25 Southbound	620	14
Trowbridge Road	3,465	394
Rte 28 Northbound	1,275	102
Sandwich Road	855	19

BELMONT CIRCLE 2040 NO-BUILD		
Intersection	Max Queue (feet)	Vehicle Delay (sec)
Non-Summer PM		
Exit 3 Off Ramps	645	2
Head of Bay Road	1,780	317
Buzzards Bay Bypass	110	3
Main Street	1,245	29
Scenic Highway	840	14

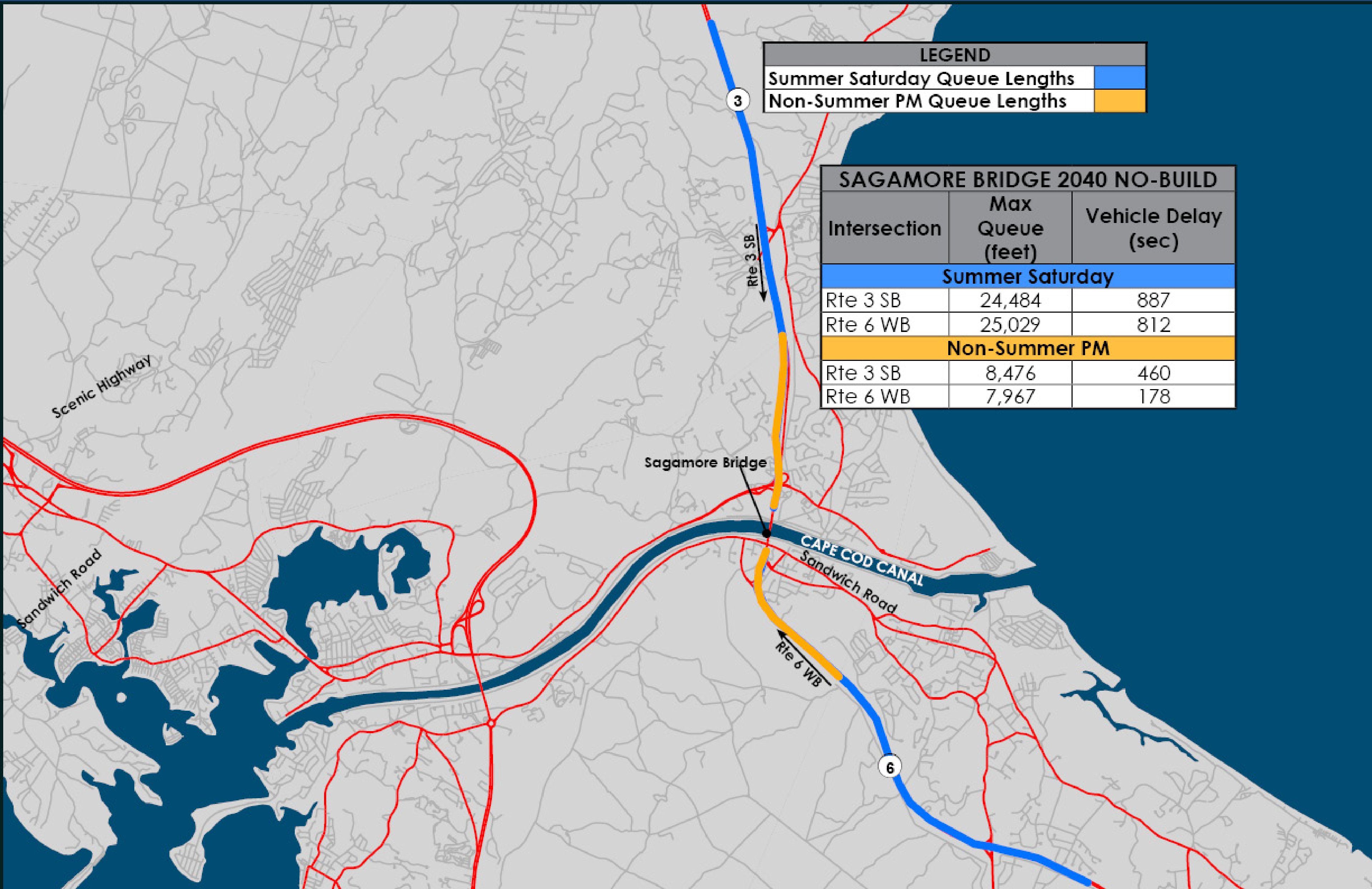
2040 Future No-Build Analysis
Summer Saturday Period.



BOURNE ROTARY 2040 NO-BUILD		
Intersection	Max Queue (feet)	Vehicle Delay (sec)
Summer Saturday		
Rte 25 Southbound	9,935	329
Trowbridge Road	2,225	265
Rte 28 Northbound	3,605	189
Sandwich Road	6,430	135

BELMONT CIRCLE 2040 NO-BUILD		
Intersection	Max Queue (feet)	Vehicle Delay (sec)
Summer Saturday		
Exit 3 Off Ramps	1,025	3
Head of Bay Road	2,700	656
Buzzards Bay Bypass	305	11
Main Street	6,140	126
Scenic Highway	11,610	161

Sagamore Bridge - 2040 Future No-Build Analysis
Summer and Non-Summer



SAGAMORE BRIDGE 2040 NO-BUILD		
Intersection	Max Queue (feet)	Vehicle Delay (sec)
Summer Saturday		
Rte 3 SB	24,484	887
Rte 6 WB	25,029	812
Non-Summer PM		
Rte 3 SB	8,476	460
Rte 6 WB	7,967	178

Travel Simulation Video –
Belmont Circle & Bourne Rotary
Future No-Build (Summer and Non-Summer).

Main Street, Bourne
Travel Demand Model Analysis

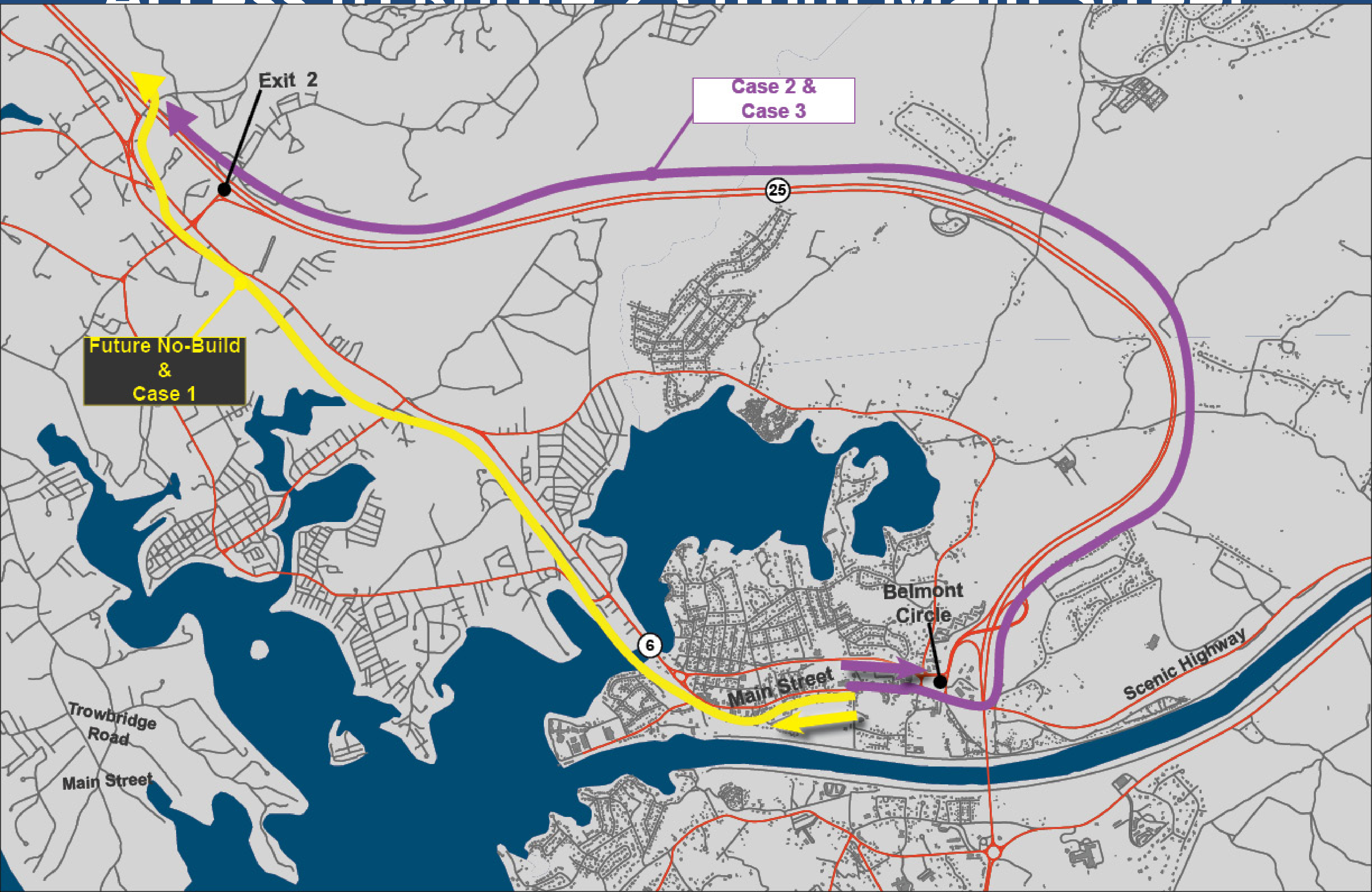
Summer Travel Patterns on Main Street, Bourne to Access Route 25.

- 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).

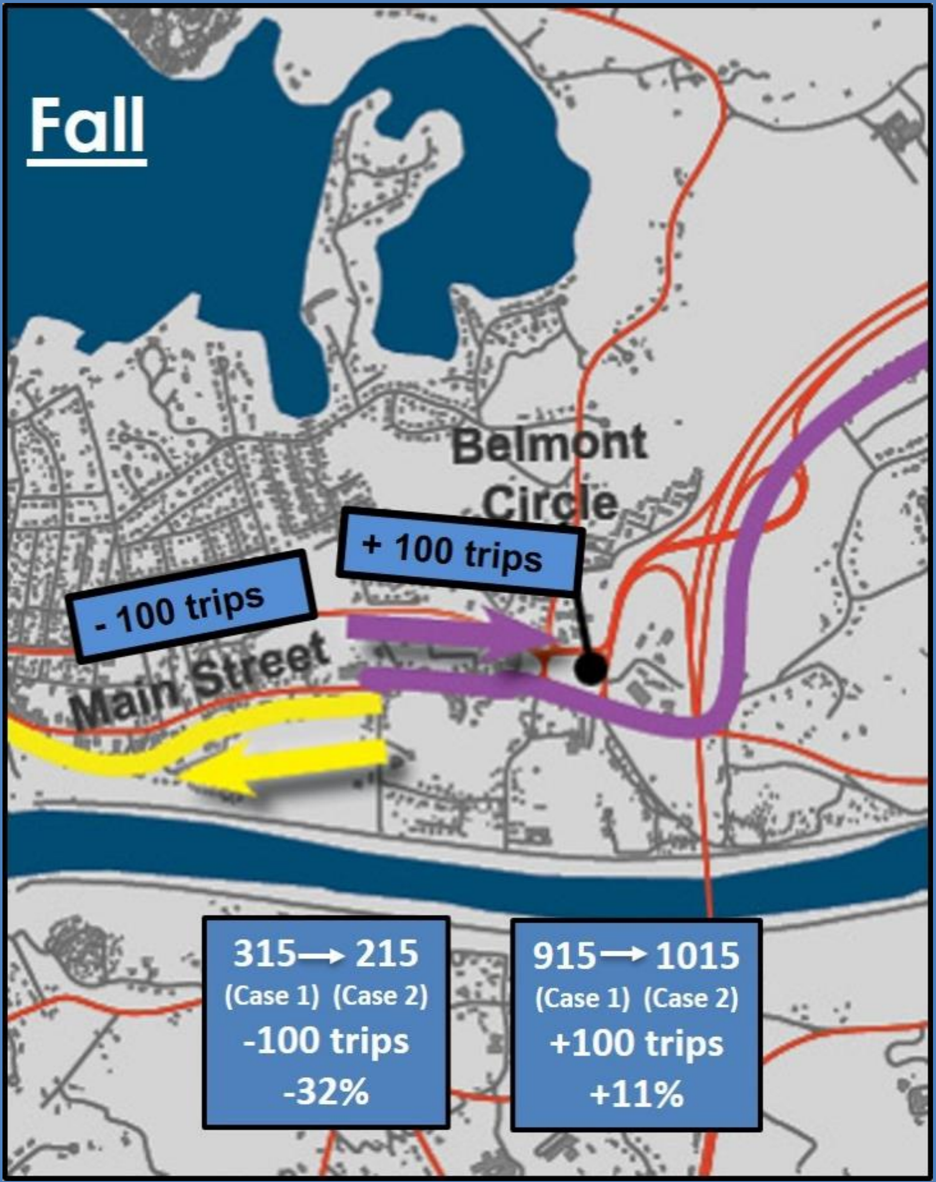
Summer Travel Patterns on Main Street, Bourne to Access Route 25.

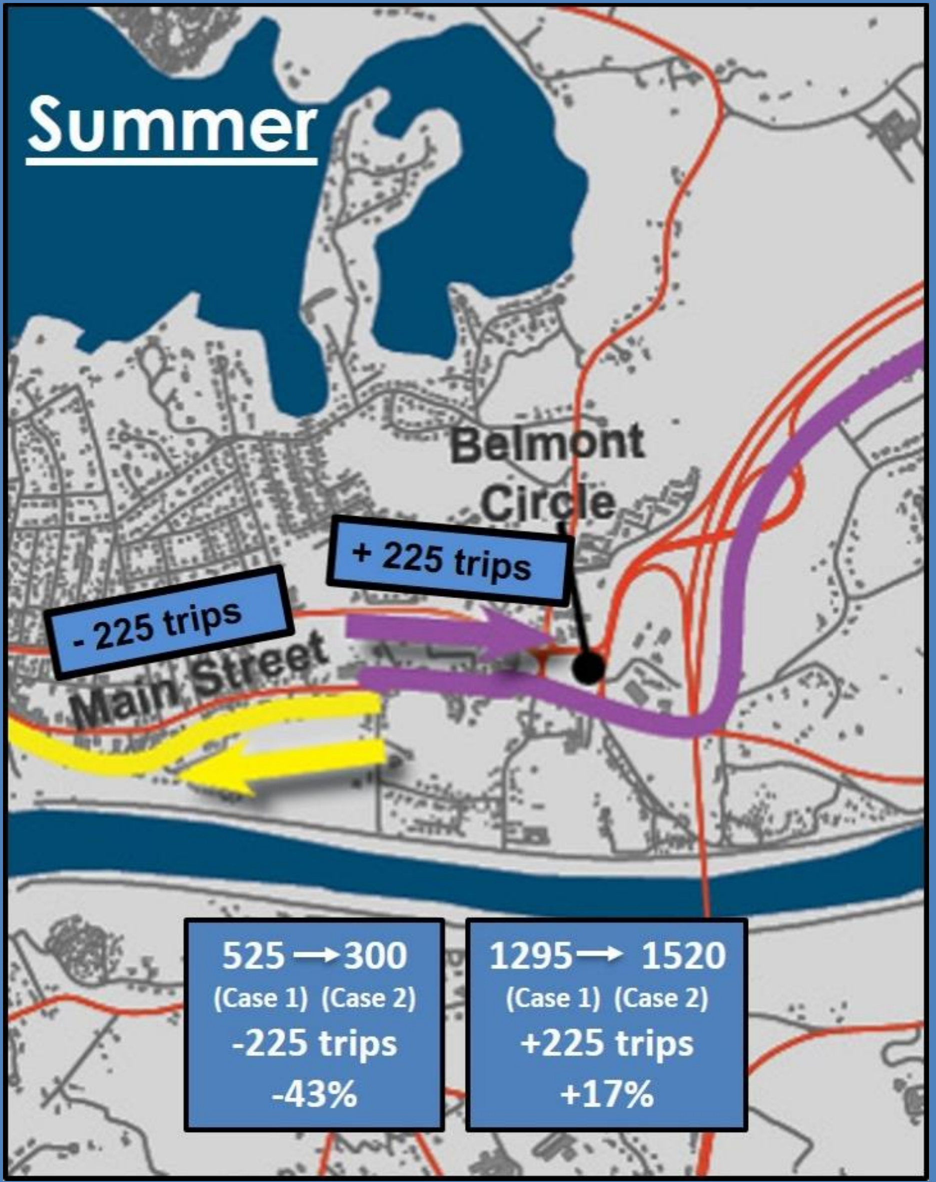
- Case 2 includes improvements to Belmont Circle (3-leg roundabout and signalized intersection).
- With these improvements, travel *eastbound* on Main Street increases to the more direct route to Route 25 via Belmont Circle.
- These additional trips dampen the overall reduction in travel delays at the Circle.

