

#### **CCRPC Board**

February 17<sup>th</sup>, 2021



## **Presentation Overview**

- 1. Project Background & Overview
- 2. Review Interchange Concept Plans
- 3. Review Interchange Evaluation
  - seeking input on metrics and scoring
  - leading to direction on Interchange Investments
- 4. Introduce beginning concepts for Bundles *seeking initial input on the bundles*
- 5. Next Steps



# Project Background & Overview



#### **Demographic Forecasts**

2015	2050	2015 to 2050 % increase
161,382	183,172	14%
135,511	182,688	35%
63,498	79,151	25%
	2015 161,382 135,511 63,498	2015       2050         161,382       183,172         135,511       182,688         63,498       79,151

## 2018 ECOS Plan Metropolitan Transportation Plan Priorities

- 70% of Funding goes to System Preservation
- Concentrate growth in our Villages and Downtowns
  - 90% of HH growth in areas planned for growth
- Safety (HCL) Improvements
- ITS Investments
- TDM Programs
- Increases in walking/biking
- Capacity expansion only when needed



# MTP Priorities (Cont'd)

- Transit enhancements
  - 15 minute headways on all trunk routes (US2, US7, VT15 & North Ave)
  - 20 30 min headways on all other routes and improved weekend service
  - New Colchester loop
- Identified Need for I-89 2050 Study (Exits 12 to 16)
  - -I-89 Third Lane between Exits 14 and 15?
  - Interchange Improvements: Exit 12B (placeholder) or Exit 14 reconstruction or Exit 14N or Exit 13 or other?

#### MTP Outcomes – meeting our transportation /climate/energy goals

- The significant MTP investment in bike/ped, transit, and park & ride projects, if fully implemented, is estimated to have the following impacts on regional travel through 2050:
  - **2.4%** decrease in Vehicle Miles Traveled (VMT)
  - **4.6%** decrease in Vehicle Hours of Travel (VHT)
  - Increase in Non-Automobile Mode-Share from about 12% to 16%
  - 90% fleet electrification to meet the State's energy goal of having 90% of Vermont's energy needs provided by renewable sources by 2050
  - **77%** Reduction in Fuel Consumption compared to 2015

#### **Roadway Capacity**

- Balance possible I-89 widening vs. local road improvements
- Pursue alternative ways to reduce congestion
  - Transit, HOV lane, Connected& Autonomous Vehicles
- Increase funding share for alternative modes

#### Congestion Levels (v/c ratio)





#### **Project Study Area**



#### Chittenden County I-89 2050 Study Project Overview

Our schedule for successfully moving from project kick-off through stakeholder engagement and technical evaluations to develop a comprehensive, forward-looking plan for the I-89 corridor.





www.envision89.com

#### **Process after this study**

There are likely to be three kinds of recommendations coming out of this study. Each will have a different implementation process. All projects must be included in CCRPC's MTP and TIP if federal funding is required.

- Minor capital investments (shared-use paths, sidewalks, crosswalks, park and ride lots, technology, signage, lane or ramp changes, etc.) – These will follow the normal capital budgeting and implementation process of the responsible agency (VTrans or municipality).
- Operational investments (transit services, transportation demand management programs, etc.) – These will follow the normal operating budget process of the responsible agency (VTrans, GMT, or municipality).
- Major capital investments (Interchange or I-89 projects) These will have to go through the federally-required NEPA process and will require an Environmental Impact Study (EIS).

The timing of the different types of investments will be included in Task 6 – Implementation Plan and include monitoring of conditions and triggers (what circumstances will trigger the need for improvements).

#### **Current I-89 Vision & Goals**



The 2050 Vision for the I-89 Corridor through Chittenden County is an interstate system (mainline and interchanges) that is safe, resilient, and provides for reliable and efficient movement of people and goods in support of state, regional, and municipal plans and goals.

- **Safety**: Enhance safety along the I-89 Study Corridor and Adjacent interchanges for all users.
- Livable, Sustainable and Healthy Communities: Promote compact growth that supports livable, affordable, vibrant, and healthy communities.
- Mobility & Efficiency: Improve the efficiency and reliability of the I-89 Corridor and Adjacent Interchanges for all users.
- Environmental Stewardship & Resilience: Establish a resilient I-89 Corridor that minimizes environmental impacts associated with the transportation system.
- **Economic Access & Vitality**: Improve economic access and vitality in Chittenden County.
- **System Preservation**: Preserve and improve the condition and performance of the I-89 Corridor

There is significant uncertainty about long-lasting changes on where people will live and how they will travel in the future due to the COVID-19 pandemic, technology, demographics, and other dynamics. We recognize that the I-89 Vision, Goals, Objectives and implementation actions that will follow will need to be monitored and reassessed periodically to ensure that they address the evolving situation.

#### • Two Rounds of Interchange Evaluation





8. Exit 17N - Milton

Based on results from the first round of interchange evaluation, the I-89 Advisory Committee voted to advance Exits 12B, 13, and 14 to the second round of evaluation

# Interchange Concept Plans



#### **Second Round of Interchange Evaluation - Overview**



#### **Second Round of Interchange Evaluation: Exit 12B**





#### **Interchange Evaluation: Exit 13**









#### **Interchange Evaluation: Exit 14**











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# Interchange Evaluation

#### Second Round Interchange Evaluation Metrics – 1 of 2

**SAFETY GOAL:** Enhance safety along the I-89 Study Corridor and Adjacent Interchanges for all users

- Ramp Spacing
- Safety Impact
- Bike/Ped Safety

LIVABLE, SUSTAINABLE, & HEALTHY COMMUNITIES GOAL: Promote compact growth that

supports livable, affordable, vibrant, and healthy communities.

