EAST-WEST PASSENGER RAIL STUDY

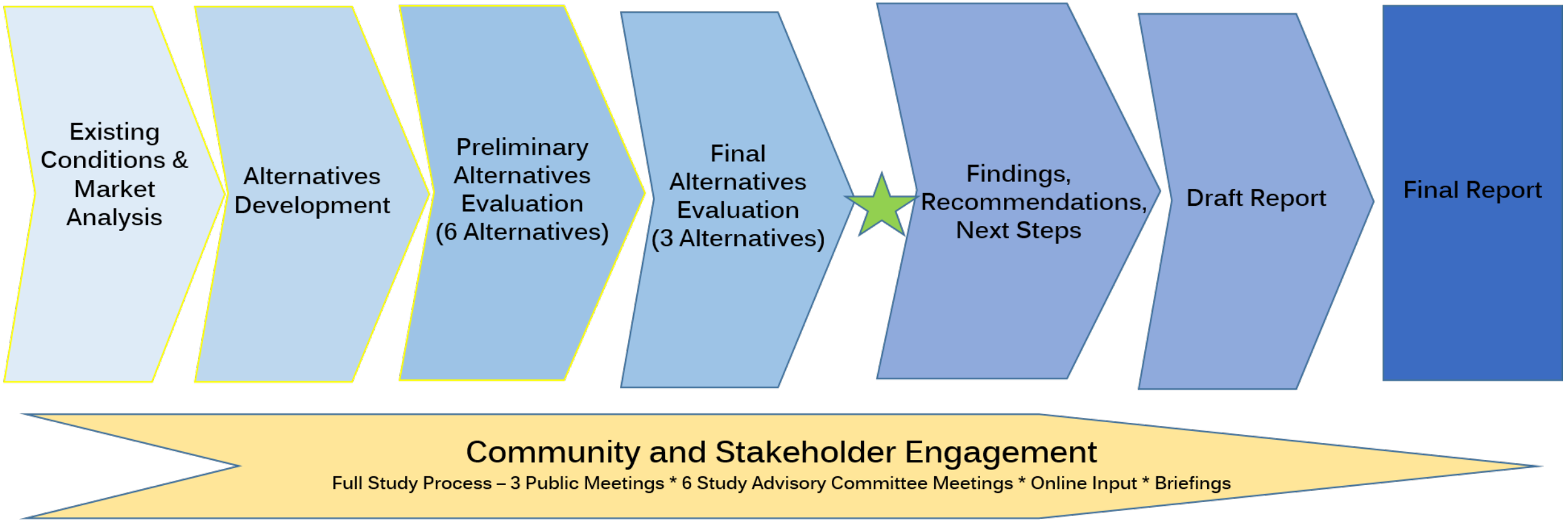
Advisory Committee Meeting #6

September 30, 2020

Meeting Agenda

- Review of Study Process and Next Steps
- Review of 3 Final Alternatives Selection
- Alternatives Evaluation
  - Service Performance
  - Costs
  - Environmental and Community Impacts
  - Benefit-Cost Analysis
- Advisory Committee Discussion
- Next Steps

Study Process and Next Steps



We Are Here

Upon completion of the East-West Passenger Rail Study, what next steps would you recommend?

Study Alternatives

- Are there any alternatives that you would prioritize or deprioritize?
- What phasing approaches, if any, should be considered?

Potential items for further analysis to consider

- Examples: indirect economic benefits, impacts to freight service, electrification of the alternatives, life-cycle cost analysis, disposition/condition of CSX infrastructure

Potential operational items to consider

- Safety issues associated with grade crossings
- Discussions with CSX

Governance and funding items to consider

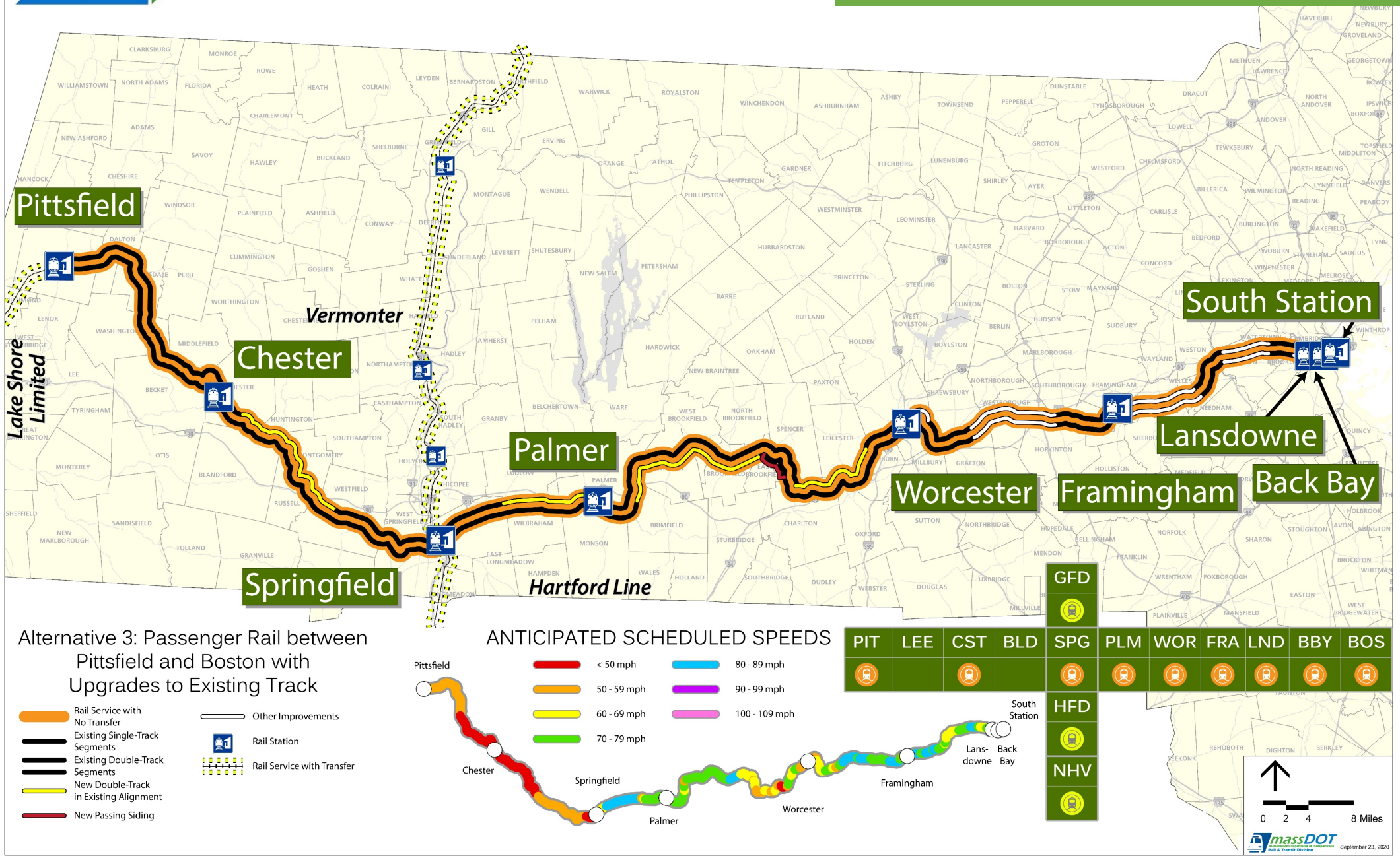
- Proposed operating entity (e.g., Amtrak or other railroad)
- Legislative actions that may be required
- Funding sources (including federal funding under new proposed legislation)