Travel Patterns - Access to Route 25 from Main Street



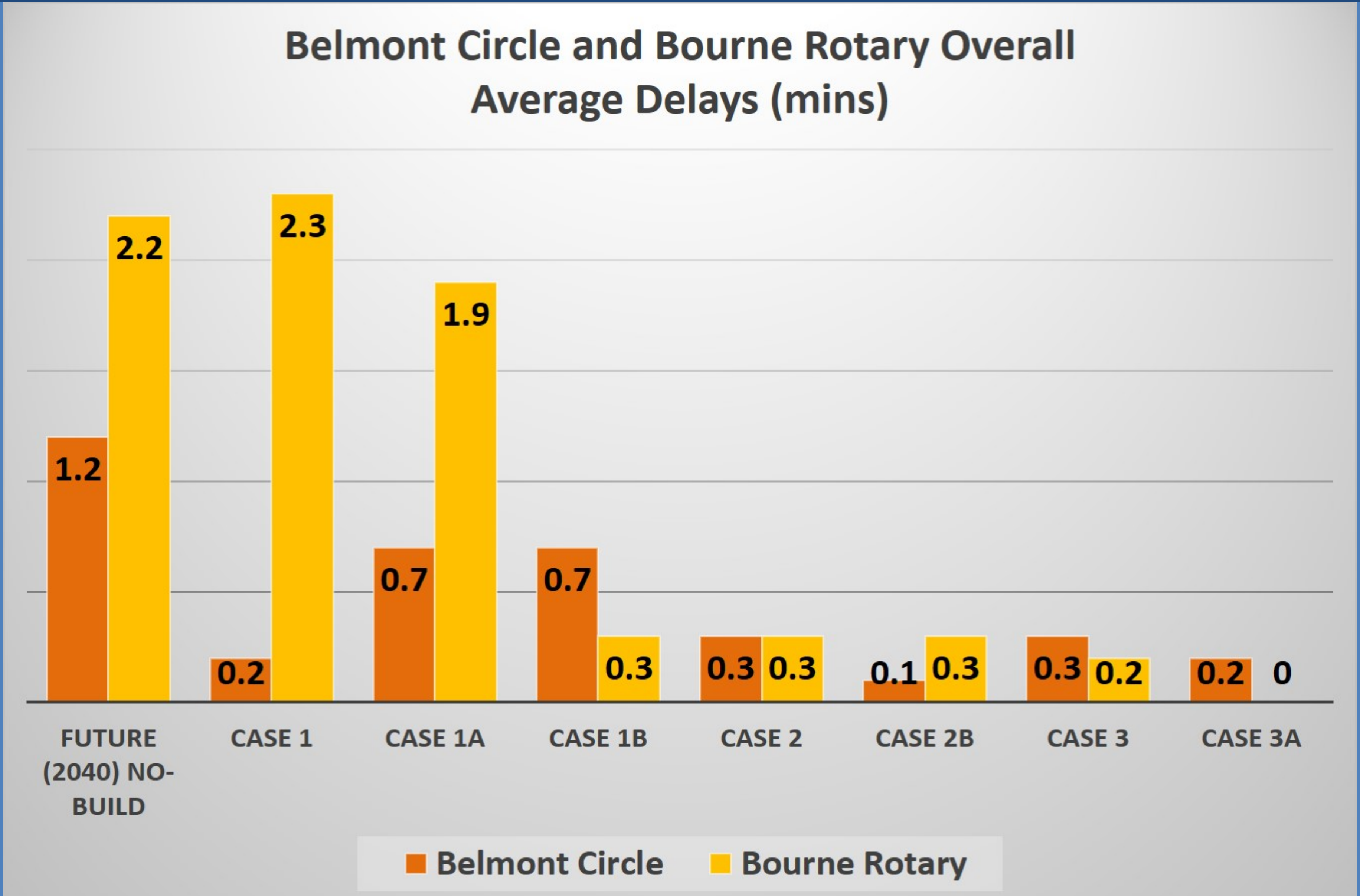
Change in Travel Patterns-Case 1 to Case 2 Access to Route 25 from Main Street.



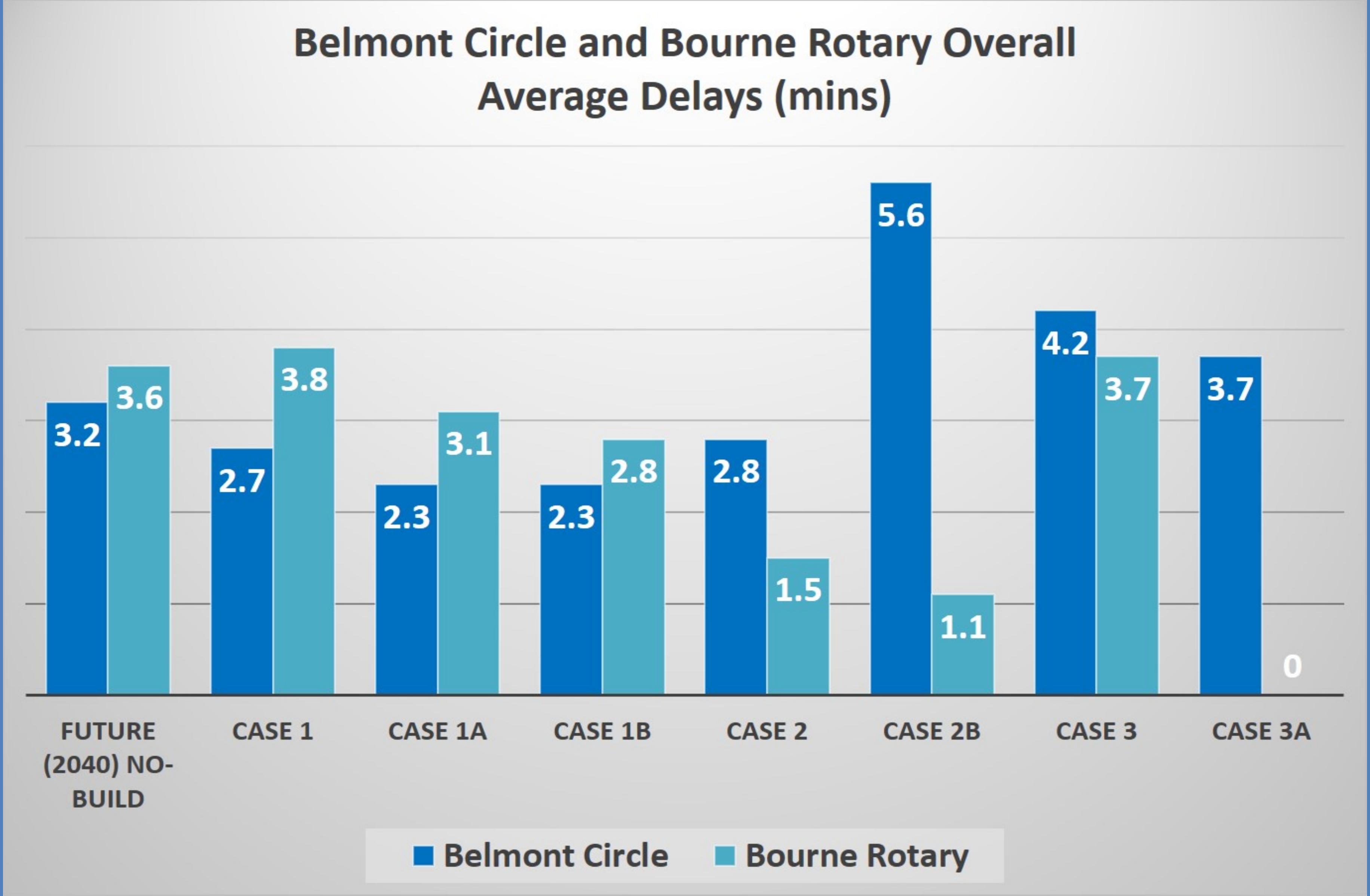


Summary of Travel Demand Model Findings.

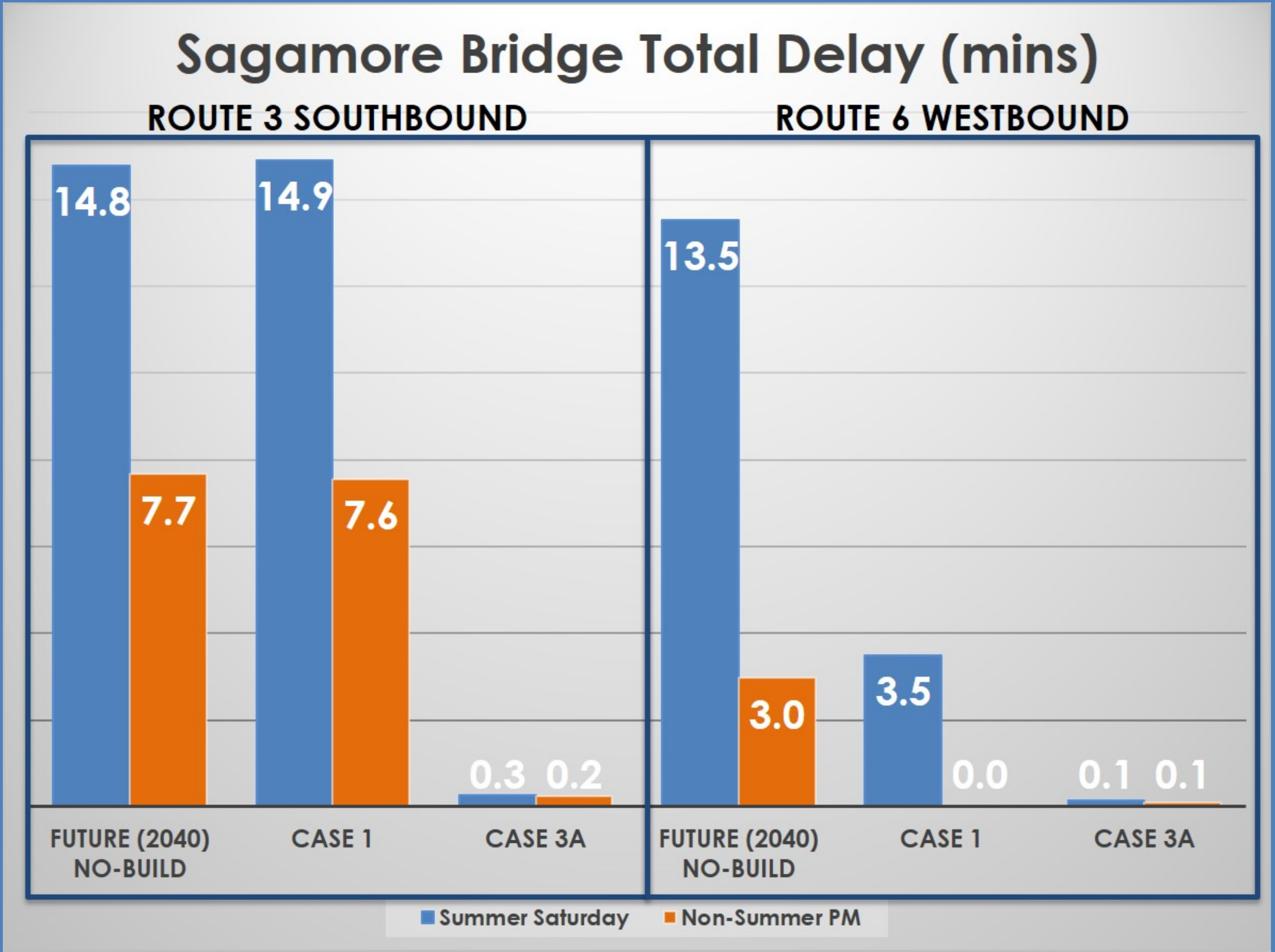
Travel Demand Model
Non-Summer PM Overall Findings.



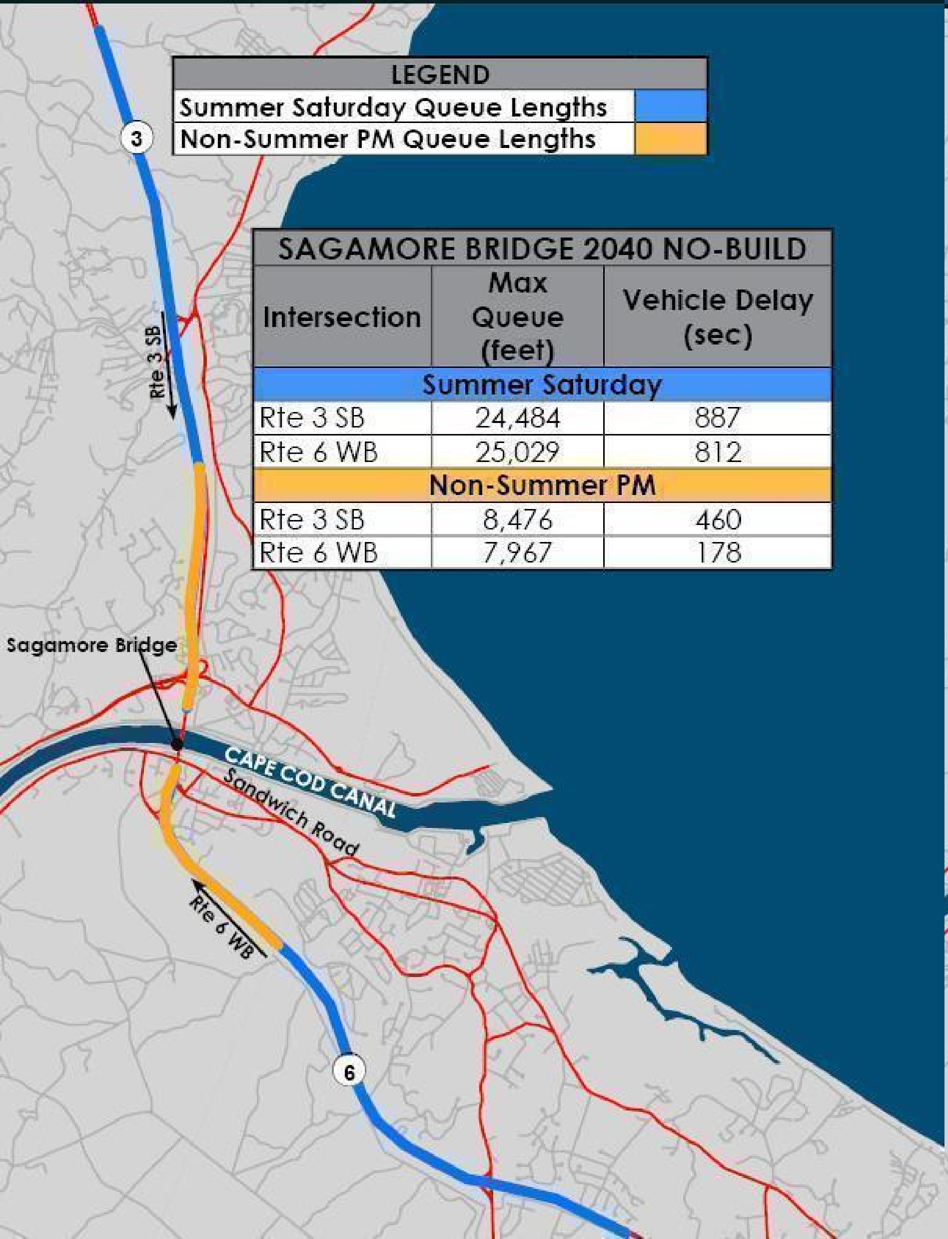
Travel Demand Model
Summer Saturday Overall Findings.