- Consistent with Regional Plan
- ROW Impacts
- Environmental Justice / Underserved Populations

**MOBILITY & EFFICIENCY GOAL:** Improve the efficiency and reliability of the I-89 Corridor and Adjacent Interchanges for all users.

- Interchange Trips
- VMT
- VHT
- I-89 Corridor V/C
- Average Delay
- Bike/Ped Connectivity

#### Second Round Interchange Evaluation Metrics – 2 of 2

**ENVIRONMENTAL STEWARDSHIP GOAL:** Establish a resilient I-89 Corridor that minimizes environmental impacts associated with the transportation system.

- Wetland Impacts
- River Corridors
- Natural Habitats
- Fuel Consumption

#### **ECONOMIC ACCESS GOAL:** Improve economic access and vitality in Chittenden County.

- Connectivity to Areas Planned for Growth
- Job Access

## **SYSTEM PRESERVATION GOAL:** Preserve and improve the condition and performance of the *I-89* corridor.

- Asset Maintenance Cost
- Construction Cost
- Maintenance & Construction Cost

#### **Draft** Evaluation Scoring Process

- Metrics were identified and evaluated for each goal. Many are specific to the interchange evaluation stage. Others are more general and can be used for evaluating bundles in the next stage.
  - Are there any metrics that should be changed or added at this stage?
- Scoring was applied to the metric results to highlight differences between interchanges:
  - The results were scored with a range from 0-4 comparing the lowest to the highest so that each result received points based upon which quintile it fell in.
  - Should some of the metrics be scored on a different basis? For example, compared to a base of 0, compared to 2015, or compared to a no-build?

#### **Second Round Interchange Evaluation Matrix**

- Two summary tables
  - Raw metric values (left)
  - Metric scores (right)
- Organized by project goal
- 26 total scored metrics
  - Rows in gray provided for information only (not scored)
- Metric scores :
  - (0 = low, 4 = high)

These matrices are attached separately and on the website.