The Following 3 Alternatives Were Selected for Final Analysis:

Corridor Type	Shared Corridor – Existing Alignment	Shared Corridor – New Separate Track Alignment	
Alternative	**Alternative 3**	**Alternative 4**	**Alternative 4/5 Hybrid**
Rail Service	PIT – BOS	PIT – BOS	PIT – BOS
Intermediate Stops	Chester and Palmer	Chester and Palmer	Chester and Palmer
Infrastructure and Improvements	Double-tracking of single-track segments for full corridor	New railroad line mostly within CSX property, double-track between Pittsfield and Springfield	New railroad line mostly within CSX property, double-track between Pittsfield and Springfield
	Improvements to railroad, signals, control – increased maximum allowable speed	Newly built railroad infrastructure (SPG – WOR) and lack of freight conflict enables increased maximum allowable speed	Realignments to straighten curves, reduce travel time between Springfield and Worcester

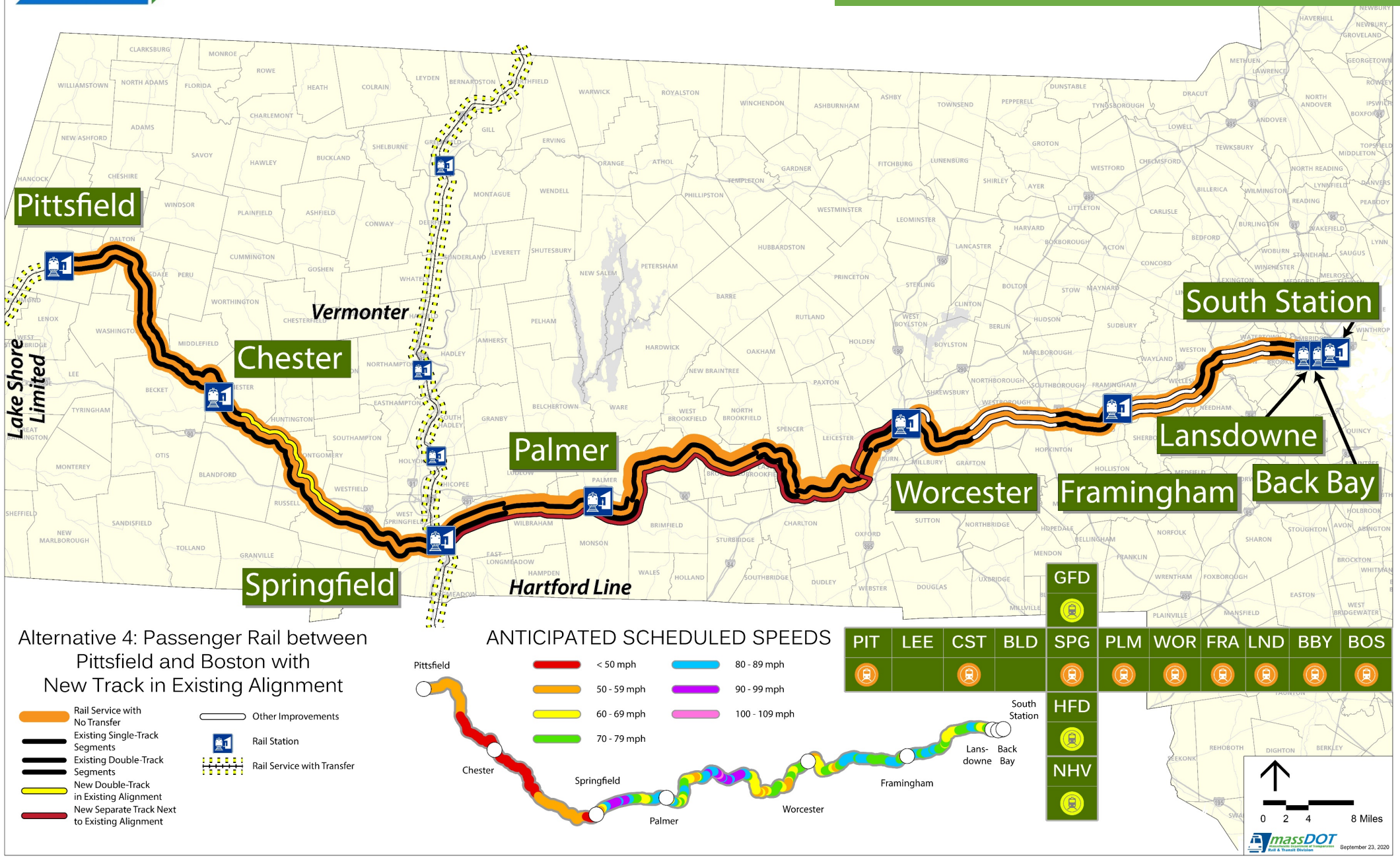
Review of 3 Final Alternatives Selection