Travel Demand Model
Sagamore Bridge Overall Findings.



Travel Model Case 1
Summary of Findings – Sagamore Bridge.



SAGAMORE BRIDGE 2040 NO-BUILD		
Intersection	Max Queue (feet)	Vehicle Delay (sec)
Summer Saturday		
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Non-Summer PM		
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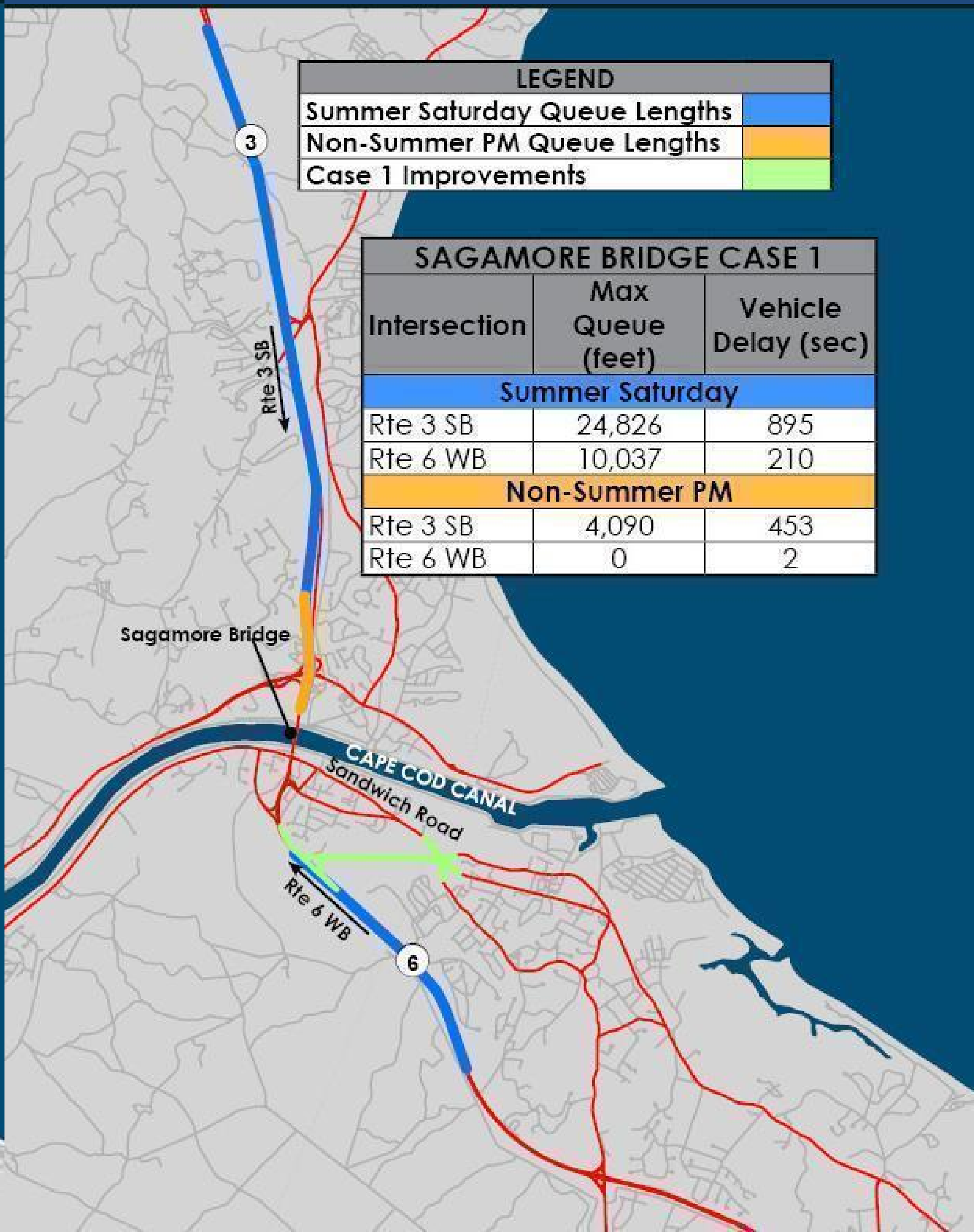
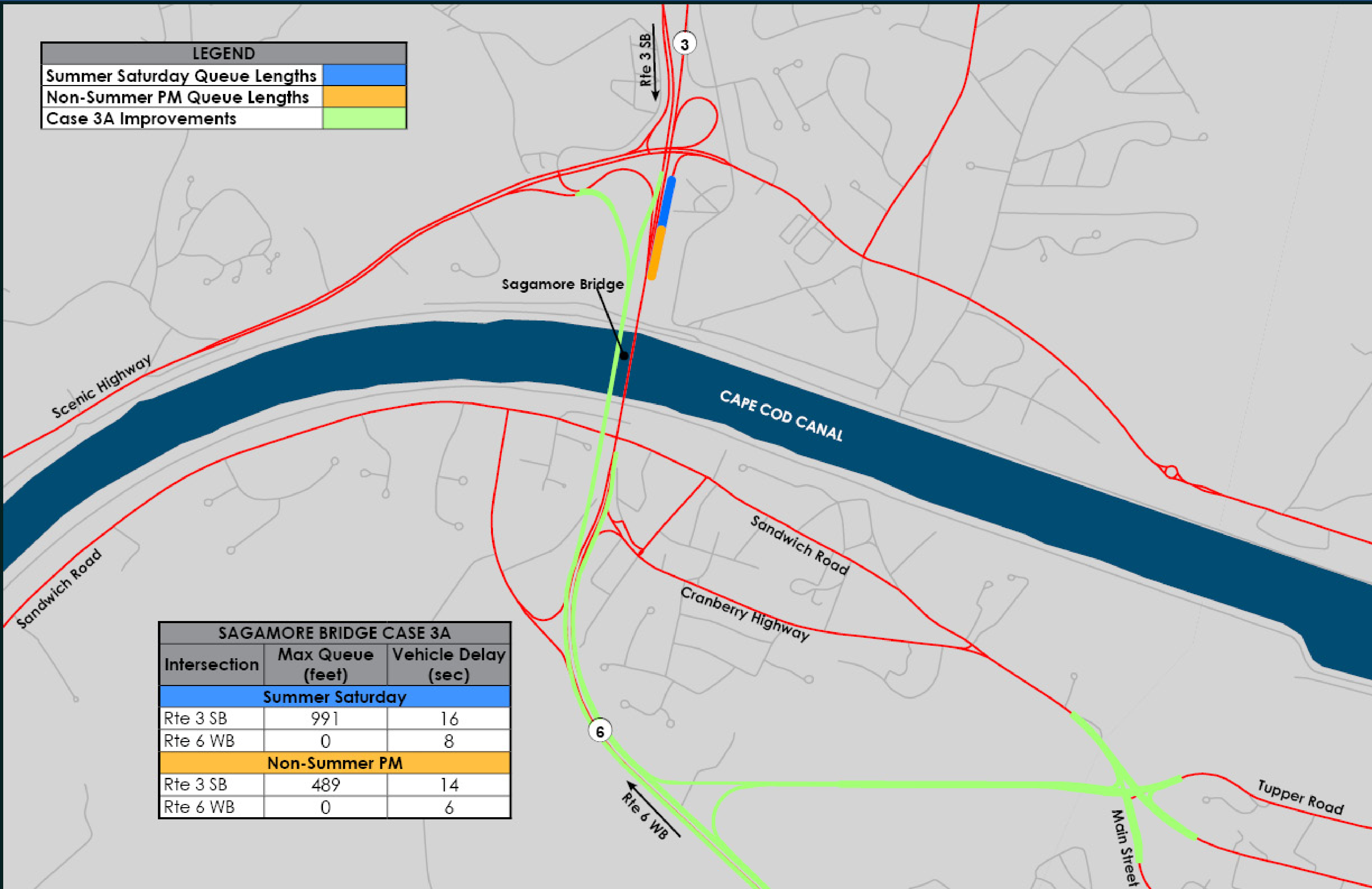


SAGAMORE BRIDGE CASE 1		
Intersection	Max Queue (feet)	Vehicle Delay (sec)
Summer Saturday		
Rte 3 SB	24,826	895
Rte 6 WB	10,037	210
Non-Summer PM		
Rte 3 SB	4,090	453
Rte 6 WB	0	2

Travel Model Case 3A
Sagamore Bridge Approaches.

LEGEND	
Summer Saturday Queue Lengths	
Non-Summer PM Queue Lengths	
Case 3A Improvements	



SAGAMORE BRIDGE CASE 3A		
Intersection	Max Queue (feet)	Vehicle Delay (sec)
Summer Saturday		
Rte 3 SB	991	16
Rte 6 WB	0	8
Non-Summer PM		
Rte 3 SB	489	14
Rte 6 WB	0	6

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.

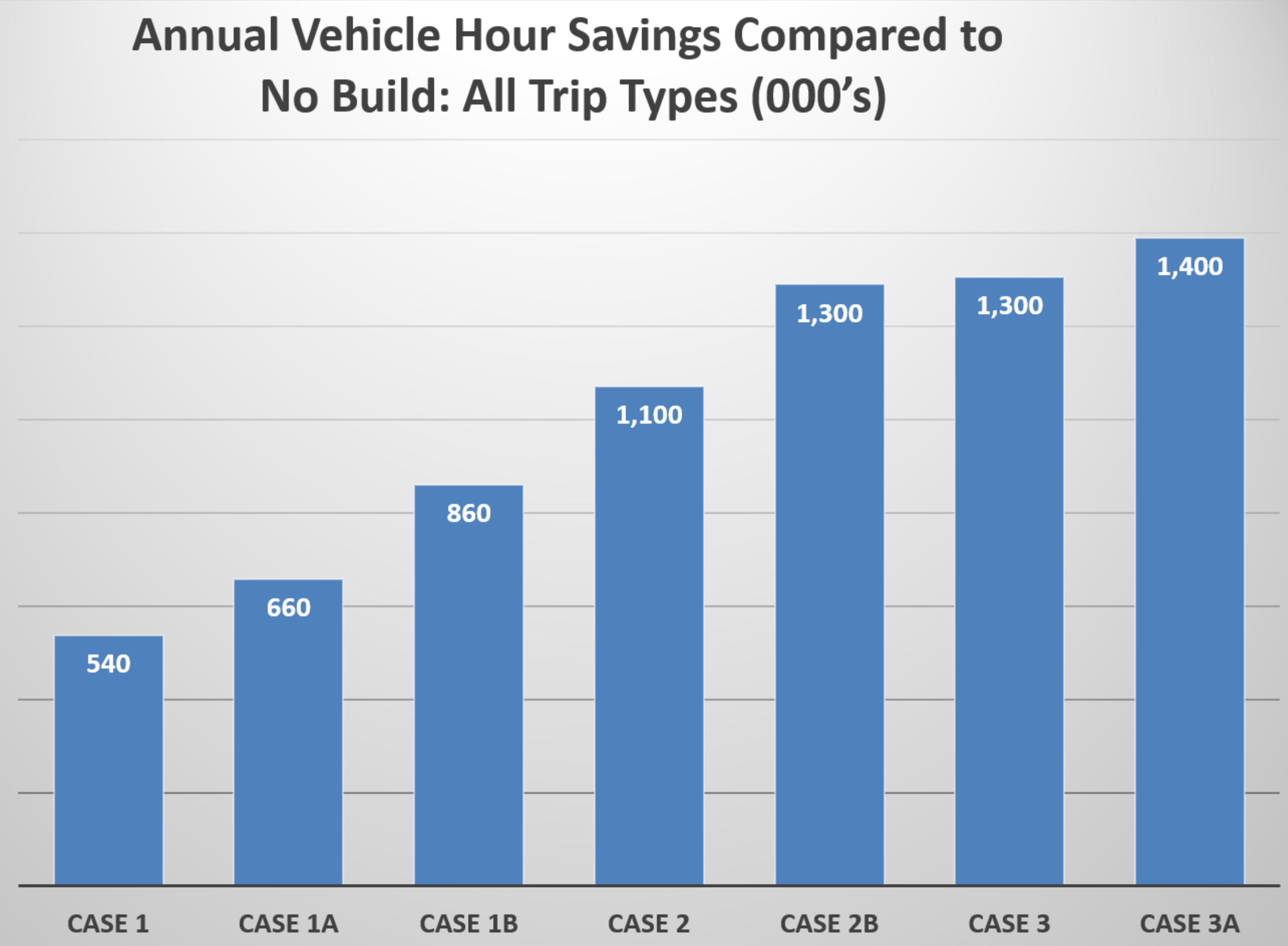
Travel time savings enhance personal satisfaction and business productivity, and can expand labor, freight, and visitor markets.

Economic Analysis: Approach and Methods.