		Chittenden C	ounty I-89	2050	Study				
		DRAFT Second Roun	d Interchar	nge Scr	eening Ma	itrix			
			2050 Base Scenario		Exit 12B New	Exi Hybrid + Bike	t 13	Exit	: 14
Metric SAFETY: Enhance safety	Metric Description y along the I-89 Study Corridor and Adjacent Inter	Changes for all users			Interchange	Overpass	SPDI	Cloverleaf	DDI
Ramp Spacing	Meets AASHTO Standard for Ramp Spacing to Next Closest Interchange	Yes / No	N/A		Yes	Yes*	Yes	Yes	Yes
	Interactive Highway Safety Design Model (HSDM) Change in Total Crashes across the Network	% Change in Total Estimated Crashes Compared to 2050 Base Scenario	N/A		-3.2%	-1.3%	0.4%	-5.0%	-2.8%
Safety Impact	Interactive Highway Safety Design Model (HSDM) Change in Fatal and Injury Crashes across the Network	% Change in Estimated Injury / Fatal Crashes Compared to 2050 Base Scenario	N/A		-1.1%	-1.9%	-3.1%	-4.5%	-2.3%
Bike/Ped Safety	Safety Improvements for Bicyclists and Pedestrians based on Proposed Accommodations, Number of Conflicts Points, and Type of Conflict Point	Relative Level of Safety Improvement for Bicyclists and Pedestrians	N/A		Improved	Significantly Improved	Improved	Improved	Improved
Safety / Operational Commentary						*Left Off-Ramp and Left On- Ramp Not Advised	Declassify I-189 from Interstate to Limited Access State Highway	C-D Road Advised at Current/Future Volumes for Loop	Removes Merge on Mainline
LIVABLE, SUSTAINABL	E, & HEALTHY COMMUNITIES: Promote compact	growth that supports livable, afford	able, vibrant, and I	nealthy com	imunities.			Ramps	
Consistent with Realised	Proportion of 2020 to 2050 Household Growth Located in	Total Secondary Growth Households	0		593	203	203	0	0
Plan	Center, Enterprise, Metro, Village and Suburban Designations)	Proportion of 2020 to 2050 Household Growth Located in Growth Zones Inclusive of Secondary Growth	90.24%		90.40%	90.33%	90.33%	90.24%	90.24%
ROW Impacts	Approximate area of ROW impacts based on limit of disturbance around the interchange	Acres of ROW Disturbance	N/A		4.0	0.2	0.0	0.4	0.1
	Additional Travel Time for Traffic Analysis Zones Identified as EJ communities	Minutes of Additional Travel Time in 2050	N/A	1	0.019	0.022	0.011	0.018	0.023
Environmental Justice / Underserved Population	Average Trip Length in the Model	Average Trip Length in minutes	15.69		15.61	15.66	15.68	15.69	15.72
	Additional Travel Time for EJ TAZs as a Percent of Average Trip Length	% Additional Travel Time per Average Trip in 2050	N/A		0.12%	0.14%	0.07%	0.12%	0.15%
MOBILITY & EFFICIENC	Y: Improve the efficiency and reliability of the I-8	9 Corridor and Adjacent Interchang	es for all users.						
	Daily trips using new interchange in 2050	Total Trips Using New Interchange in 2050	N/A		24,321	56,198	57,334	49,677	46,924
Interchange Trips	Number of daily trins usion the Feit 14 Interchance	# of Daily Trips Using Exit 14	51,929		47,226	46,654	45,319	49,677	46,924
	reaction of daily sign carry are the the charge	Percent Change in # of Daily Trips Using Exit 14	N/A		-9.1%	-10.2%	-12.7%	-4.3%	-9.6%
		Total VMT	5,207,449	1	5,219,058	5,206,473	5,201,707	5,203,632	5,200,102
VMT	Networkwide change in Vehicle Miles of Travel (VMT) per vehicle trip with interchange improvement and projected	VMT per vehicle trip	8.103		8.087	8.097	8.090	8.097	8.092
9	growth compared to the Future Base Model	% Change in VMT per vehicle trip in 2050	N/A		-0.20%	-0.07%	-0.17%	-0.07%	-0.14%
	Networkwide channe in Vehicle Hours of Travel AHT) with	Total VHT	147,758		147,394	147,452	147,636	147,737	147,906
VHT	interchange improvement and projected growth compared to the Future Base Model	% Change in VHT in 2050	N/A		-0.25%	-0.21%	-0.08%	-0.01%	0.10%
I-89 Corridor V/C	Mainline corridor congestion as indicated by the number of miles with v/c of greater than or equal to 0.9	Miles of Mainline with Severe Congestion	1.34		2.18	1.34	1.34	1.34	1.34
Average Delay	Change in 2050 PM Peak Hour Delay at Exit 14	Change in Average Delay per Trip (seconds)	N/A	1	-40	-34	-37	-47	-41
Bike/Ped Connectivity	Bicyclist and Pedestrian Connectivity Improvements Across I- 89 Based on Existing and Proposed Accomodations WARDSHIL2: Establish a restlicted 1889 Corridon that	Level of Bike/Ped Connectivity Improvements	N/A	transportat	Improved	Significantly Improved	Significantly Improved	Improved	Improved
Watland Impacts	Approximate area of wetland/wetland buffer impacts based	Acres of Impact to VSWI Wetlands	N/A		0	0.4	0.1	0.1	0
Herana Impaca	improvements	Acres of Impact to 50 ft Wetland Buffers	N/A		0.1	1.0	0.5	0.3	0
River Corridors	Approximate area of river corridor, floodway, and 100-year flood zone impacts based on the estimated limits of	Acres of Impact to River Carridors	N/A		0	1.1	1.8	0	0
Natural Mahitate	disturbance for the interchange improvements Approximate area of rare, threatened, and endangered (RTE) species imparts based on the estimated limits of	Acres of impact to 100-year Hood Zone	N/A	1	7	0	0.5	0	0
Basilianas	disturbance for the interchange improvements	Provent alterna in anti-	N/A	-	0.38%	0.919/	0.03%	0.08%	0.149/
Resilience	Total Fuel Consumption Across Model Network (based on	Total Gallons of Fuel Consumed per Day in	40.744		40.835	40.736	40.699	40 714	40.686
Fuel Consumption	2050 projection assuming MTP Investments and 90% electric vehicle fleet)	2050 % Change in Gallons of Fuel Consumed per Day in 2050	N/A		0.22%	-0.02%	-0.11%	-0.07%	-0.14%
ECONOMIC ACCESS: In		County							
	nprove economic access and vitality in Chittenden	county.							
Connectivity to Areas Planned for Growth	nprove economic access and vitality in Chittender Percentage of land area within 1 mile of interchange that is classified as an ECOS Growth Zone (includes Center, Enterprise, Metro, Village and Suburban Designations) Total authempt of enterched one links in 2015 compared to	Percentage of area within 1 mile of interchange in ECOS Growth Zone	N/A	-	87%	90%	90%	100%	100%
Connectivity to Areas Planned for Growth Job Access	prove economic access and vitability in Chiltenden Percentage of land area within 1 mile of interchange that is disatified as an ECOS Growth Zoee (include Conter, Enterprise, Metro, Village and Saburban Designations) Tooli number of projection and job in 200 compared to 2000 within 1 radail mile of the interchange including adopted job projections and secondary growth Tooli number of projections and secondary growth Tooli number of projections 200 bits in 1 radail mile of	Percentage of area within 1 mile of interchange in ECOS Growth Zone Total number of New Jobs within 1 Radial Mile of the Interchange	N/A N/A		87% 3,054	90% 2,461	90% 2,461	4,133	4,133