EAST-WEST PASSENGER RAIL STUDY



Review of 3 Final Alternatives Selection

EAST-WEST PASSENGER RAIL STUDY



Review of 3 Final Alternatives Selection

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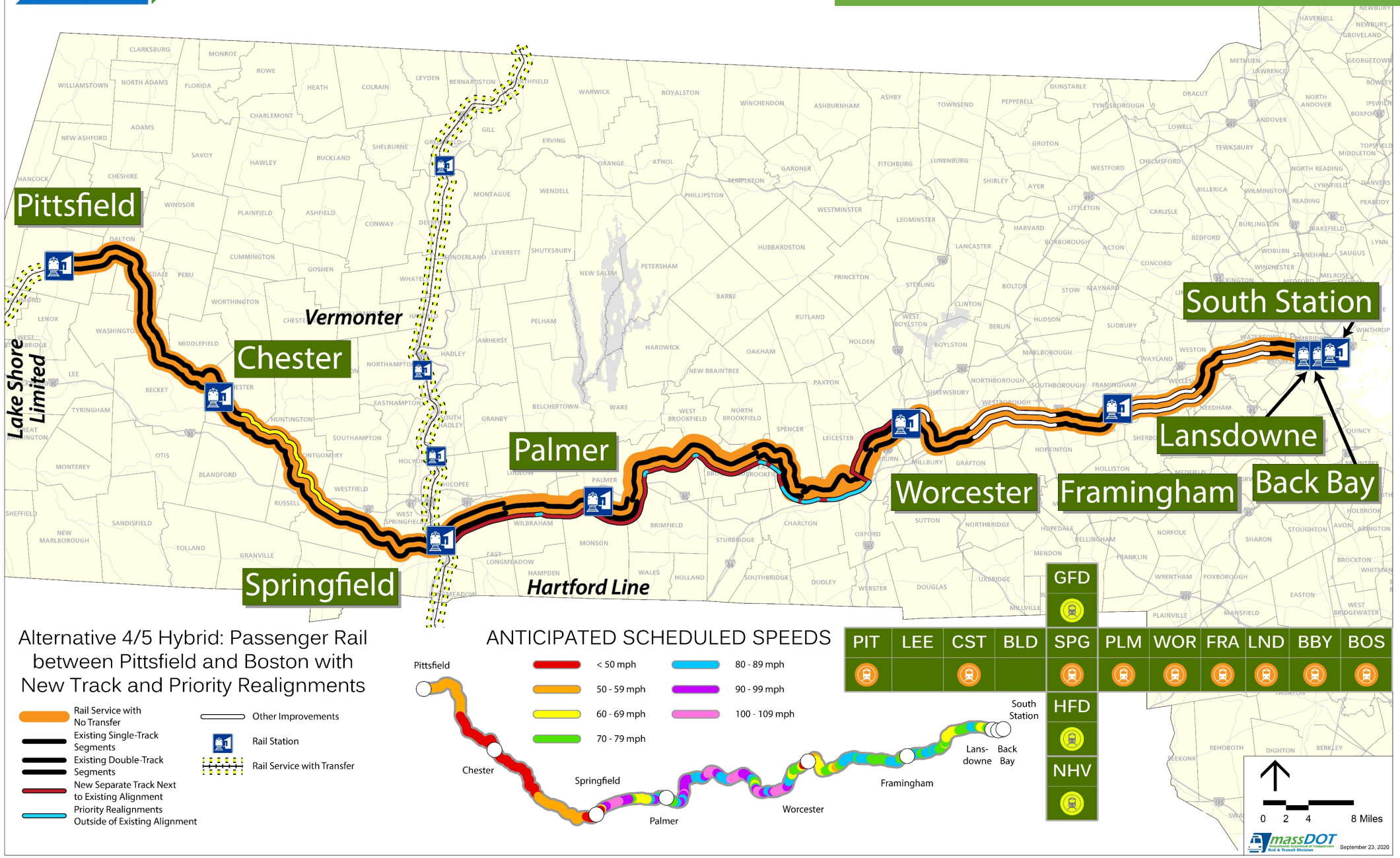
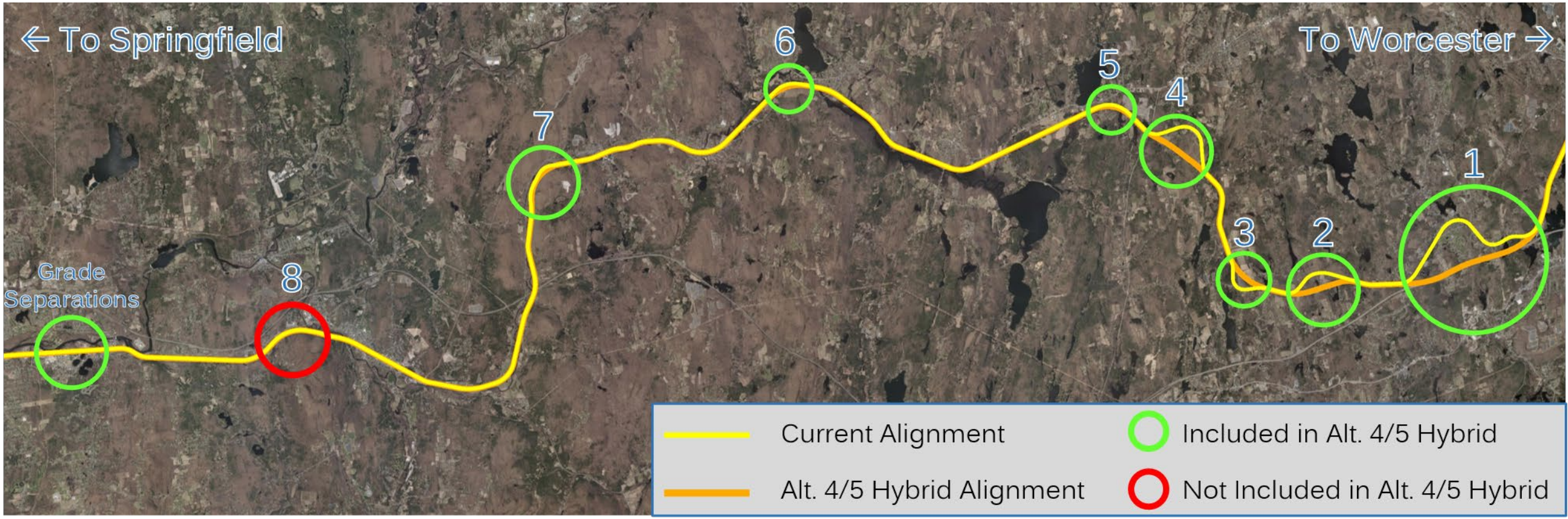