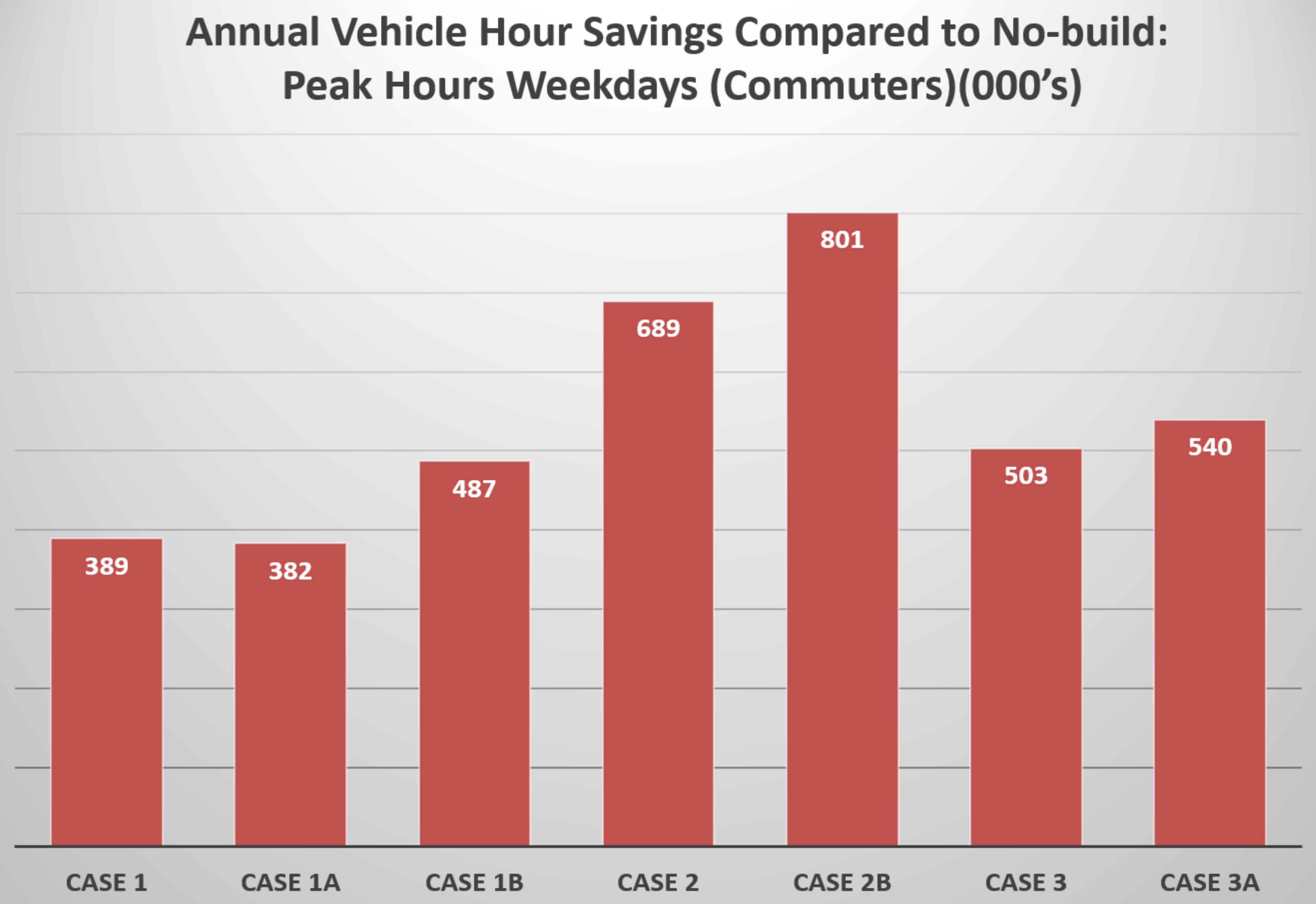
- Estimate the $ value of travel time benefits:
  - Commuters,
  - Peak seasonal visitors,
  - Non-business local travelers,
  - Goods movements (trucks).

- Compare the $ value of annualized user benefits to annualized construction costs.

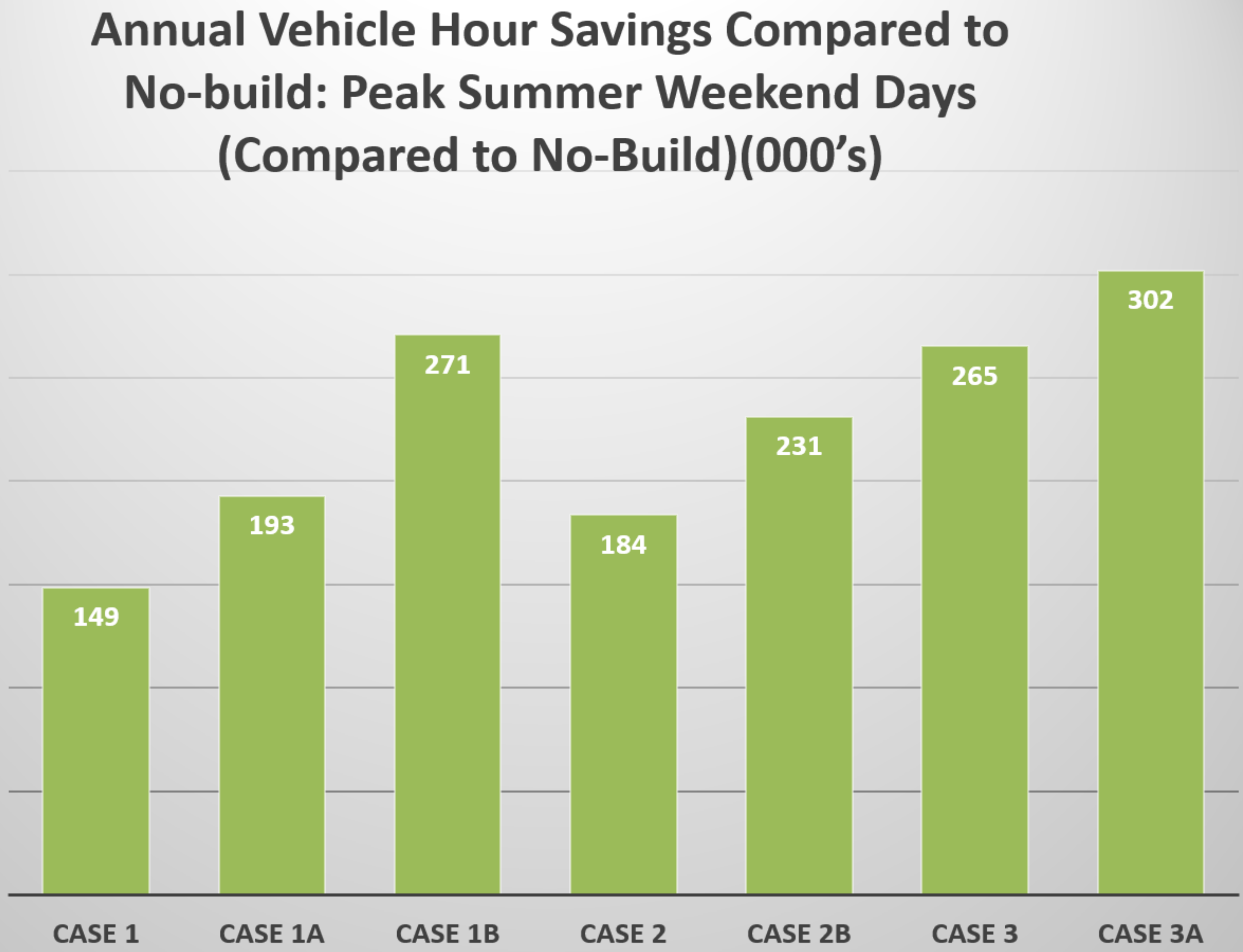
Annual Vehicle Hour Savings: All Trip Types.



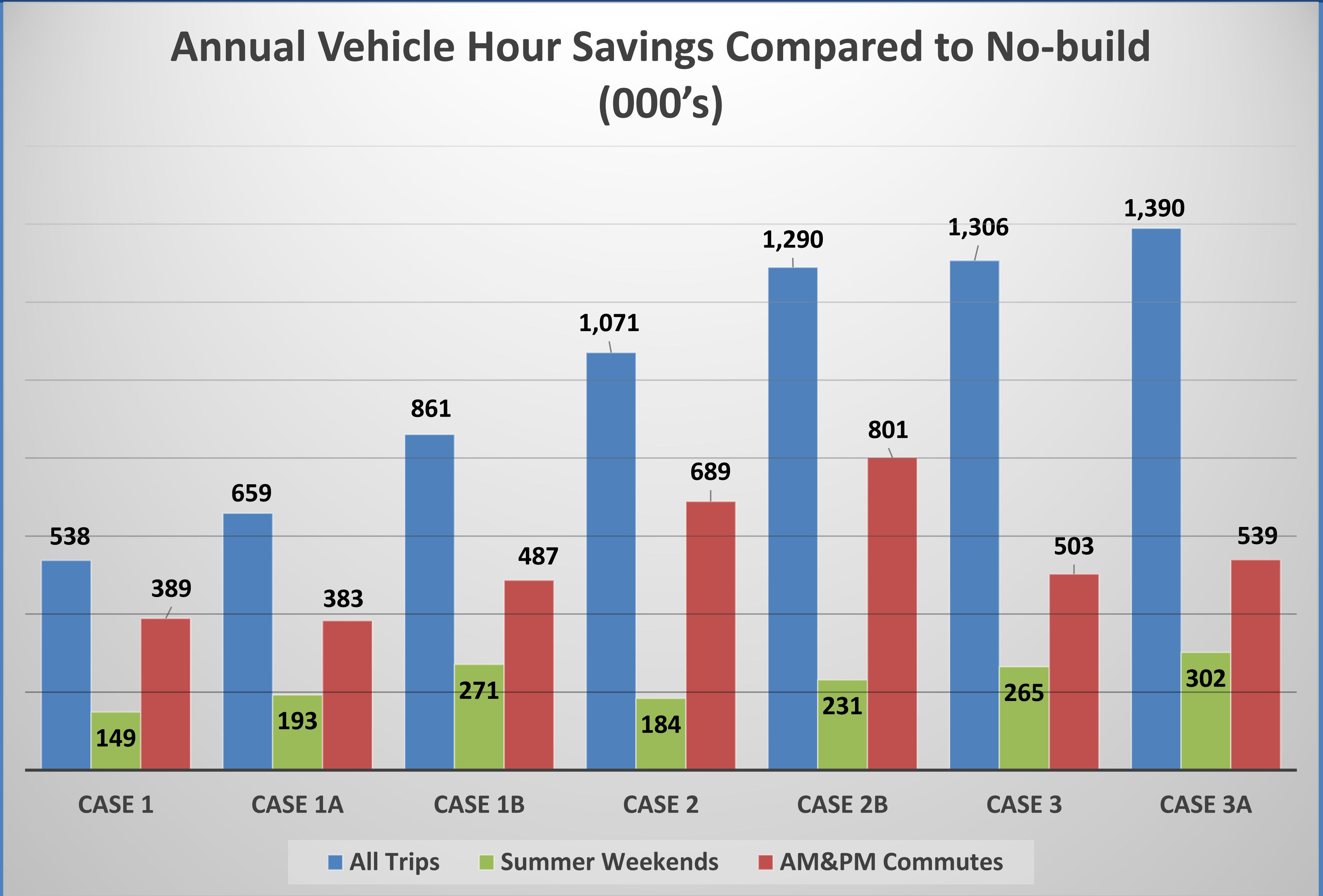
Annual Vehicle Hour Savings: Commuters –



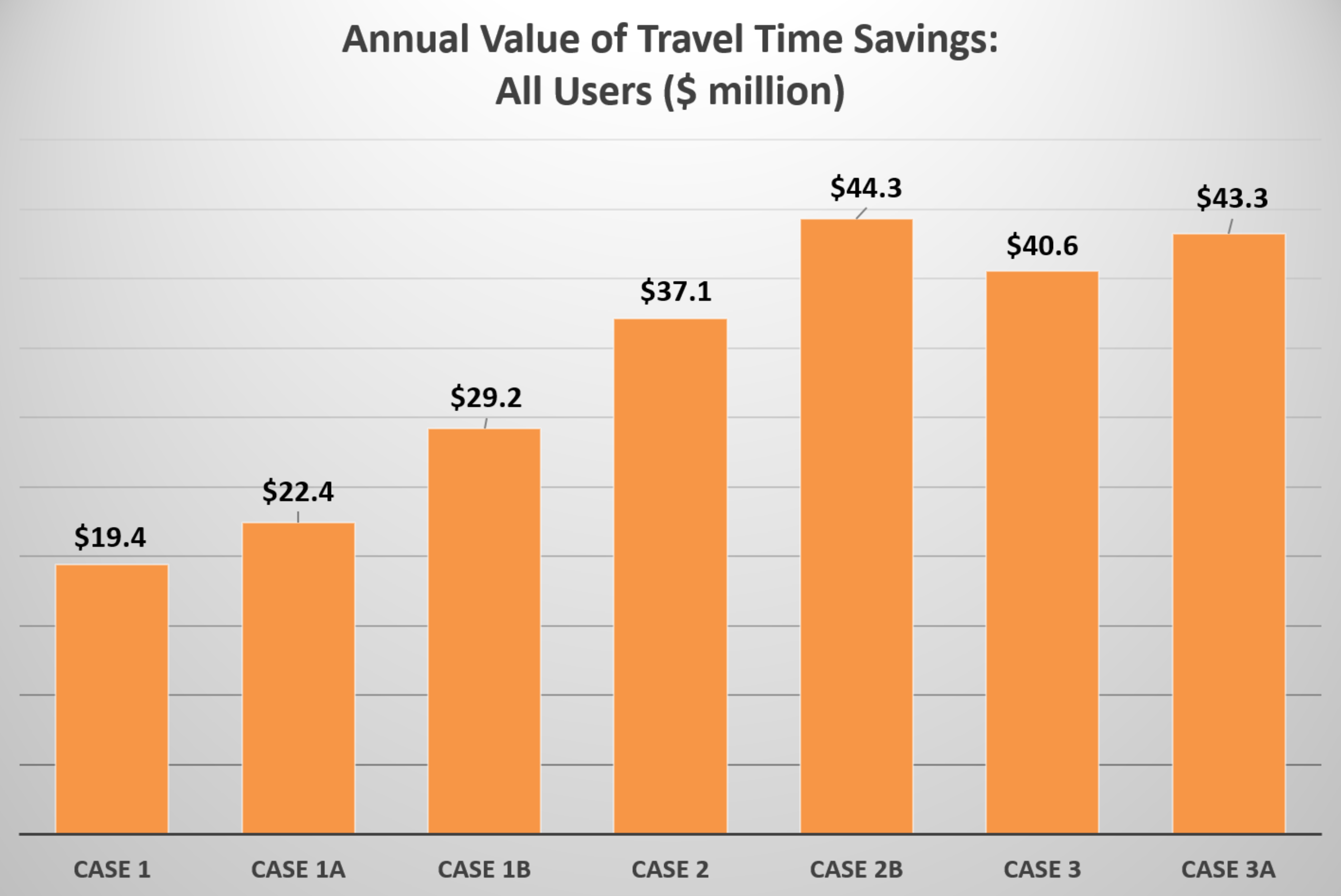
Annual Vehicle Hour Savings:



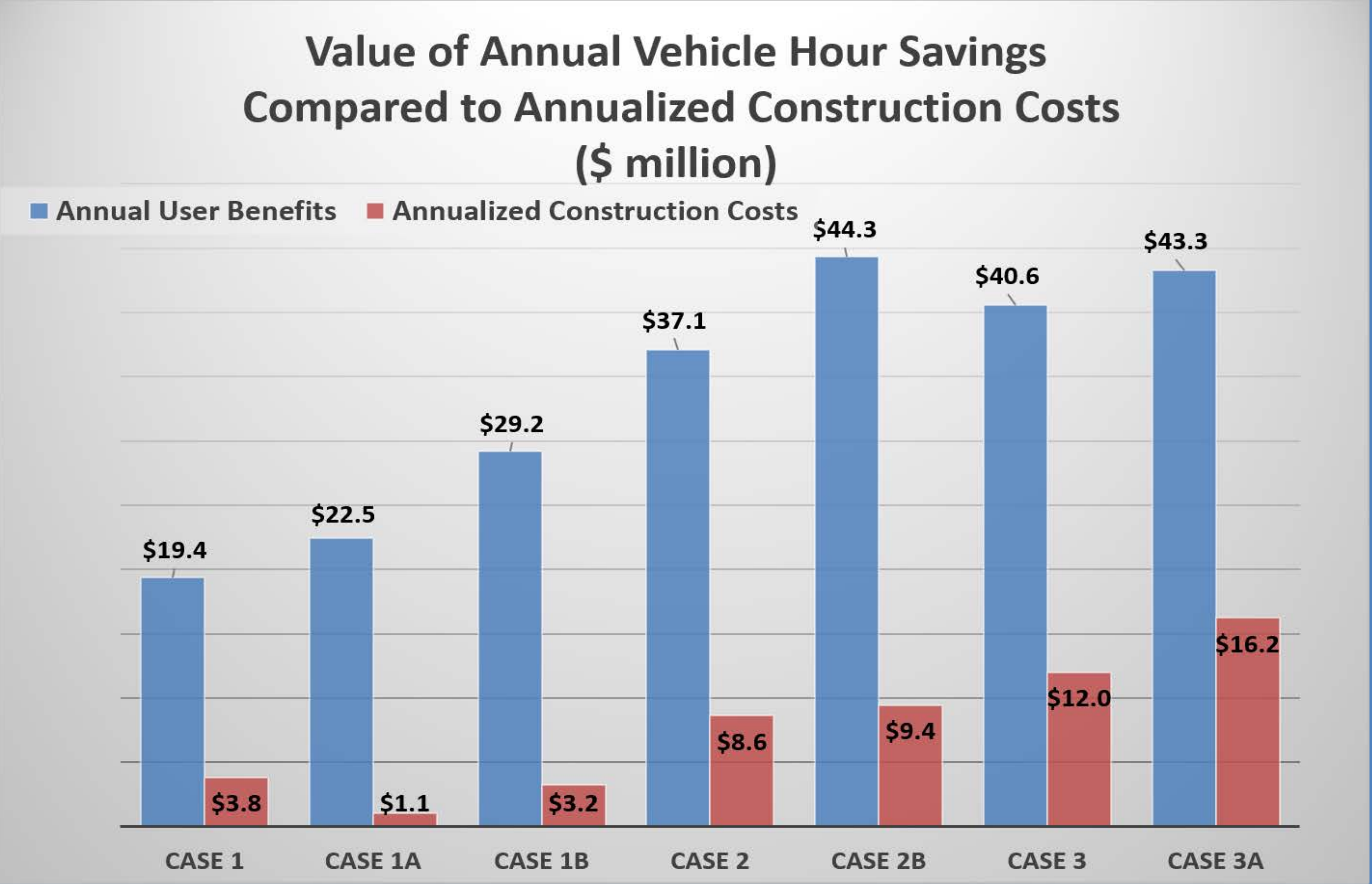
Annual Vehicle Hour Savings: Overall Comparison.