Connectivity to Areas Planned for Growth Job Access	Increase of commit access and vicinity in Chiltender Nerrentge of lad east within it mice interchange that is classified as an ECOS Growth Zore (includes Career, Emeryina, Matter, Villeg and Schulten Breisgenston) Total number of projected new jobs in 2030 compared to 2020 within 1 radia linke of the interchange including adopted job projections and secondary growth Total number of projected 2020 jobs within 1 radia mile of the new interchange effects/careful excluding adopted job projections and secondary growth	Percentage of area within 1 mile of interchange in ECOS Growth Zone Total number of New Jobs within 1 Radial Mile of the Interchange Total Number of Jobs Within 1 Radial Mile of Interchange	N/A N/A N/A		87% 3,054 11,416	90% 2,461 9,592	90% 2,461 9,592	100% 4,133 27,220	4,133 27,220
Connectivity to Areas Planned for Growth Job Access	prover account is access and ybring in Chintoshi proving of counts with 1 min of interviewage that is clustered as an ICOS Groot Zoos (includes Contro, Emprise), Minto, Yilliaga as Sabarba Tabespation) Tadi anther of projection amy pilon spectra 2000 anteris in cadi an and the interviewage including adapted by projections and secondary access 2000 anteris in cadi and the interviewage including adapted by projections and secondary access and another and an anti-anti-anti-anti-anti- the new interviewage infrastructure including adapted job projections and secondary growth. N. Researce and Improve this condition and perfor-	Percentage of area within 1 mile of interchange in ECOS Growth Zone Total number of New John within 1 Rodal Mile of the Interchange Total Number of John Within 1 Rodal Mile of Interchange mannae of the 16-85 corridor.	N/A N/A N/A		87% 3,054 11,416	90% 2,461 9,592	90% 2,461 9,592	100% 4,133 27,220	100% 4,133 27,220
Connectivity to Areas Planned for Growth Job Access SYSTEM PRESERVATIO Asset Maintenance Cost	reprove eccession of sources and so young in a fail function of provings of out our set in his of intervalues that is clustering as an ICOS Groot Zoos (includes Cone, Demyrels, Merry, Yang, and Sachata Darbeytania). Tradi an under of projection are join is 2020 compared to adaptati ja projection and associative grooting adaptati ja projection and associative grooting. That an under of projection and associative grooting adaptati ja projection and associative grooting adaptati ja projection and associative grooting. The an under of projection and associative grooting adaptati ja projection and associative grooting adaptati ja province and an advances and and and associative grooting and province and an advances and an advance advance and improves the conditional and part of Emmend Dayse associative minimumore costs at Eds 121, 13 & 14 combined.	Percentage of area within 1 mile of interchange in ECOS Granth Zuoni Total summer of New Jobs within 1 Redail Mile of the Interchange Total Number of Jobs Within 1 Redail Mile of transchange Total Summer of Line 1 Social Mile of transchange Total Social Social Conference Acad Mathematics Col Biologies Control Col Perform 2018 La Control Col Redail Social Conference Interchange and the Social Social Coloration (Standard Mathematics) and the Social Social Col- mandard Social Coloration (Standard Col- relation) and the Social Social Coloration (Standard Col- Redail Acad Social Coloration) (Standard Col- Redail Coloration (Standard Col) (Standar	N/A N/A N/A \$94,151,074		87% 3,054 11,416 \$88,516,699	90% 2,461 9,592 \$90,832,324	90% 2,461 9,592 \$48,464,064	100% 4,133 27,220 \$74,859,153	100% 4,133 27,220 \$84,840,338
Connectivity to Areas Planned for Growth Job Access SYSTEM PRESERVATIO Asset Maintenance Cost	Province accounting location and an end of the second seco	Percentage of one within 1 mile of interchange in ECS Grands Zune line and the lands within 1 Mile and Mile of the lands within 1 Mile and Mile of teachange manace of Jakes 450 controls and Mile Mile and Mile and Mile of teachange manace of Jakes 450 controls Mile Mile Mile Mile and Mile And Mile Mile Mile Mile and Mile Annual Annual Mile Mile Annual Annual Mile Annual Mile Mile Annual Annual Mile Mil	N/A N/A N/A \$94,151,074 \$0		87% 3,054 11,416 \$88,516,699 \$29,000,000	90% 2,461 9,592 \$90,832.324 \$15,000,000	90% 2,461 9,592 \$48,464,064 \$61,000,000	100% 4,133 27,220 \$74,859,153 \$44,000,000	100% 4,133 27,220 \$84,840,338 \$37,000,000
Connectivity to Areas Planned for Growth Job Access SYSTEM PRESERVATIO Asset Maintenance Cost Construction Cost	Partners of the set with 1 which of the children in the duration of an end of the set of the children of the duration of an end of the set of the children of the duration of an end of the set of the set of the partners. News, YMN, YMN, Set of the duration of the set of the set of the set of the set of the set of the set of the partners and secondary growth. The duration of the set of the set of the partners with the set of the partners with the set of the partners with the set of the set of the set of the set of the set of the set of the set of the set of the set of the between set of the set of the set of the set of the set of the set of the set of the set of the set of the set o	Percentage of area within 1 mile of intercharge it (CCS Grand Zue tercharge it (CCS Grand Zue Height of New Jobs, within 1 Reddel Hill Height of New Jobs, Within 1 Reddel Hill of Intributery et Anstholege mance of the 1430 cmoles (COS and Zue Manual Parka Cost, Cost Alack Reintercost Call Biologie & Clamba Zue Manual Parka (COS and Zue Manual Parka (COS and	N/A N/A N/A \$94,151,074 \$0 \$74,300,000		87% 3,054 11,416 \$88,516,699 \$29,000,000 \$45,300,000	90% 2,461 9,592 \$90,832,324 \$15,000,000 \$59,300,000	90% 2,461 9,592 \$48,464,064 \$61,000,000 \$13,300,000	100% 4,133 27,220 \$74,859,153 \$44,000,000 \$30,300,000	100% 4,133 27,220 \$84,840,338 \$37,000,000 \$37,300,000
Connectivity to Areas Planned for Growth Job Access Stotted Polisies/VATIC Asset Maintenance Cost Construction Cost Maintenance &	Partner actional field of the second	Percetage of one within 1 mile of interchange at COS Grand Zuer I and number of New Jobs within 1 Mild of New Jobs within 1 Mild of New Jobs Taula Annuel of New Jobs within 1 Mild of New of New Jobs New Job	N/A N/A N/A \$94,151,074 \$0 \$74,300,000 \$94,151,074		87% 3,054 11,416 \$88.516.699 \$29,000,000 \$45,300,000 \$117,516,699	90% 2,461 9,592 \$90,832,324 \$15,000,000 \$59,300,000	90% 2,461 9,592 \$48,464,064 \$61,000,000 \$13,300,000 \$109,464,064	100% 4,133 27,220 \$74,859,153 \$44,000,000 \$30,300,000 \$118,859,153	100% 4,133 27,220 \$84,840,338 \$37,000,000 \$37,300,000 \$121,840,338