Alternative 4/5: Rail Corridor Realignments

Segment	Location	Length Reduction (miles)	Travel Time Savings (min:sec)	Net Cost ($M)	Rate ($M/min.)
Shortcut 1	Auburn, Oxford, Charlton	0.64	03:58	$199	$50
Shortcut 2	Charlton	0.14	00:13	$61	$269
Shortcut 3	Charlton	0.24	01:32	$86	$56
Shortcut 4	Spencer	0.47	01:35	$330	$209
Shortcut 5	East Brookfield	0.04	00:28	$52	$110
Shortcut 6	West Brookfield	0.04	00:28	$6	$12
Shortcut 7	Warren	0.05	01:14	$5	$4
Shortcut 8	Monson (not feasible*)	NA	NA	NA	NA
Grade Separate Crossings	Wilbraham (Consolidate 3 crossings into 2 overhead bridges)	0.00	00:52	$27	$30

* The realignment in Monson is classified as “not feasible” because while the track could be realigned, doing so would not offer benefit because an adjacent curve (that cannot be straightened) prevents the trains from going any faster through that segment.

Alternative 4/5: Rail Corridor Realignments



- The following slides will evaluate the three final alternatives based on service performance, cost, environmental and community impacts, and the Benefit-Cost Analysis

Key Findings – Overall

- Ridership forecasts range from 922 to 1,554 daily boardings (278K to 469K annual boardings)
- Conceptual capital costs range from $2.4 to $4.6 billion
- Interaction between passenger and freight trains is higher in the Pittsfield to Springfield segment
  - Due to sharing the double-track, higher level of freight volumes west of Springfield, and lower speeds because of steep grades
- Differences in improvements, costs, and travel time are all attributable to the Springfield–Worcester segment

Evaluation Criteria for the 3 Final Alternatives

- Service Performance
  - Travel time
  - Frequency
  - Station stops
  - Ridership
- Costs
  - Capital
  - Operations and Maintenance
- Environmental and Community Impacts
  - Wetlands, Article 97 Lands, Areas of Critical Environmental Concern, Existing Buildings and Structures, Non-Rail/ROW Land, At-Grade Crossings, Grade Separations
- Benefit-Cost Analysis

Frequency, Travel Time, and Speed

Corridor Type	Shared Corridor – Existing Alignment	Shared Corridor – New Separate Track Alignment	
Alternative	3 – BOS-PIT, Double-Track + Rail and Equipment Upgrades	4 – BOS-PIT, New Track	4/5 Hybrid – BOS-PIT, New Track + Realignment
Weekday Round-Trips	*up to 7*	*up to 9*	*up to 9*
Average Travel Time			
WOR – BOS	0:53	0:53	0:53
SPG – WOR	1:04	0:54	0:44
PIT – SPG	1:12	1:12	1:12
Total Average Travel Time			
SPG – BOS	1:57	1:47	1:37
PIT – BOS	3:09	2:59	2:49
Max. Operating Speed (mph)			
WOR – BOS	85	85	85
SPG – WOR	85	100	105
PIT – SPG	65	65	65
Average Speed (mph)			
WOR – BOS	50	50	50
SPG – WOR	51	60	74
PIT – SPG	44	44	44

Note: Service frequencies are approximate and subject to change due to layovers and operational needs

Ridership: 2040 Daily Boardings

Corridor Type	Shared Corridor – Existing Alignment		Shared Corridor – New Separate Track Alignment			
Alternative	3 – BOS-PIT, Double-Track + Rail and Equipment Upgrades		4 – BOS-PIT, New Track		4/5 Hybrid – BOS-PIT, New Track + Realignment	
Weekday Round-Trips	*7*		*9*		*9*	
Forecast Scenario Proxy	'Enhanced' Hartford Line	Downeaster	'Enhanced' Hartford Line	Downeaster	'Enhanced' Hartford Line	Downeaster
Station Boardings						
BOS + BBY + LAN	389	449	496	535	560	610
FRA (LSL)	5	2	5	1	6	3
WOR (Direct Access)	64	117	77	131	84	143
WOR (MBTA Transfers)	21	31	24	32	27	38
PLM	16	22	20	24	22	26
SPG (Direct Access)	350	387	449	466	505	528
SPG (HL Transfers)	34	74	35	70	37	78
CHS	5	14	6	16	6	17
PIT	38	92	45	104	49	111
TOTAL	**922**	**1,188**	**1,157**	**1,379**	**1,296**	**1,554**

Note: Forecasts represent likely ridership assumptions given available data and tools

Ridership: 2040 Annual Boardings

Corridor Type	Shared Corridor – Existing Alignment		Shared Corridor – New Separate Track Alignment			
Alternative	3 – BOS-PIT, Double-Track + Rail and Equipment Upgrades		4 – BOS-PIT, New Track		4/5 Hybrid – BOS-PIT, New Track + Realignment	
Weekday Round-Trips	*7*		*9*		*9*	
Forecast Scenario Proxy	'Enhanced' Hartford Line	Downeaster	'Enhanced' Hartford Line	Downeaster	'Enhanced' Hartford Line	Downeaster
Station Boardings						
BOS + BBY + LAN	117,350	135,550	149,700	161,500	169,200	184,100
FRA (LSL)	1,550	650	1,550	450	1,750	800
WOR (Direct Access)	19,300	35,250	23,250	39,500	25,500	43,250
WOR (MBTA Transfers)	6,400	9,450	7,250	9,550	8,100	11,350
PLM	4,950	6,550	6,050	7,100	6,500	8,000
SPG (Direct Access)	105,700	116,750	135,700	140,600	152,400	159,500
SPG (HL Transfers)	10,250	22,200	10,500	21,150	11,250	23,600
CHS	1,400	4,200	1,700	4,700	1,850	5,000
PIT	11,400	27,650	13,650	31,500	14,650	33,400
TOTAL	**278,300**	**358,250**	**349,350**	**416,050**	**391,200**	**469,000**

Note: Forecasts represent likely ridership assumptions given available data and tools