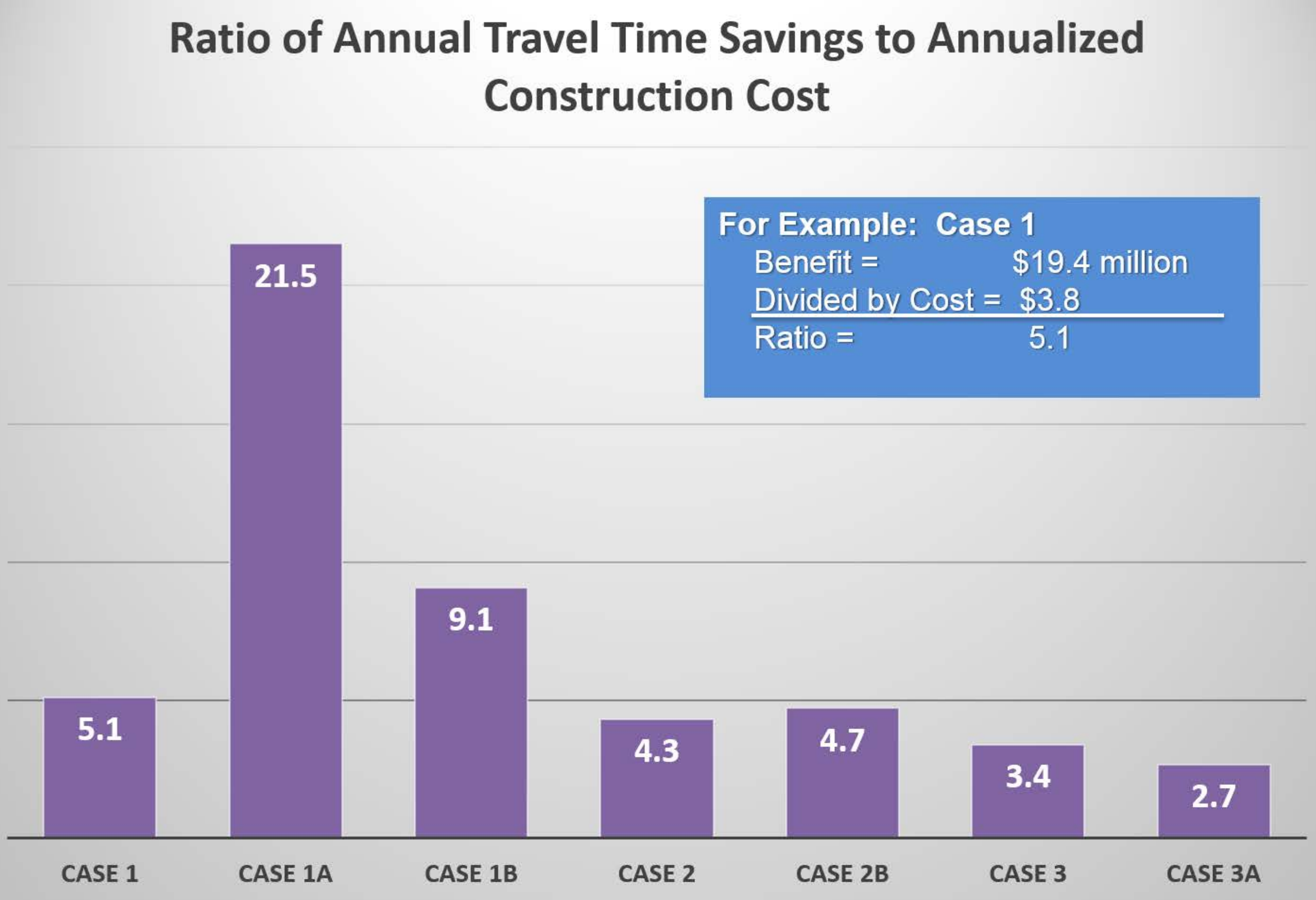
Annual Value of Travel Time: All Users



Annual Value of Vehicle Hour Savings Compared to Annualized Construction Costs.



Benefit Cost Ratios.



Highway Noise.

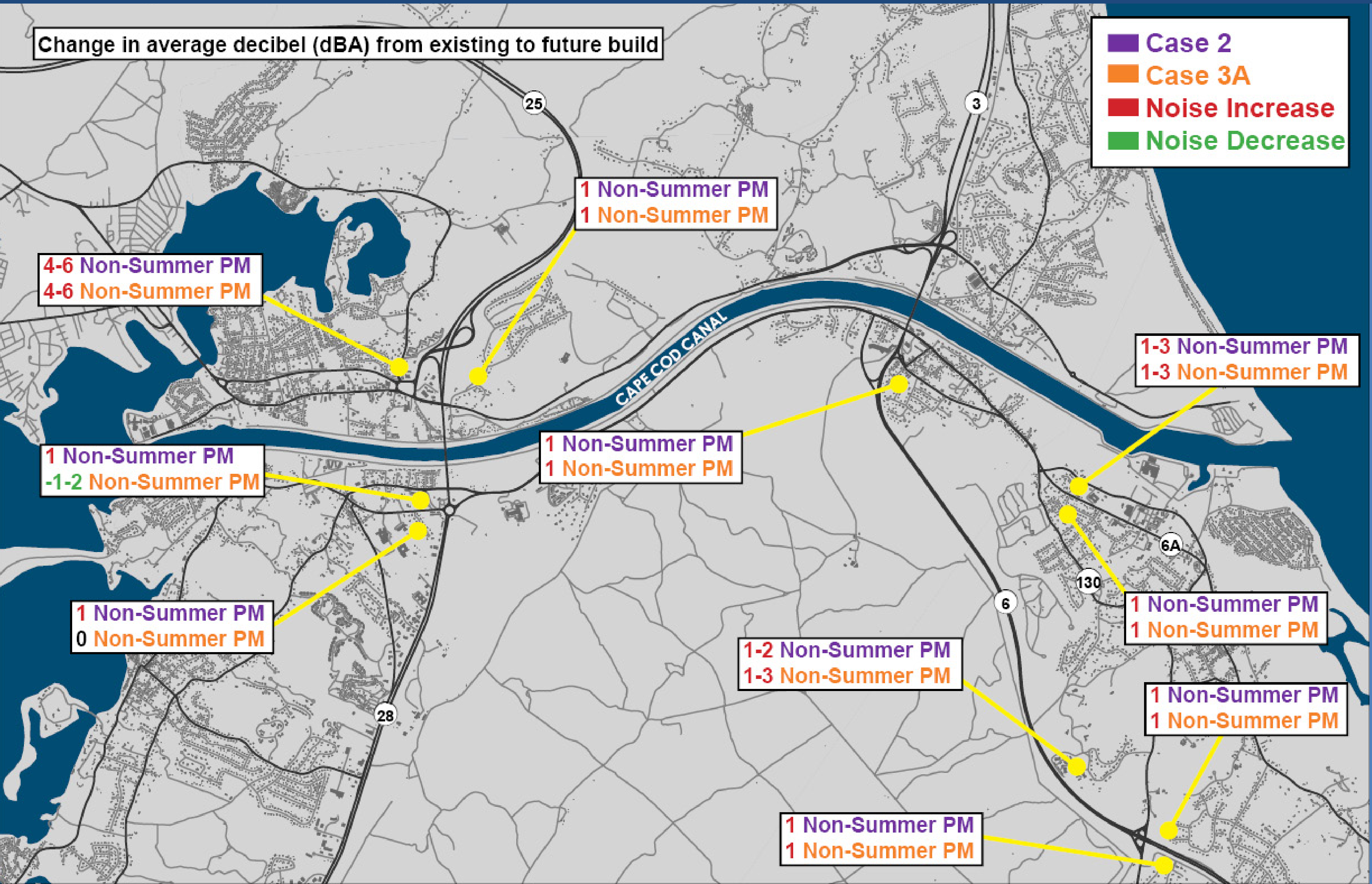
Preliminary Highway Noise Analysis – Methodology.

- 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.



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.

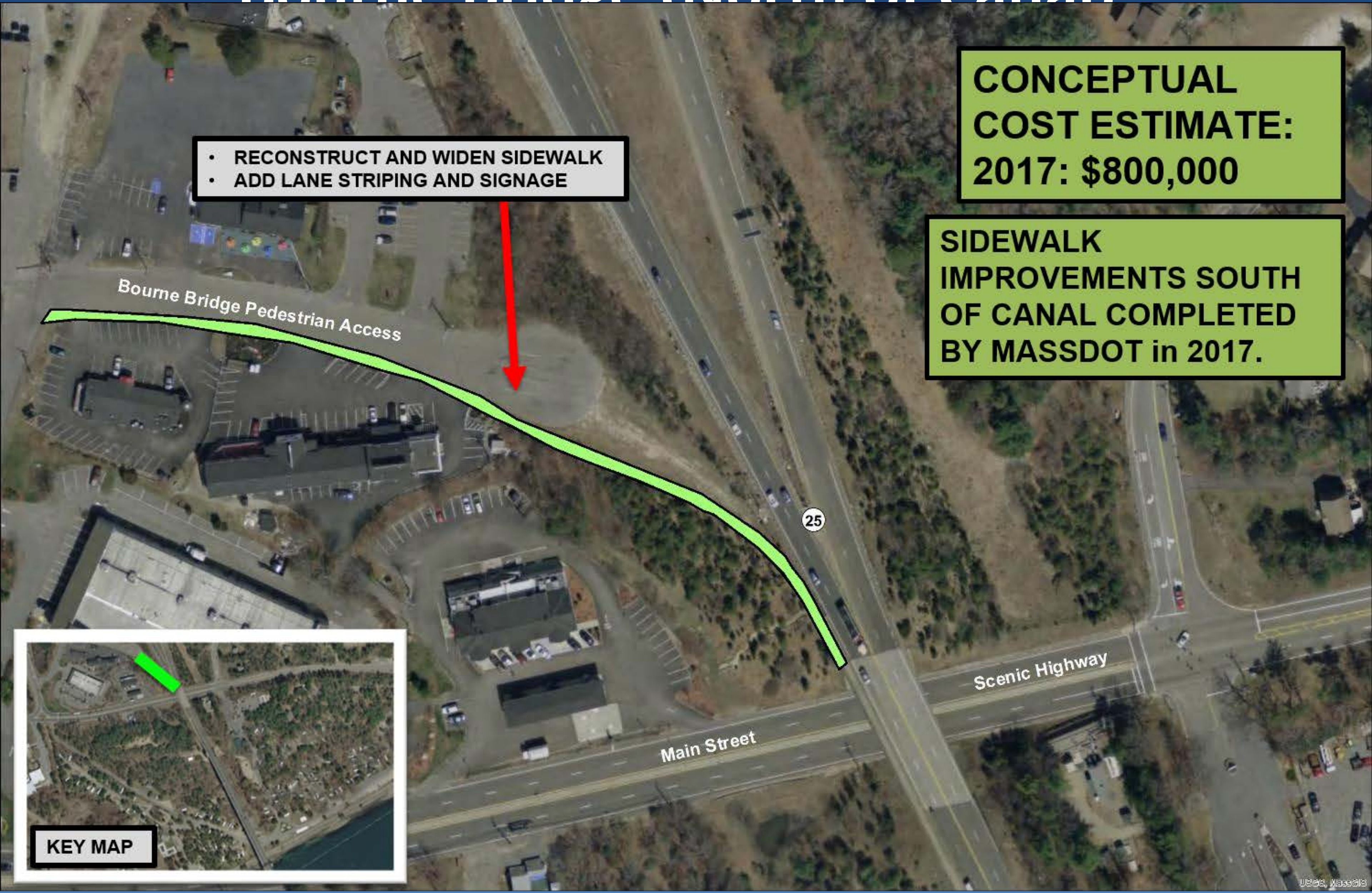
- Old Bridge Road – Bourne.
- Pleasant Street – Bourne.
- Bourne Ball Field- Bourne.

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

Accessible Trail Connection

Bicycle/Pedestrian Access: Sagamore Bridge Approaches & Adams Street Complete Street Improvements

Bicycle/Pedestrian Access: Bourne Bridge (North of Canal)



Conceptual Cost Estimates, Short-Term – Geometric Intersections Improvements.