	C	hittenden County I-	89 2050 S ange Scre	itudy ening Mat	rix		
			Exit 12B New	Exi Hybrid + Bike	it 13	Exit Enhanced	:14
Metric SAFETY: Enhance safety	along the I-89 Study Corridor and Adjacent Inter	changes for all users	Interchange	Overpass	SPDI	Cloverleaf	DDI
Ramp Spacing	Meets AASHTO Standard for Ramp Spacing to Next Closest Interchange	Yes / No	4	3	4	4	4
	Interactive Highway Safety Design Model (HSDM) Change in Total Crashes across the Network	% Change in Total Estimated Crashes Compared to 2050 Base Scenario	3	1	0	4	2
Safety Impact	Interactive Highway Safety Design Model (HSDM) Change	% Change in Estimated Injury / Fatal	0	1	2	A	1
	in Fatal and Injury Crashes across the Network	Crashes Compared to 2050 Base Scenario	v		-		
Bike/Ped Safety	Safety Improvements for Bicyclists and Pedestrians based on Proposed Accommodations, Number of Conflicts Points, and Type of Conflict Point	Relative Level of Safety Improvement for Bicyclists and Pedestrians	2	4	3	2	2
Safety / Operational Commentary				*Left Off-Ramp and Left On- Ramp Not Advised	Declassify I-189 from Interstate to Limited Access State Highway	Advised at Current/Future Volumes for Loop Ramps	Removes Merge on Mainline
LIVABLE, SUSTAINABLE	& HEALTHY COMMUNITIES: Promote compact of	growth that supports livable, afford	able, vibrant, and	healthy commu	nities.		
	Reservice of 2050 Hoursholds Located in ECOS Growth	Total Secondary Growth Households					
Consistent with Regional Plan	Zones Inclusive of Secondary Growth (includes Center, Enterprise, Metro, Village and Suburban Designations)	Properties of 2000 Hoursholds Jacobed in					
		Growth Zones Inclusive of Secondary Growth	4	4	4	4	
ROW Impacts	Approximate area of ROW impacts based on limit of disturbance around the interchange	Acres of ROW Disturbance	0	3		3	
	Additional Travel Time for Traffic Analysis Zones Identified as EJ communities	Minutes of Additional Travel Time in 2050					
Environmental Justice / Underserved Populations	Average Trip Length in the Model	Average Trip Length in minutes					
	Additional Travel Time as a Percent of Average Trip Length	% Additional Travel Time per Average Trip	2	2	2	2	2
MOBILITY & EFFICIENCY	: Improve the efficiency and reliability of the I-89	Corridor and Adjacent Interchange	es for all users.				
	Daily trips using new interchange in 2050	Total Trips Using New Interchange in 2050					
International Trian		A					
interchange rinps	Number of daily trips using the Exit 14 Interchange	+ of Daily Trips Using Ent 14					
		Hercent Change in # of Daily Trips Using Exit 14	2	3	4	4	1
		Total VMT					
VMT v	Networkwide change in Vehicle Miles of Travel (VMT) per vehicle trip with interchange improvement and projected growth compared to the Future Base Model	VMT per vehicle trip					
		% Change in VMT per vehicle trip in 2050		0	3	0	2
	Networkwide change in Vehicle Hours of Travel (VHT) with	Total VHT					
VHT	interchange improvement and projected growth compared to the Future Base Model	% Change in VHT in 2050			2	1	0
I-89 Corridor V/C	Mainline corridor congestion as indicated by the number of miles with v/c of greater than or equal to 0.9	Miles of Mainline with Severe Congestion	0	4	4	4	4
Average Delay	Change in 2050 PM Peak Hour Delay at Exit 14	Change in Average Delay per Trip (seconds)	2	0	1	4	2
Bike/Ped Connectivity	Bicyclist and Pedestrian Connectivity Improvements Across I- 89 Based on Existing and Proposed Accomodations	Level of Bike/Ped Connectivity Improvements	2	4	4	2	2
ENVIRONMENTAL STEV	VARDSHIP: Establish a resilient I-89 Corridor that	minimizes environmental impacts as	sociated with the	e transportation :	system.		
Wetland Impacts	Approximate area of wetland/wetland buffer impacts based on the estimated limits of disturbance for the interchange	Acres of impact to VSWI Wetlands	4	0	4	4	4
	improvements Approximate seas of sizer consider, Boostway, and 100 years	Acres of Impact to 50 ft Wetland Buffers	4	0	2	3	4
River Corridors	flood zone impacts based on the estimated limits of disturbance for the interchange improvements	Acres of Impact to 100-year Flood Zone	4	0	2	4	4
Natural Habitats	Approximate area of rare, threatened, and endangered (RTE) species impacts based on the estimated limits of	Acres of RTE Impacts	0	4	4	4	4
Resilience	unsurpance for the interchange improvements Percent Change Network Trip Robustness (NTR)	Percent change in robustness	0	4	4	1	0
	Total Fuel Consumption Across Model Network (based on	Total Gallons of Fuel Consumed per Day in 2050					
Fuel Consumption	2050 projection assuming MTP Investments and 90% electric vehicle fleet)	% Change in Gallons of Fuel Consumed per Day in 2050	0	3	4	4	4
ECONOMIC ACCESS: Im	prove economic access and vitality in Chittenden	County.					
Connectivity to Areas Planned for Growth	Percentage of land area within 1 mile of interchange that is classified as an ECOS Growth Zone (includes Center, Enterprise, Metro, Village and Suburban Designations)	Percentage of area within 1 mile of interchange in ECOS Growth Zone	0	1	1	4	4
Job Arress	Total number of projected new jobs in 2050 compared to 2020 within 1 radial mile of the interchange including adopted job projections and secondary growth	Total number of New Jobs within 1 Radial Mile of the Interchange	1	0	0	4	4
	Total number of projected 2050 jobs within 1 radial mile of the new interchange infrastructure including adopted job projections and secondary growth	Total Number of Jobs Within 1 Radial Mile of Interchange	0	0	0	4	
SYSTEM PRESERVATION	V: Preserve and improve the condition and perfor	mance of the I-89 corridor.					
Asset Maintenance Cost	Estimated 30-year asset maintenance costs at Exits 128, 13 & 14 combined	Asset Maintenance Cast (Bridges & Culverts) for Exits 128, 13, & 14 combined (not including assets replaced with construction)	0	0		1	0
		Planning-Level Cost Estimate (millions of 2020 dollars) (Includes PE, CON, and	3	4	0	1	2
Construction Cost	Estimated cost for the interchange improvements	contingency) Remaining MTP Allocation for Interstate and Interchange Projects (MTP Allocation - Cost Estimuted					
Maintenance &	Estimated cost for the interchange improvements plus 30-	Total 2050 Cast (inclusive of asset maintenance and new construction casts)	1	4	3	0	0
Construction Cost	year asset maintenance costs at Exits 128, 13 & 14 combined	Incremental Additional Cast					