Key Findings – Costing

- Alternatives 4 and the Alternative 4/5 Hybrid provide separated track between Springfield and Worcester to comply with CSX guidance
  - This results in a capital cost increase of approximately $1.5 billion
- The proposed improvements/cost estimates in the Pittsfield to Springfield and Worcester to Boston segments are the same for all 3 Final Alternatives
- The cost difference between Alternative 4 and the Alternative 4/5 Hybrid primarily relates to track realignments that reduce travel time by approximately 10 minutes
- At this conceptual stage of planning, the standard contingencies added to cost estimates to account for unknowns (e.g., condition of CSX assets, condition of utilities) constitute 23% of the total capital cost for each alternative

Conceptual Cost Estimates – Refined for Final Alternatives

- Followed federal guidelines for cost estimation – Federal Railroad Administration (FRA) 2016 rail estimation guidance
- “Quantities” (i.e. amount of demolition, construction, tracks, support facilities, etc.) developed based on GIS-based rail alignments and alternatives development
- Unit costs based on actual expenditures on recent construction projects in Massachusetts and New England
- Adherence to CSX guidance for physical separation of freight and passenger services also impacts cost estimates

Cost Estimates - CSX Policies and Study Assumptions

- **Under federal law, Amtrak has the right to provide passenger service on freight-owned lines, but the host railroad (CSX) sets the terms for an operating agreement**

- For passenger service operating at 90 mph or lower, CSX allows shared operation of freight and passenger service
  - Pittsfield to Springfield & Worcester to Boston
    - Operating speed = 65 mph, shared corridor/track for 40+ mile segments

- For passenger service operating in excess of 90 mph, CSX requires operation on separate track with 30 foot spacing from existing freight rail
  - Springfield to Worcester
    - Alternative 3: operating speed = 85 mph, shared corridor/track for 50+ mile segment
    - Alternatives 4 & 4/5 Hybrid: operating speed = 100 & 105 mph, separate track is consistent w/ CSX standards, costs approximately $1.5 billion

What is Included in the Capital Cost Estimates?

Construction Cost

- Includes rail, bridges, stations, support facilities (storage and maintenance), site work, utilities, environmental mitigation, signals, safety systems, fare collection, etc.
- Adheres to CSX guidance for physical separation along a shared corridor, leading to higher costs than NNEIRI
  - Bridge reconstruction, not rehabilitation
  - Relocation of associated track and utilities

35% Contingency

- Mitigates Unknowns
  - Added to construction-only cost
  - Accounts for uncertainties in conceptual planning phase
  - Percentage decreases over course of design process as more becomes known
- FRA guidance: 35% contingency at Preliminary Engineering
- Further investigations of land, geotechnical, utility, and environmental conditions would influence final alignment and determine ultimate costs

Professional Services

- 30% of total construction cost (including 35% construction contingency)
- FRA guidance: 20 – 35%
- Services required to implement the project, including:
  - Planning and environmental permitting (legal, external reviews)
  - Project development / start-up
  - Design and engineering
  - Surveying and site assessment
  - Project management for design and construction
  - Professional liability and insurance

What is Included in the Capital Cost Estimates?

Property Acquisition and Rolling Stock

- Right-of-Way
  - Purchase or lease of all areas permanently incorporated, regardless of ownership, based on a standard rate per square foot
  - Relocation assistance for existing households and businesses whose buildings would be intersected by the proposed alignment
- Vehicles
  - Procure all non-maintenance vehicles necessary to operate the service
  - New single-level coaches
  - New diesel locomotives

Unallocated 5% Contingency

- Mitigates Unknowns
  - Added to all costs (including construction and 35% contingency, professional services, property acquisition, and rolling stock)
  - Accounts for uncertainties in project delivery and construction
  - Percentage remains constant, reflecting that, until construction has been completed, a degree of risk still remains
- FRA guidance: 5 – 8% and accounts for any remaining uncertainties in cost estimates

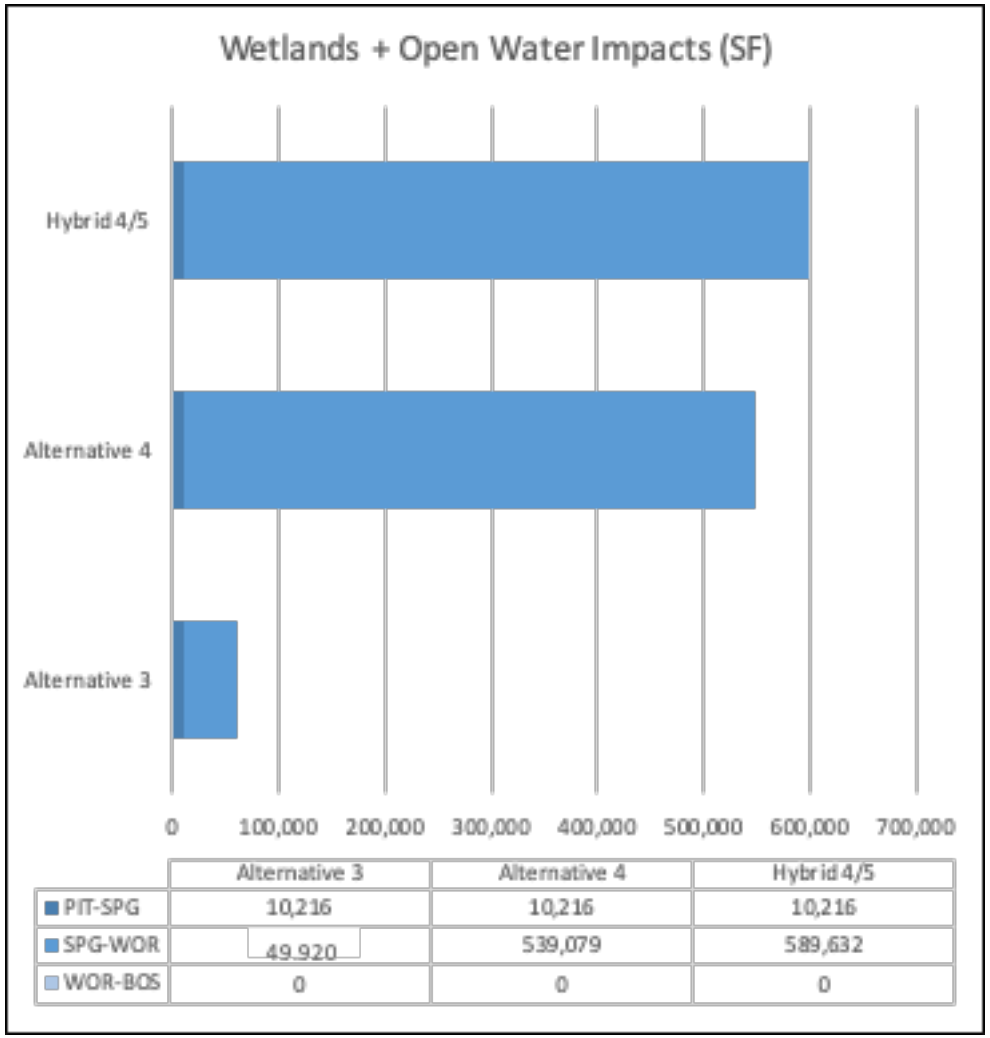
Conceptual Cost Estimates (2020 $ Millions)