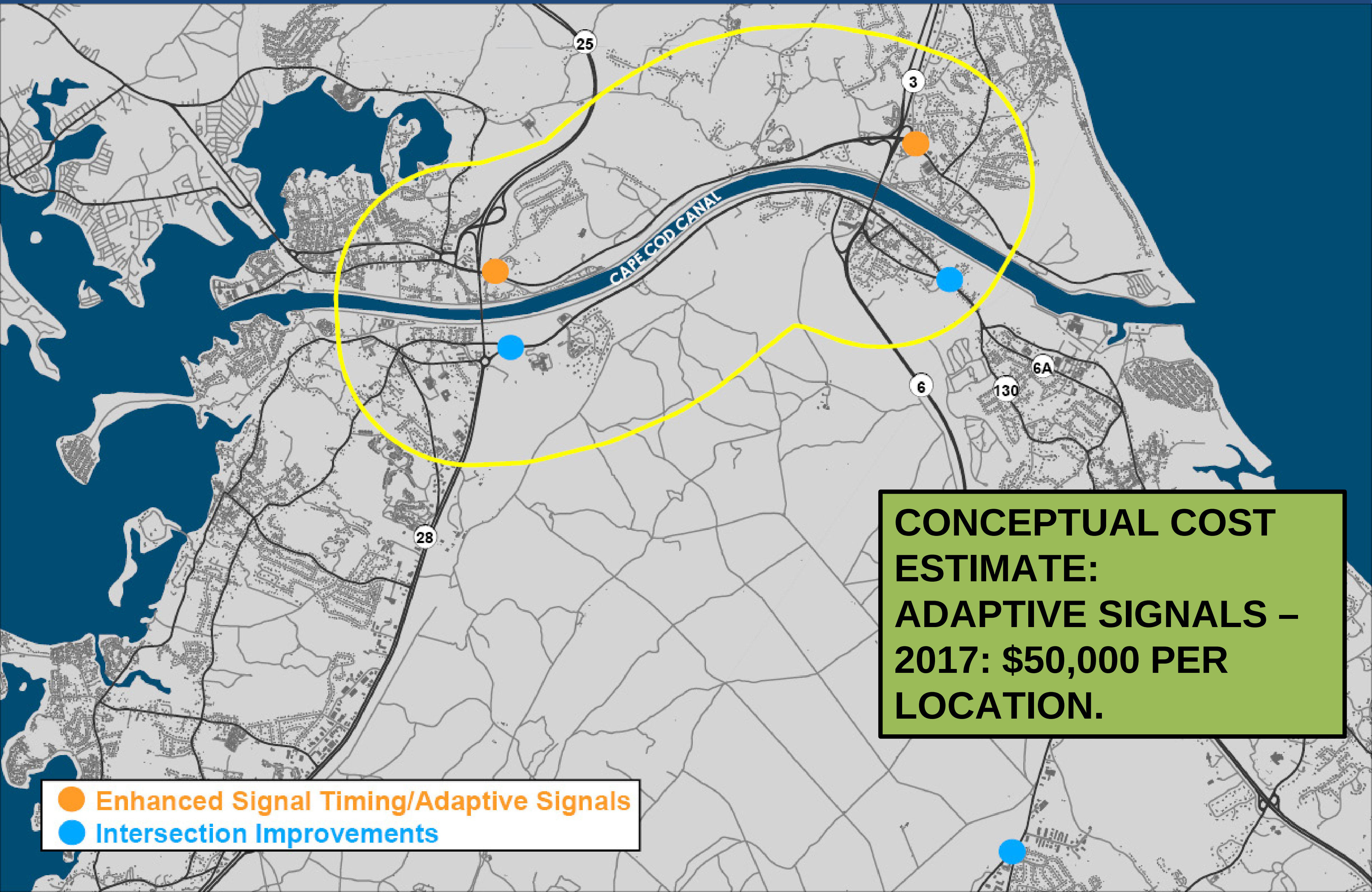
<u>Enhanced Signal Timing / Adaptive Signals.</u>

- Scenic Hwy/Canal Road/State Road, Bourne.
- Nightingale Road/Scenic Hwy, Bourne.

<u>Improved Intersection Geometry</u>

- 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.

Route 6A at Cranberry Highway/ Sandwich Road, Bourne

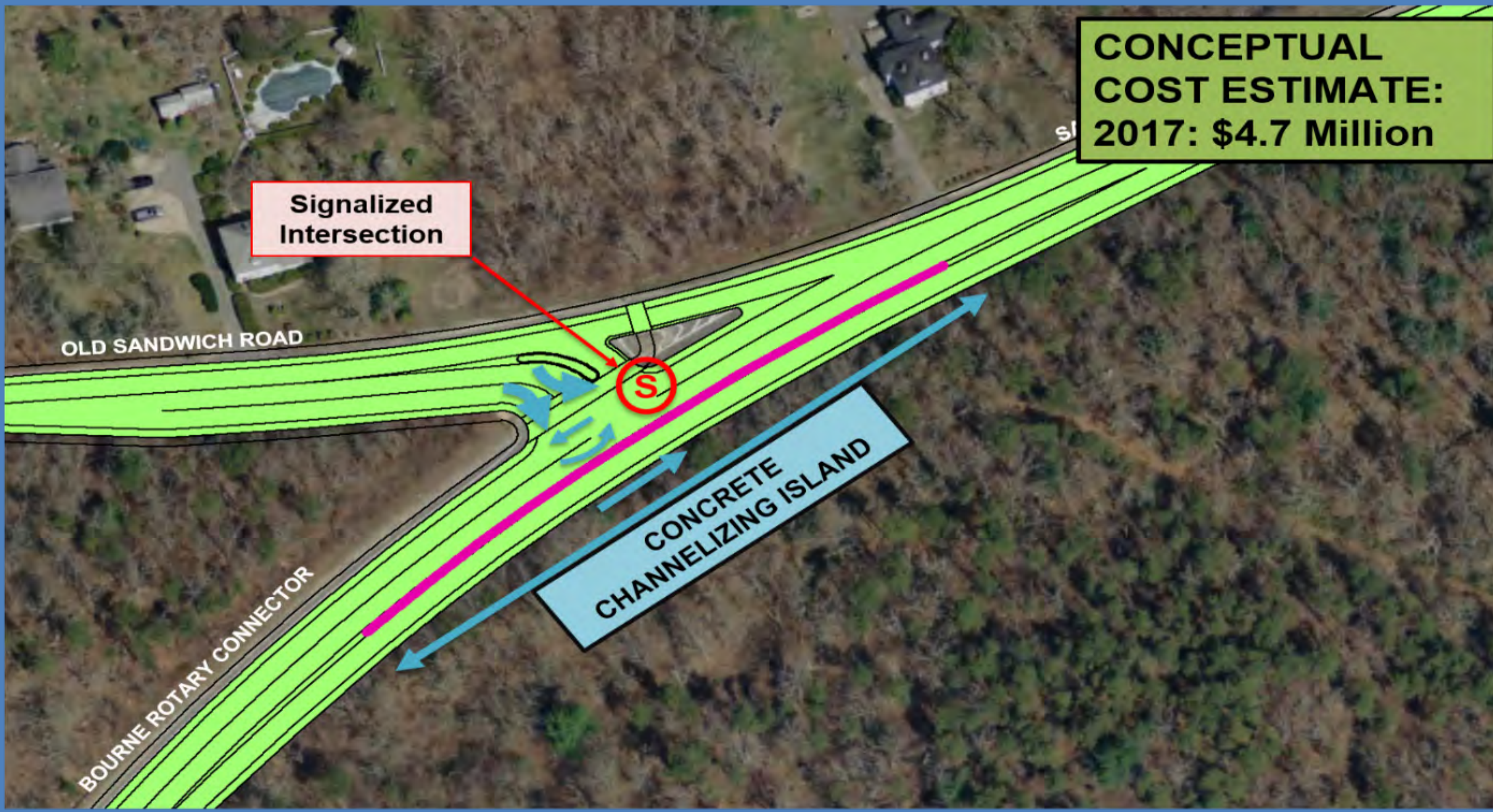
Proposed: Add exclusive left-turn lanes on westbound approach.
ADA-compliant sidewalks and crosswalk on all approaches.

Route 130 at Cotuit Road, Sandwich

<u>Proposed:</u> Signalized Intersection.

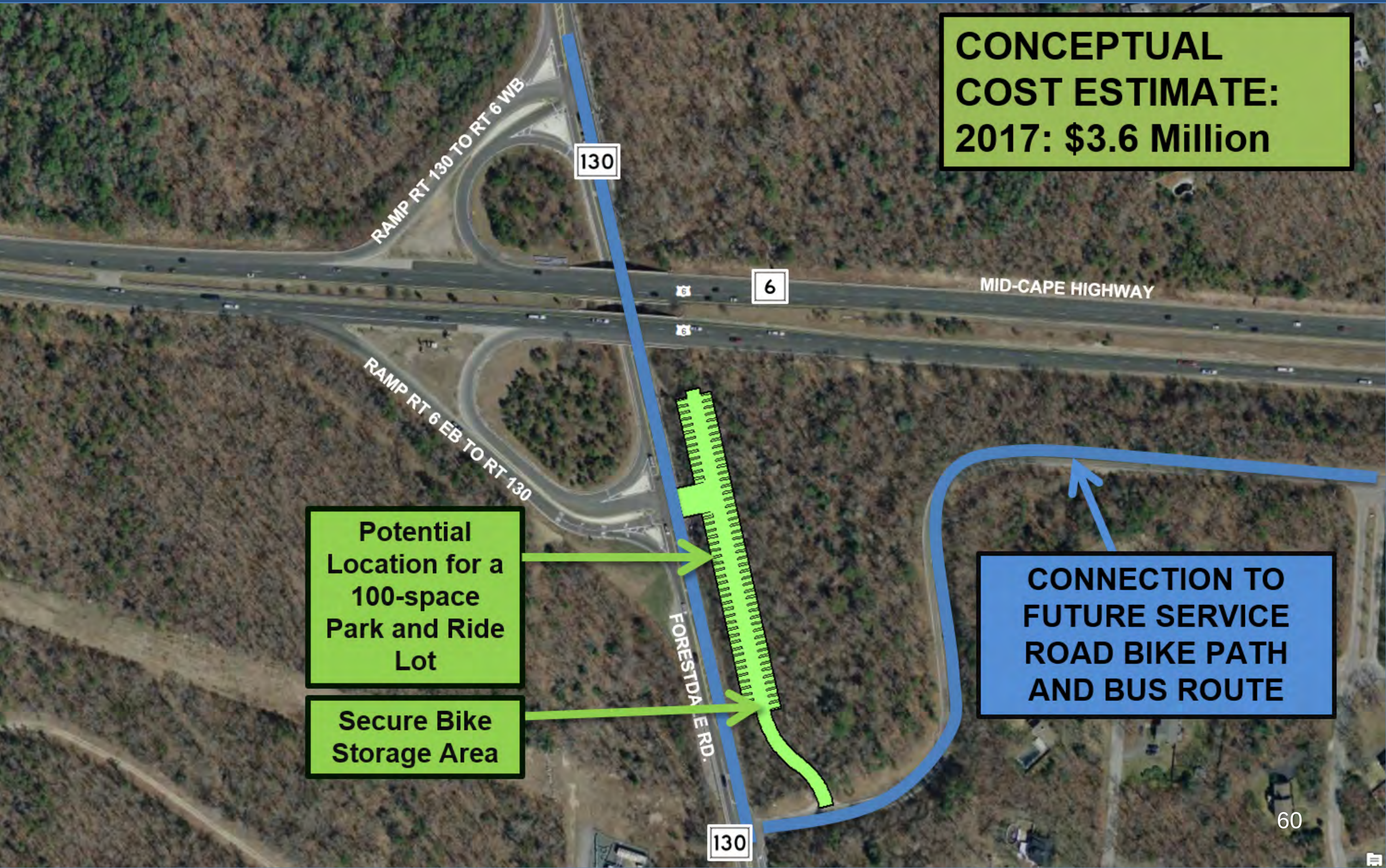
ADA-compliant sidewalks and crosswalk on all approaches.

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.

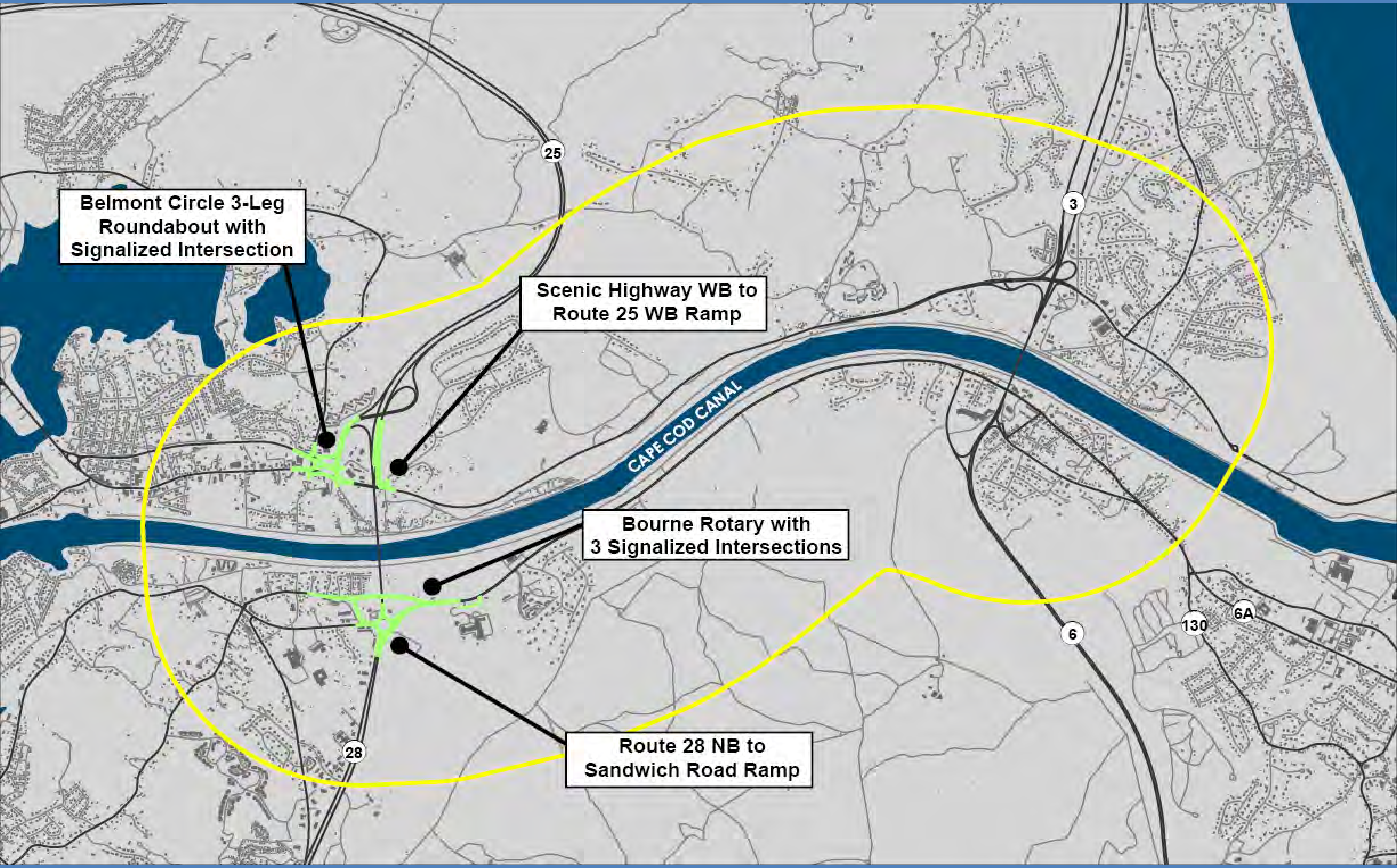
Conceptual Cost Estimate– Multi-Modal Center Route 6 at Route 130 Park & Ride Lot.