#### Goal: Safety

	Chittenden County I-89 2050 Study									
DRAFT Second Round Interchange Screening Matrix										
Metric	Metric Description	Units	2050 Base Scenario		Exit 12B New Interchange	Exi Hybrid + Bike Overpass	t 13 SPDI		Exit Enhanced Cloverleaf	: 14 DDI
SAFETY: Enhance safe	ty along the I-89 Study Corridor and Adjacent Interc	hanges for all users								
Ramp Spacing	Meets AASHTO Standard for Ramp Spacing to Next Closest Interchange	Yes / No	N/A		Yes	Yes*	Yes		Yes	Yes
	Interactive Highway Safety Design Model (IHSDM) Change in Total Crashes across the Network	% Change in Total Estimated Crashes Compared to 2050 Base Scenario	N/A		-3.2%	-1.3%	0.4%		-5.0%	-2.8%
Safety Impact	Interactive Highway Safety Design Model (IHSDM) Change in Fatal and Injury Crashes across the Network	% Change in Estimated Injury / Fatal Crashes Compared to 2050 Base Scenario	N/A		-1.1%	-1.9%	-3.1%		-4.5%	-2.3%
Bike/Ped Safety	Safety Improvements for Bicyclists and Pedestrians based on Proposed Accommodations, Number of Conflicts Points, and Type of Conflict Point	Relative Level of Safety Improvement for Bicyclists and Pedestrians	N/A		Improved	Significantly Improved	Significantly Improved		Improved	Improved
Safety / Operational Commentary						*Left Off-Ramp and Left On- Ramp Not Advised	Declassify I-189 from Interstate to Limited Access State Highway		C-D Road Advised at Current/Future Volumes for Loop Ramps	Removes Merge on Mainline

#### Goal: Safety

Chittenden County I	I-89 2050 Study
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#### **DRAFT** Second Round Interchange Screening Matrix

			Exit 12B	Exit 13			Exi	t 14
			New	Hybrid + Bike			Enhanced	
Metric	Metric Description	Units	Interchange	Overpass	SPDI		Cloverleaf	DDI
SAFETY: Enhance safet	ty along the I-89 Study Corridor and Adjacent Interc	hanges for all users						
Ramp Spacing	Meets AASHTO Standard for Ramp Spacing to Next Closest Interchange	Yes / No	4	3	4		4	4
	Interactive Highway Safety Design Model (IHSDM) Change in Total Crashes across the Network	% Change in Total Estimated Crashes Compared to 2050 Base Scenario	3	1	0		4	2
Safety Impact	Interactive Highway Safety Design Model (IHSDM) Change in Fatal and Injury Crashes across the Network	% Change in Estimated Injury / Fatal Crashes Compared to 2050 Base Scenario	0	1	2		4	1
Bike/Ped Safety	Safety Improvements for Bicyclists and Pedestrians based on Proposed Accommodations, Number of Conflicts Points, and Type of Conflict Point	Relative Level of Safety Improvement for Bicyclists and Pedestrians	2	4	4		2	2
Safety / Operational Commentary				*Left Off-Ramp and Left On- Ramp Not Advised	Declassify I-189 from Interstate to Limited Access State Highway		C-D Road Advised at Current/Future Volumes for Loop Ramps	Removes Merge on Mainline