Corridor Type	Shared Corridor – Existing Alignment			Shared Corridor – New Separate Track Alignment					
Alternative	3 – BOS-PIT, Double-Track + Rail and Equipment Upgrades			4 – BOS-PIT, New Track			4/5 Hybrid – BOS-PIT, New Track + Realignment		
By Segment	*PIT – SPG*	*SPG – WOR*	*WOR – BOS*	*PIT – SPG*	*SPG – WOR*	*WOR – BOS*	*PIT – SPG*	*SPG – WOR*	*WOR – BOS*
Construction Cost	$283.7	$908.4	$33.3	$283.7	$1,665.2	$33.3	$283.7	$2,080.4	$33.3
Contingency (35% of Construction Cost)	$99.3	$317.9	$11.6	$99.3	$582.8	$11.6	$99.3	$728.2	$11.6
Construction Total	**$383.0**	**$1,226.4**	**$44.9**	**$383.0**	**$2,248.0**	**$44.9**	**$383.0**	**$2,808.6**	**$44.9**
Professional Services (30% of Construction Total)	$496.3			$802.8			$971.0		
Property Acquisition	$4.4	$12.2	$0	$4.4	$37.2	$0	$4.4	$37.5	$0
Vehicles	$131.8			$155.7			$155.7		
Unallocated Contingency (5% of All Costs)	$114.9			$183.8			$220.3		
Capital Cost Total	**$2,413.9**			**$3,859.9**			**$4,625.3**		
Annual Operation & Maintenance Cost (Gross)	**$26.2**			**$34.1**			**$33.9**		

Note: Cost elements may not exactly sum to total costs due to rounding

Key Findings – Environmental and Community Impacts

- Compared to Alternative 3, impacts to wetlands and open water are about 9 to 10 times greater for Alternative 4 and the Alternative 4/5 hybrid
- The Article 97 land impacted by Alternative 4 and the Alternative 4/5 Hybrid is about 4-5 times greater than Alternative 3
- Alternatives 4 and 4/5 create greater environmental and community impacts because they diverge from the existing rail alignment



	Alternative 3	Alternative 4	Hybrid 4/5
PIT-SPG	10,216	10,216	10,216
SPG-WOR	49,920	539,079	589,632
WOR-BOS	0	0	0

Key Findings – Environmental and Community Impacts

- For all 3 Final Alternatives, some air quality impacts improve and others worsen

Metric	Alternative 3		Alternative 4		Alternative 4/5 Hybrid	
	'Enhanced' Hartford Line	Downeaster	'Enhanced' Hartford Line	Downeaster	'Enhanced' Hartford Line	Downeaster
Decrease in Auto VMT	23,371,876 miles	31,234,674 miles	29,497,986 miles	36,318,653 miles	33,042,389 miles	40,831,308 miles
Increase in Train Miles	509,540 miles	509,540 miles	798,620 miles	798,620 miles	785,845 miles	785,845 miles
Change in Emissions	+154.24 tons of NOX +4.84 tons of PM2.5 -0.04 tons of PM10 +0.08 tons of SOX +7.39 tons of VOC -4,191.7 tons of CO2	+154.11 tons of NOX +4.83 tons of PM2.5 -0.06 tons of PM10 +0.07 tons of SOX +7.37 tons of VOC -5,601.88 tons of CO2	+241.87 tons of NOX +7.6 tons of PM2.5 -0.06 tons of PM10 +0.14 tons of SOX +11.6 tons of VOC -5,290.4 tons of CO2	+241.76 tons of NOX +7.59 tons of PM2.5 -0.07 tons of PM10 +0.13 tons of SOX +11.58 tons of VOC -6,513.68 tons of CO2	+237.93 tons of NOX +7.47 tons of PM2.5 -0.06 tons of PM10 +0.13 tons of SOX +11.41 tons of VOC -5,926.09 tons of CO2	+237.8 tons of NOX +7.46 tons of PM2.5 -0.08 tons of PM10 +0.12 tons of SOX +11.38 tons of VOC -7,323.01 tons of CO2

- In the Pittsfield to Springfield segment, 16 of the existing at-grade railroad crossings would remain; 5 would require a new overpass or underpass

Environmental and Community Impacts

Environmental Impacts (Square Feet)

Corridor Type	Shared Corridor – Existing Alignment			Shared Corridor – New Separate Track Alignment					
Alternative	3 – BOS-PIT, Double-Track + Rail and Equipment Upgrades			4 – BOS-PIT, New Track			4/5 Hybrid – BOS-PIT, New Track + Realignment		
By Segment	*PIT – SPG*	*SPG – WOR*	*WOR – BOS*	*PIT – SPG*	*SPG – WOR*	*WOR – BOS*	*PIT – SPG*	*SPG – WOR*	*WOR – BOS*
Wetlands	814	18,771	0	814	363,943	0	814	385,381	0
Open Water	9,402	31,149	0	9,402	175,136	0	9,402	204,251	0
Article 97 Lands	133,997	2,514	0	133,997	420,768	0	133,997	505,341	0
Area of Critical Env. Concern	0	0	0	0	0	0	0	0	0