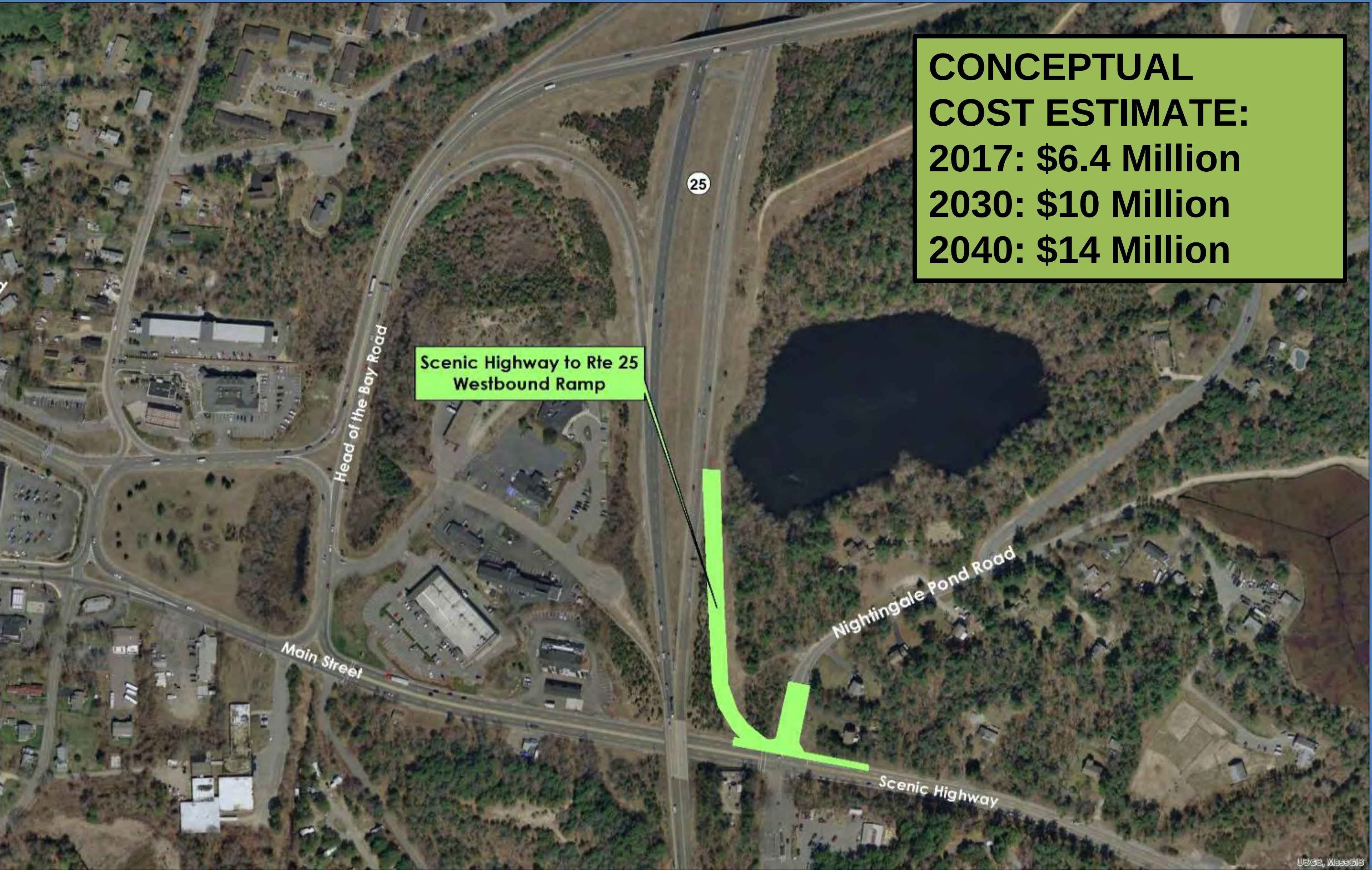
Conceptual Cost Estimates Mid-Term Roadway.

- 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.



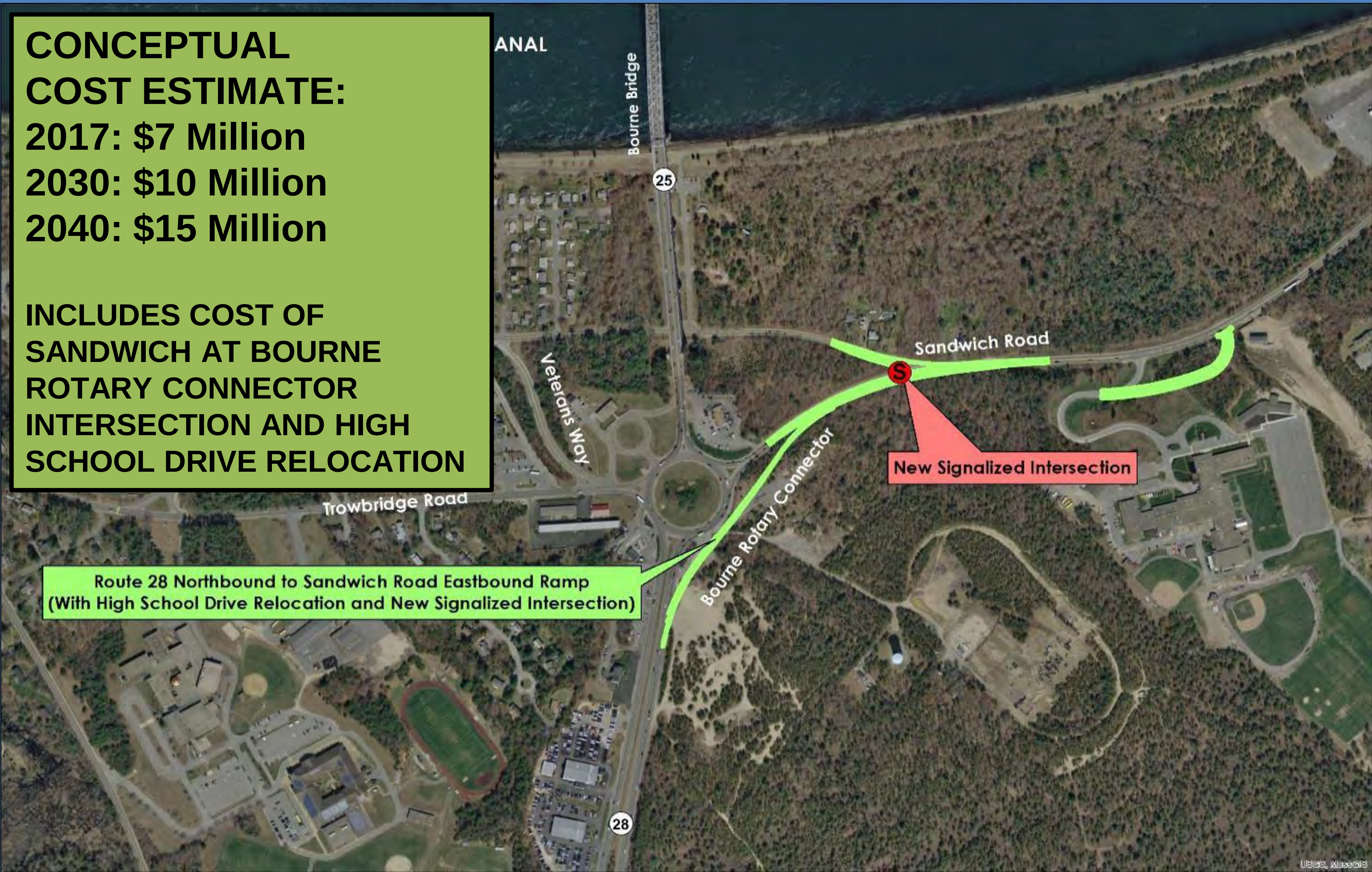
Scenic Highway Westbound to Route 25 Westbound Ramp.



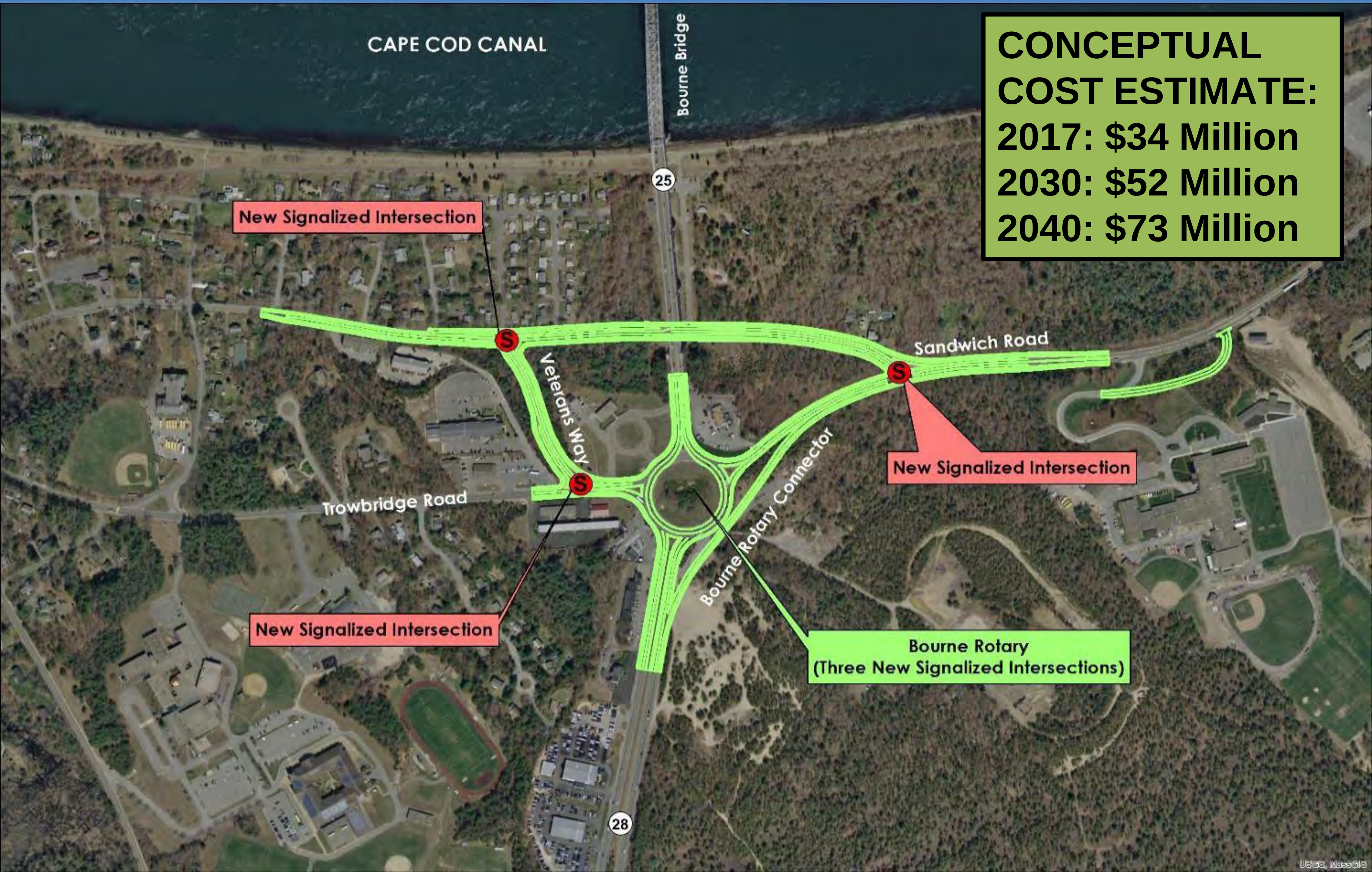
Route 28 Northbound to Sandwich Road Eastbound Ramp.

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

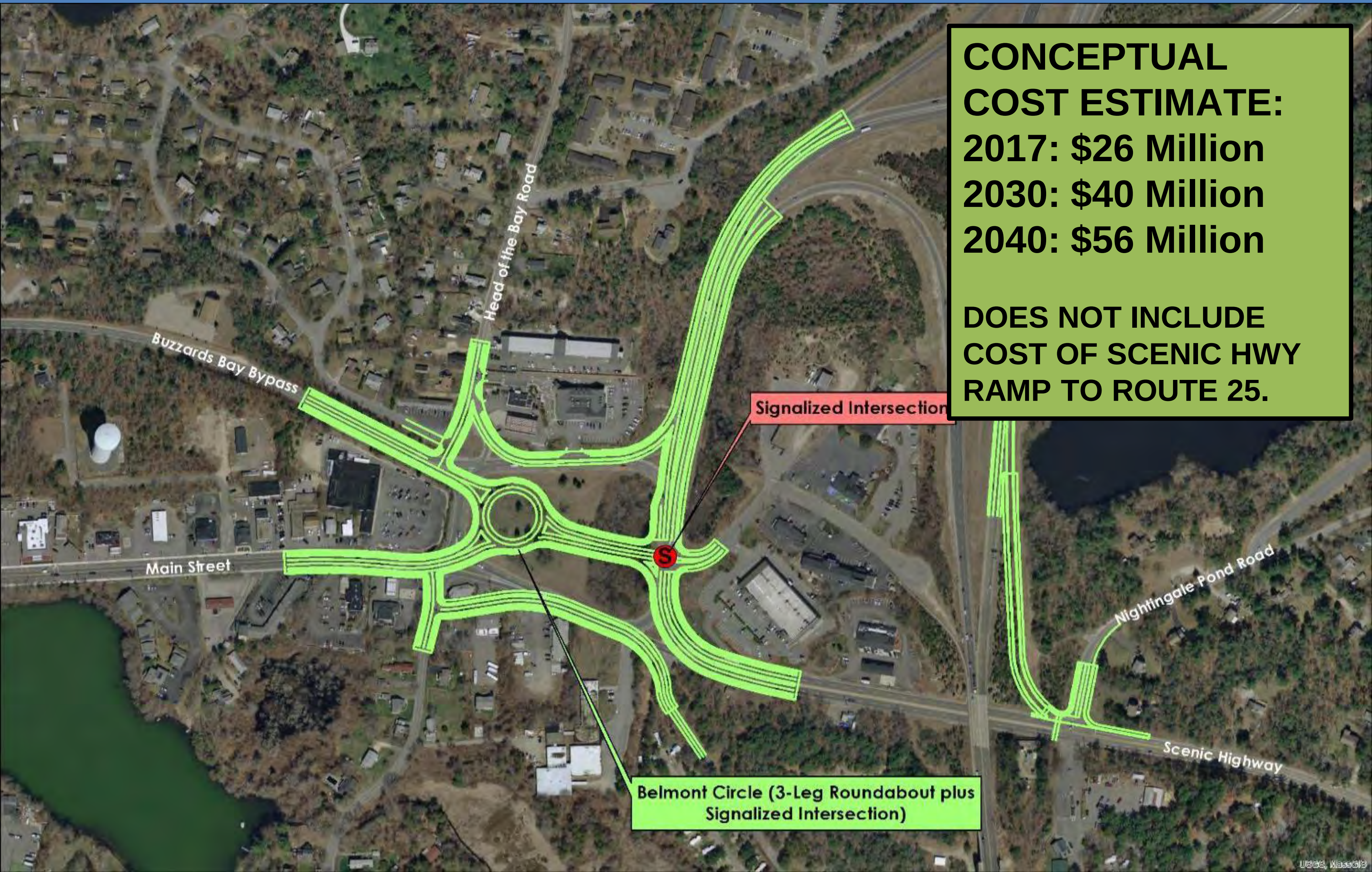
INCLUDES COST OF SANDWICH AT BOURNE ROTARY CONNECTOR INTERSECTION AND HIGH SCHOOL DRIVE RELOCATION



Bourne Rotary Reconstruction (3 Signalized Intersections).