#### Goal: Livable, Sustainable, & Healthy Communities

Chittenden County I-89 2050 Study										
DRAFT Second Round Interchange Screening Matrix										
Metric	Metric Description	Units	2050 Base Scenario		Exit 12B New Interchange	Exit Hybrid + Bike Overpass	t 13 SPDI		Exit Enhanced Cloverleaf	14 DDI
LIVABLE, SUSTAINABLE	, & HEALTHY COMMUNITIES: Promote compact o	prowth that supports livable, afforda	able, vibrant, and h	nealthy com	munities.	1 1				
Consistent with Regional	Proportion of 2020 to 2050 Household Growth Located in Growth Zones Inclusive of Secondary Growth (includes Center, Enterprise, Metro, Village and Suburban Designations)	Total Secondary Growth Households	0		593	203	203		0	0
Plan		Proportion of 2020 to 2050 Household Growth Located in Growth Zones Inclusive of Secondary Growth	90.24%		90.40%	90.33%	90.33%		90.24%	90.24%
ROW Impacts	Approximate area of ROW impacts based on limit of disturbance around the interchange	Acres of ROW Disturbance	N/A		4.0	0.2	0.0		0.4	0.1
	Additional Travel Time for Traffic Analysis Zones Identified as EJ communities	Minutes of Additional Travel Time in 2050	N/A		0.019	0.022	0.011		0.018	0.023
Environmental Justice / Underserved Populations	Average Trip Length in the Model	Average Trip Length in minutes	15.69		15.61	15.66	15.68		15.69	15.72
	Additional Travel Time for EJ TAZs as a Percent of Average Trip Length	% Additional Travel Time per Average Trip in 2050	N/A		0.12%	0.14%	0.07%		0.12%	0.15%

#### Goal: Livable, Sustainable, & Healthy Communities

	Chittenden County I-89 2050 Study									
DRAFT Second Round Interchange Screening Matrix										
			Exit 12B Exit 13							
Metric	Metric Description	Units	New Interchange	Hybrid + Bike Overpass	SPDI		Enhanced Cloverleaf	DDI		
LIVABLE, SUSTAINABLE	, & HEALTHY COMMUNITIES: Promote compact	prowth that supports livable, afford	able, vibrant, and	l healthy commur	nities.					
Consistent with Regional	Proportion of 2050 Households Located in ECOS Growth Zones Inclusive of Secondary Growth (includes Center, Enterprise, Metro, Village and Suburban Designations)	Total Secondary Growth Households								
Plan		Proportion of 2050 Households Located in Growth Zones Inclusive of Secondary Growth	4	4	4		4	4		
ROW Impacts	Approximate area of ROW impacts based on limit of disturbance around the interchange	Acres of ROW Disturbance	0	3	4		3	4		
	Additional Travel Time for Traffic Analysis Zones Identified as EJ communities	Minutes of Additional Travel Time in 2050								
Environmental Justice / Underserved Populations	Average Trip Length in the Model	Average Trip Length in minutes								
	Additional Travel Time as a Percent of Average Trip Length	% Additional Travel Time per Average Trip in 2050	2	2	2		2	2		

#### Goal: Mobility & Efficiency

Chittenden County I-89 2050 Study										
DRAFT Second Round Interchange Screening Matrix										
			2050 Base		Exit 12B	Exit 13			Exit	: 14
Metric	Metric Description	Units	Scenario		New Interchange	Hybrid + Bike Overpass	SPDI		Enhanced Cloverleaf	DDI
MOBILITY & EFFICIENC	Y: Improve the efficiency and reliability of the I-89	Orridor and Adjacent Interchange	s for all users.							
	Daily trips using new interchange in 2050	Total Trips Using New Interchange in 2050	N/A		24,321	56,198	57,334		49,677	46,924
Interchange Trips		# of Daily Trips Using Exit 14	51,929		47,226	46,654	45,319		49,677	46,924
	Number of daily trips using the Exit 14 interchange	Percent Change in # of Daily Trips Using Exit 14	N/A		-9.1%	-10.2%	-12.7%		-4.3%	-9.6%
	Networkwide change in Vehicle Miles of Travel (VMT) per vehicle trip with interchange improvement and projected growth compared to the Future Base Model	Total VMT	5,207,449		5,219,058	5,206,473	5,201,707		5,203,632	5,200,102
VMT		VMT per vehicle trip	8.103		8.087	8.097	8.090		8.097	8.092
		% Change in VMT per vehicle trip in 2050	N/A		-0.20%	-0.07%	-0.17%		-0.07%	-0.14%
	Networkwide change in Vehicle Hours of Travel (VHT) with	Total VHT	147,758		147,394	147,452	147,636		147,737	147,906
VHT	interchange improvement and projected growth compared to the Future Base Model	% Change in VHT in 2050	N/A		-0.25%	-0.21%	-0.08%		-0.01%	0.10%
I-89 Corridor V/C	Mainline corridor congestion as indicated by the number of miles with v/c of greater than or equal to 0.9	Miles of Mainline with v/c > 0.9	1.34		2.18	1.34	1.34		1.34	1.34
Average Delay	Change in 2050 PM Peak Hour Delay at Exit 14	Change in Average Delay per Trip (seconds)	N/A		-40	-34	-37		-47	-41
Bike/Ped Connectivity	Bicyclist and Pedestrian Connectivity Improvements Across I- 89 Based on Existing and Proposed Accomodations	Level of Bike/Ped Connectivity Improvements	N/A		Improved	Significantly Improved	Significantly Improved		Improved	Improved
# Goal: Mobility & Efficiency