Community Impacts

Corridor Type	Shared Corridor – Existing Alignment			Shared Corridor – New Separate Track Alignment					
Alternative	3 – BOS-PIT, Double-Track + Rail and Equipment Upgrades			4 – BOS-PIT, New Track			4/5 Hybrid – BOS-PIT, New Track + Realignment		
By Segment	*PIT – SPG*	*SPG – WOR*	*WOR – BOS*	*PIT – SPG*	*SPG – WOR*	*WOR – BOS*	*PIT – SPG*	*SPG – WOR*	*WOR – BOS*
Buildings – TOTAL	0	0	0	0	91	0	0	98	0
Non-Rail/ROW Land (Sq. Ft.)	380,070	337,233	0	380,070	3,338,362	0	380,070	3,939,953	0
Existing At-Grade Crossings	21	7	10	21	7	10	21	7	10
Remaining At-Grade Crossings	16	7	7	16	7	7	16	4	7

Benefit-Cost Analysis (BCA)

- Comparison of Baseline ("2040 Future No-Build") to Build Scenarios
  - 2040 Future No-Build Scenario = current E-W infrastructure and levels of service
  - Build Scenarios = Alternatives 3, 4, and 4/5 hybrid
- Monetization of benefits using values recommended by U.S. DOT, as well as other sources as required
- Evaluation of project costs relative to the economic value of social benefits generated by the project over an analysis period
  - Use discounting to account for inflation/"time value of money"
  - Bring future costs and benefits to "present value"
- Current Federal rules consider BCA as part of the evaluation criteria for project funding

BCA - Project Benefits (U.S. DOT Methodology)

Travel Time Savings

- New Riders shifting from Auto to Rail
- Faster times for existing riders

Vehicle Operating Cost Savings

- Reduced vehicle operating costs for new riders shifting from auto to rail

Emissions Reductions

- Reduced auto emissions from mode shift from auto to rail
- *Minus* increased train emissions from new rail service

Safety Benefits

- Reduced auto collisions from mode shift from auto to rail
- *Minus* increased rail collisions from new rail service

Pavement Damage Reductions

- Reduced "wear and tear" on roadway pavement as a result of shift of trips from auto to rail

Residual Value

- Remaining value of project at end of analysis period, based on assumed asset useful life of 40 years

Note: For analysis purposes, capital costs assumed to take place over 10 years and the operations period follows for 30 years. Residual value calculation assumes 10 years of remaining value after the 30 years of operations.

Not included: Benefits to freight service; economic impacts of project, including increases in jobs, GDP, etc.; "transfers" in form of fares, tolls, etc.

BCA - Project Costs

Capital Costs	O&M Costs

• Construction Elements
  • Rail and bridges
  • Stations
  • Support Facilities
  • Sitework & Special Conditions
  • Systems
• Property Acquisition (ROW)
• Rolling Stock/Vehicles
• Professional Services
	• Net Annual Costs: Build Costs minus Future No-Build Costs
	• Costs to operate new service
	• Costs to maintain new infrastructure

Note: For analysis purposes, capital costs assumed to take place over 10 years. Operations period follows for 30 years.

Benefit–Cost Analysis (BCA) Results

BCA Summary, Millions of 2020 Dollars, Discounted 7%

BCA Metric	Alternative 3		Alternative 4		Alternative 4/5 Hybrid	
	'Enhanced' Hartford Line	Downeaster	'Enhanced' Hartford Line	Downeaster	'Enhanced' Hartford Line	Downeaster
Total Benefits	**$167**	**$212**	**$224**	**$264**	**$268**	**$314**
Travel Time Savings	$19	$20	$31	$32	$41	$44
Safety	$64	$87	$81	$100	$91	$113
Vehicle Operating Cost Savings	$62	$83	$79	$97	$88	$109
Reduced Pavement Damage	$0.1	$0.2	$0.2	$0.2	$0.2	$0.3
Reduced Emissions	($19)	($18)	($30)	($29)	($29)	($29)
Residual Value	$40	$40	$64	$64	$77	$77
Total Costs	**$1,778**	**$1,778**	**$2,836**	**$2,836**	**$3,366**	**$3,366**
Capital Costs	$1,666	$1,666	$2,675	$2,675	$3,205	$3,205
O&M Costs	$112	$112	$161	$161	$160	$160
Net Present Value (NPV)	**($1,611)**	**($1,566)**	**($2,612)**	**($2,573)**	**($3,098)**	**($3,051)**
Ratio Produced by BCA	**0.09**	**0.12**	**0.08**	**0.09**	**0.08**	**0.09**

Note: A ratio of 1.0 or higher makes a project more competitive for discretionary grants under current federal rules

Advisory Committee Discussion

General comments or questions about the Alternatives Evaluation?

Advisory Committee Discussion

Upon completion of the East-West Passenger Rail Study, what next steps would you recommend?

Study Alternatives

- Are there any alternatives that you would prioritize or deprioritize?
- What phasing approaches, if any, should be considered?

Advisory Committee Discussion

Upon completion of the East-West Passenger Rail Study, what next steps would you recommend?

Potential items for further analysis to consider

- Examples: indirect economic benefits, impacts to freight service, electrification of the alternatives, life-cycle cost analysis, disposition/condition of CSX infrastructure

Advisory Committee Discussion

Upon completion of the East-West Passenger Rail Study, what next steps would you recommend?

Potential operational items to consider

- Safety issues associated with grade crossings
- Discussions with CSX

Advisory Committee Discussion

Upon completion of the East-West Passenger Rail Study, what next steps would you recommend?

Governance and funding items to consider

- Proposed operating entity (e.g., Amtrak or other railroad)
- Legislative actions that may be required
- Funding sources (including federal funding under new proposed legislation)

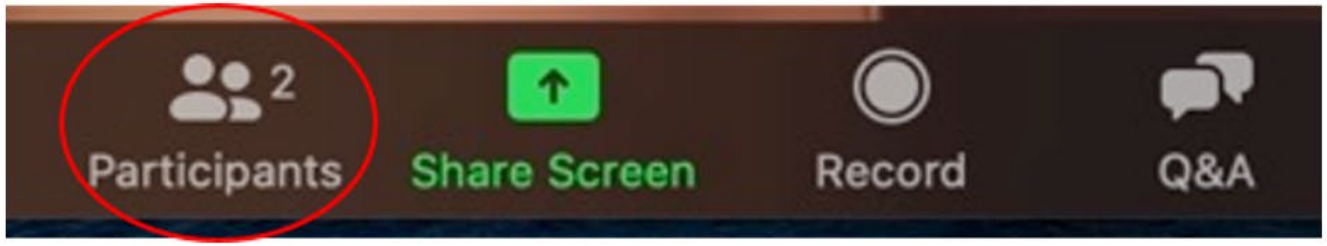
Note: A project proponent, funding source(s), and an agreement with the host railroad (CSX) are needed for project development.