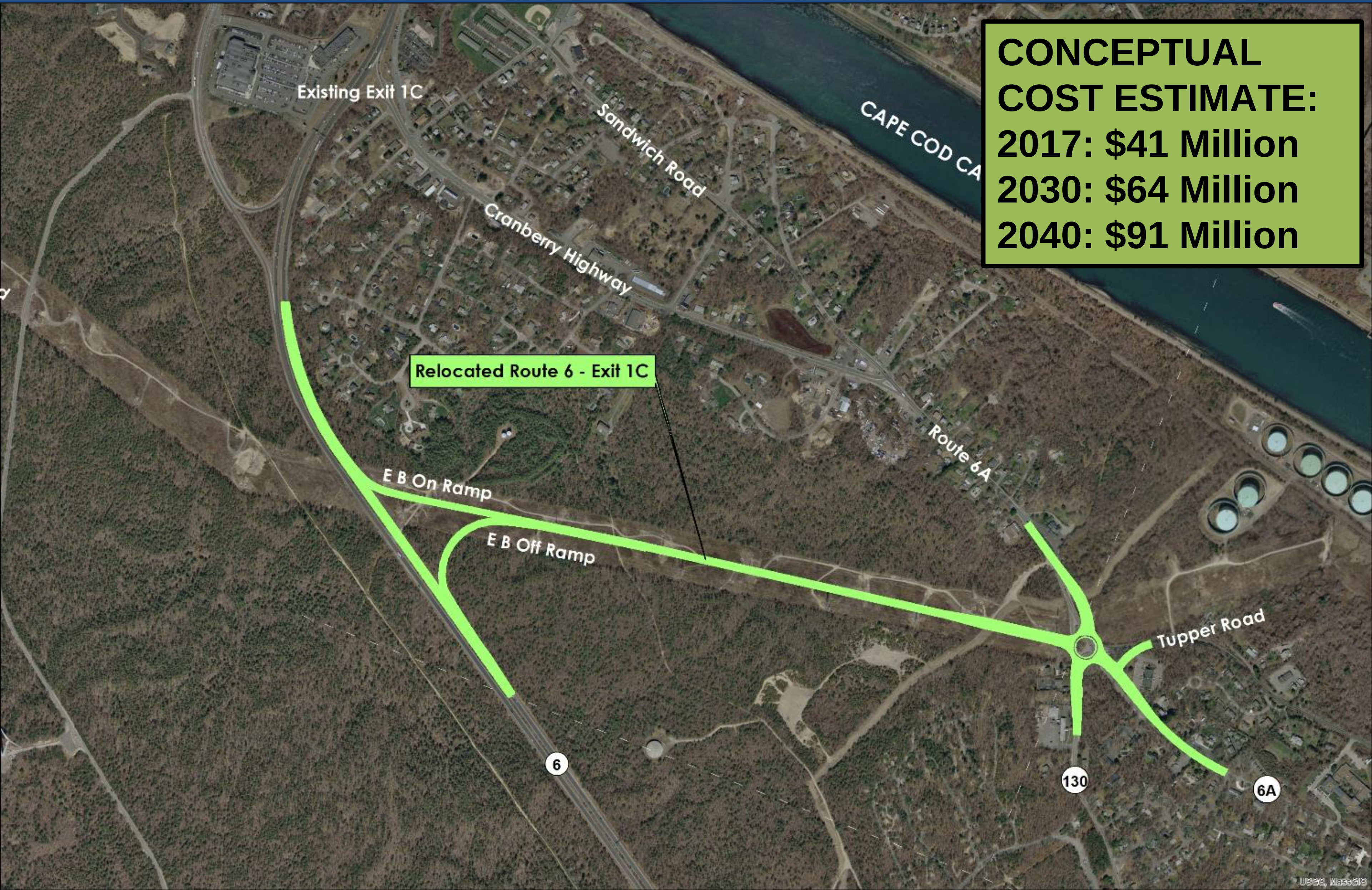
Belmont Circle Reconstruction (3-Leg Roundabout with Signalized Intersection).



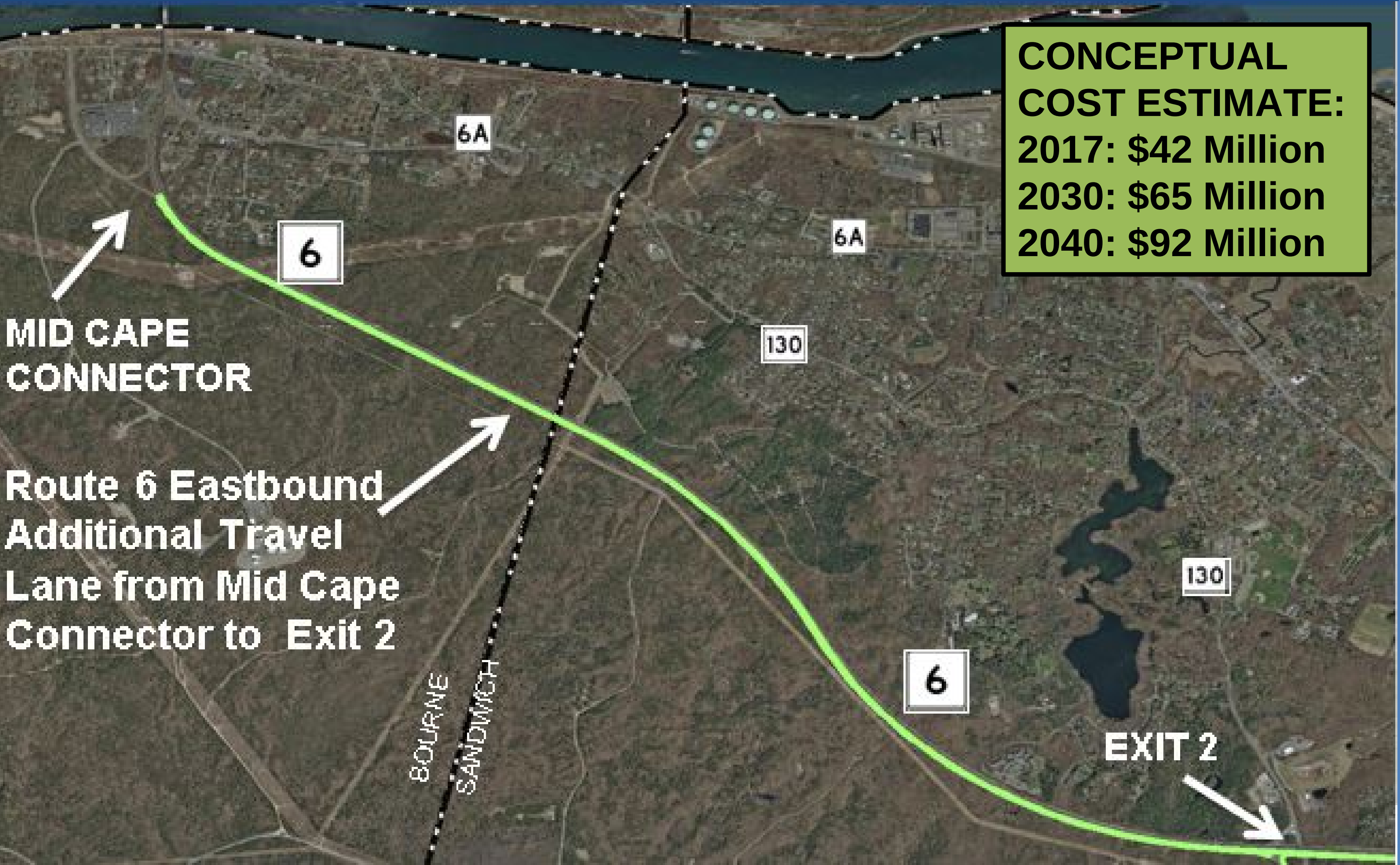
CONCEPTUAL COST ESTIMATE:
2017: $26 Million
2030: $40 Million
2040: $56 Million

DOES NOT INCLUDE COST OF SCENIC HWY RAMP TO ROUTE 25.

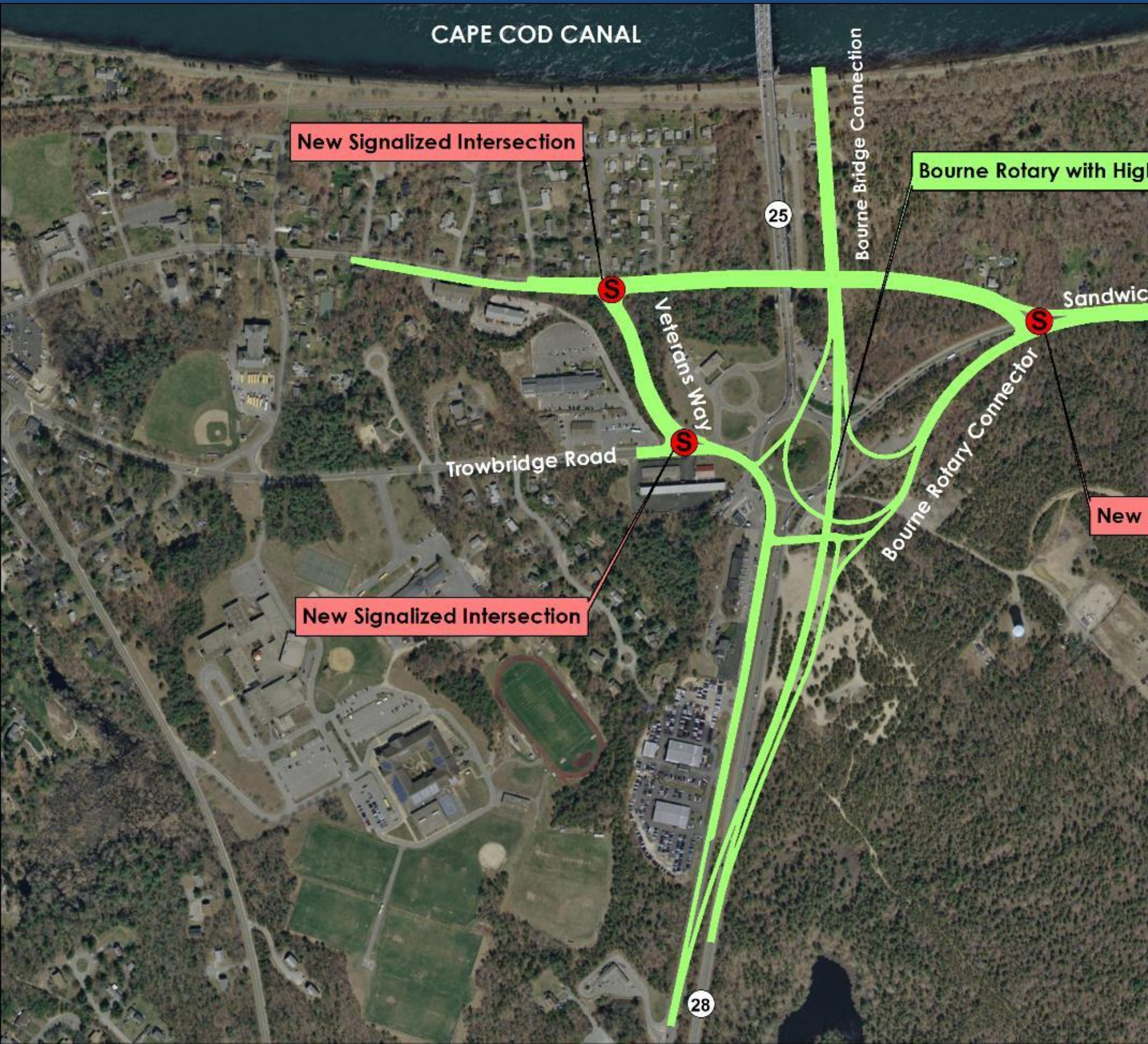
Route 6 Exit 1C Relocation.



Route 6 – Additional Eastbound Lane Sagamore Bridge to Exit 2.



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.

Cost Estimates ($ in millions)			
Alternatives	2017	2030	2040
Scenic Highway to Route 25 WB Ramp	$6	$10	$14
Route 6 Exit 1C Relocation	$41	$64	$91
Rte 28 NB to Sandwich Road Ramp	$7	$10	$15
Bourne Rotary Reconstruction	$34	$52	$73
Belmont Circle Reconstruction	$26	$40	$56
Belmont Circle Reconstruction with Rte 25 Fly-over to Scenic Highway	$36	$56	$80
Route 6 EB Travel Lane	$42	$65	$92
Bourne Rotary Interchange	$87	$136	$191

Summary of Conceptual Cost Estimates by Case.

Cost Estimates by Case ($ in millions)			
Cases	2017	2030	2040
Case 1	$47	$74	$105
Case 1A	$13	$20	$29
Case 1B	$40	$63	$88
Case 2	$107	$166	$234
Case 2B	$117	$183	$258
Case 3	$149	$231	$326
Case 3A	$202	$315	$444

Matrix of Benefits and Impacts of each TDM Case.

Matrix of Benefits and Impacts of Cases.

	Alternatives Traffic Operations Evaluation Matrix Legend		
	Minor	Moderate	Substantial
Benefits	○	◒	●
Impacts	○	◒	●
Neutral (no impact or resource not present)	◇		

Matrix of Case Analysis – Benefit/Impact Definitions.

Category		Benefit Levels		
		○	◒	●
Safety	Emergency Vehicle Response Time	Minor or No Benefit	Modest Benefit	Substantial Improvement
Bicycle/Pedestrian (facilities or access)		Minor or No Benefit	Modest Benefit	Substantial Improvement

Category	Impact Levels		
	○	◒	●
Wetlands	Minor or No Impact	> 5,000 SF of wetlands	> 1 acre of Wetlands
Rare Species	Minor or No Impact	> 1 acre of work in rare species habitat	Requires a Conservation Management Permit
Area of Critical Environmental Concern (ACEC)	Minor or No Impact	Impacts land within ACEC	Impacts wetlands within ACEC
100-Year Floodplain	Minor or No Impact	Moderate fill within 100-year floodplain	Substantial fill within 100-year floodplain
Water Supply Protection Areas	Minor or No Impact	Impact to land in DEP IWPA or Zone II	Impact to land in DEP Zone I or ORW
Air Quality/Public Health	Minor or No Impact	Modest reductions in idle time/queueing	Substantial reductions in idle time/queueing
Open Space	Minor or No Impact	Acquisition of open space land	Acquisition of open space affecting recreational facilities
Historic Resources	Minor or No Impact	Impacts historic parcel or historic district	Adverse Effect on historic property
Land Use/Economic Development	Minor or No Impact	Modest impact to residential or commercial property	Substantial impact to residential or commercial property

Matrix of Case Analysis – Future No-Build & Case 1.

Category			2040 Future No Build		Case 1	
			Rating	Data	Rating	Data/% change from 2040 No-Build
Traffic	Vehicle Hours Traveled	Summer Sat			◒	82,125
		Fall PM				
	Average Delay (min.)	Summer Sat	●	7.0	○	6.5
		Fall PM	◒	3.4	◒	2.5
	Travel Time (min.)	Summer Sat				
		Fall PM				
Category						
Safety	Emerg. Response Time				○	
Bike / Ped	Safety/ New Facilities				◇	
Environmental	Wetlands				○	0.0
	Rare Species				●	7.2 Acres
	100-year Floodplain				◇	0.0
	Water Supply (Zone I/II, IWPA)				◒	5.9
Community	Open Space				◒	0.6
	Historic Resources				◇	0.0
Property Impacts	Residential				○	0.2
	Commercial				◇	0.9
	Utility				◒	4.7
Economic Impact					◒	
Cost ($ millions)						74

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.

	2016			2017												2018			
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
TASK 3 Alternatives Development																			
Working Group Meeting																			
Public Meeting			♦																
TASK 4 Alternatives Analysis																			
Mobility/Accessibility Analysis																			
Safety Analysis																			
Environmental Effects Analysis																			
Land Use/Economic Development																			
Community Effects/TitleVI/EJ																			
Cost Analysis																			
Working Group Meeting				♦						♦					♦				
Public Meeting																			
TASK 5 Recommendations																			
Draft report																			
Working Group Meeting																	♦(2)		
Public Meeting																		♦	
TASK 6 Final Report																			

Questions?

Comments and feedback can be emailed to:
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End of Presentation.