Advisory Committee Comment

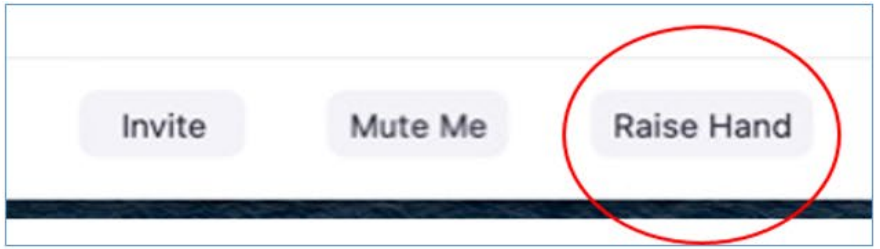
- Press the "**Raise Hand**" button. Please wait for the moderator to recognize and unmute you before speaking

- To access the Raise Hand button:

*1. Click on the **Participants** button*

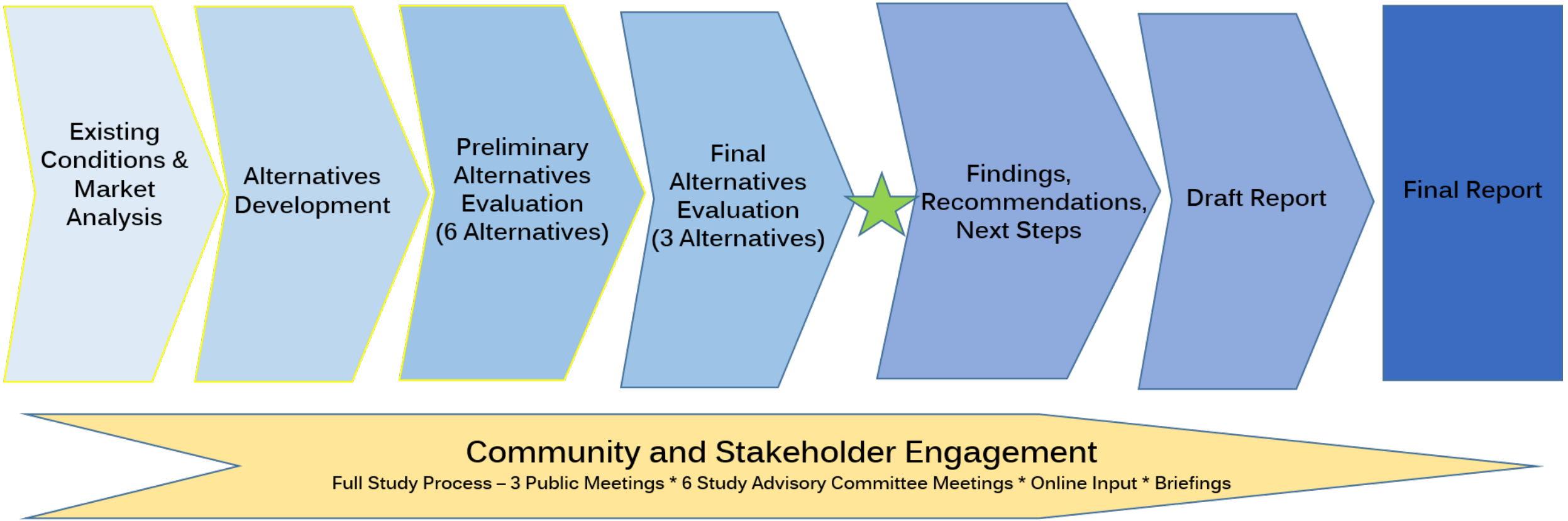


*2. Click "**Raise Hand**"*



- *After you speak, we will lower your hand and you will be muted to allow the team to respond and provide opportunities for others to participate*

Study Process and Next Steps



We Are Here

Solicit Advisory Committee Feedback on Final Analysis

- Accepting written recommendations through October 7, 2020
  - Written recommendations can be sent to Makaela Niles, MassDOT Project Manager, at Makaela.Niles@dot.state.ma.us

Draft Report – October 16, 2020

- Will include Findings and Advisory Committee Recommendations
- Released for 30-Day public comment period

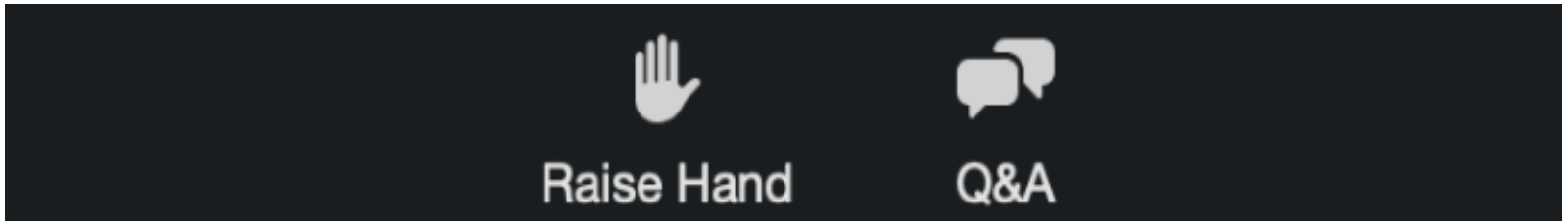
Public Meeting – October 22, 2020

- Present analysis of 3 Final Alternatives
- Solicit feedback on analysis and draft report

Final Report by November 30, 2020

Public Comment

- Please share only one question or comment at a time
- Use the "**Q+A**" button to submit a typed question or comment
- Press the "**Raise Hand**" button to share your question or comment verbally. Wait for the moderator to recognize and unmute you before speaking.
- If you have joined by phone only, you may "raise your hand" by pressing the star button and then nine (*9)
- *After you speak, we will lower your hand and you will be muted to allow the team to respond and provide opportunities for others to participate*



- Comments may also be sent to Makaela Niles, MassDOT Project Manager, at Makaela.Niles@dot.state.ma.us