## Chittenden County I-89 2050 Study

## **DRAFT** Second Round Interchange Screening Matrix

			Exit 12B Exit 13		t 13	Exit	t 14
Metric	Metric Description	Units	New Interchange	Hybrid + Bike Overpass	SPDI	Enhanced Cloverleaf	DDI
MOBILITY & EFFICIENC	CY: Improve the efficiency and reliability of the I-89	Corridor and Adjacent Interchange	es for all users.				
	Daily trips using new interchange in 2050	Total Trips Using New Interchange in 2050					
Interchange Trips	Number of daily trins using the Evit 14 Interchange	# of Daily Trips Using Exit 14					
	Number of daily tips using the Exit 14 interchange	Percent Change in # of Daily Trips Using Exit 14	2	3	4	0	3
		Total VMT					
VMT	Networkwide change in Vehicle Miles of Travel (VMT) per vehicle trip with interchange improvement and projected growth compared to the Future Base Model	Average Trip Length in miles					
		% Change in average trip length in 2050	4	0	3	0	2
	Networkwide change in Vehicle Hours of Travel (VHT) with	Total VHT					
VHT	interchange improvement and projected growth compared to the Future Base Model	% Change in VHT in 2050	4	4	2	1	0
I-89 Corridor V/C	Mainline corridor congestion as indicated by the number of miles with v/c of greater than or equal to 0.9	Miles of Mainline with $v/c > 0.9$	0	4	4	4	4
Average Delay	Change in 2050 PM Peak Hour Delay at Exit 14	Change in Average Delay per Trip (seconds)	2	0	1	4	2
Bike/Ped Connectivity	Bicyclist and Pedestrian Connectivity Improvements Across I- 89 Based on Existing and Proposed Accomodations	Level of Bike/Ped Connectivity Improvements	2	4	4	2	2

## Goal: Environmental Stewardship

	Chittenden County I-89 2050 Study									
DRAFT Second Round Interchange Screening Matrix										
	2050 Base     Exit 12B     Exit 13       New     New     Hybrid + Bike								Exit Enhanced	14
ENVIRONMENTAL STE	Wetric Description WARDSHIP: Establish a resilient I-89 Corridor that r	Units minimizes environmental impacts as	sociated with the tr	ansportati	Interchange on system.	Overpass	SPDI		Cloverleaf	DDI
	Approximate area of wetland/wetland buffer impacts based	Acres of Impact to VSWI Wetlands	N/A		0	0.4	0.1		0.1	0
Wetland Impacts i	improvements	Acres of Impact to 50 ft Wetland Buffers	N/A		0.1	1.0	0.5		0.3	0
	Approximate area of river corridor, floodway, and 100-year flood zone impacts based on the estimated limits of disturbance for the interchange improvements	Acres of Impact to River Corridors	N/A		0	1.1	1.8		0	0
River Cornabis		Acres of Impact to 100-year Flood Zone	N/A		0	1.1	0.5		0	0
Natural Habitats	Approximate area of rare, threatened, and endangered (RTE) species impacts based on the estimated limits of disturbance for the interchange improvements	Acres of RTE Impacts	N/A		7	0	0		0	0
Resilience	Percent Change Network Trip Robustness (NTR)	Percent change in robustness	N/A		-0.38%	0.81%	0.93%		-0.08%	-0.14%
	Total Fuel Consumption Across Model Network (based on	Total Gallons of Fuel Consumed per Day in 2050	40,744		40,835	40,736	40,699		40,714	40,686
rue consumption	electric vehicle fleet)	% Change in Gallons of Fuel Consumed per Day in 2050	N/A		0.22%	-0.02%	-0.11%		-0.07%	-0.14%

## Goal: Environmental Stewardship

## Chittenden County I-89 2050 Study

## **DRAFT** Second Round Interchange Screening Matrix

			Exit 12B	Exi	t 13	Exi	t 14
Metric	Metric Description	Units	New Interchange	Hybrid + Bike Overnass	SPDI	Enhanced Cloverleaf	וחח
ENVIRONMENTAL STE	WARDSHIP: Establish a resilient I-89 Corridor that r	ninimizes environmental impacts as	ssociated with the	e transportation s	ystem.	cloventeuj	DDI
	Approximate area of wetland/wetland buffer impacts based	Acres of Impact to VSWI Wetlands	4	0	4	4	4
wetland impacts	improvements	Acres of Impact to 50 ft Wetland Buffers	4	0	2	3	4
Discon Comidone	Approximate area of river corridor, floodway, and 100-year	Acres of Impact to River Corridors	4	1	0	4	4
River Corridors	disturbance for the interchange improvements	Acres of Impact to 100-year Flood Zone	4	0	2	4	4
Natural Habitats	Approximate area of rare, threatened, and endangered (RTE) species impacts based on the estimated limits of disturbance for the interchange improvements	Acres of RTE Impacts	0	4	4	4	4
Resilience	Percent Change Network Trip Robustness (NTR)	Percent change in robustness	0	4	4	1	0
Fuel Consumption	Total Fuel Consumption Across Model Network (based on 2050 projection assuming MTP Investments and 90%	Total Gallons of Fuel Consumed per Day in 2050					
Fuel Consumption	electric vehicle fleet)	% Change in Gallons of Fuel Consumed per Day in 2050	0	3	4	4	4

## Goal: Economic Access

Chittenden County I-89 2050 Study DRAFT Second Round Interchange Screening Matrix										
2050 Base Exit 12B Exit 13							Exit 14			
Metric	Metric Description	Units	Scenario		New Interchange	Hybrid + Bike Overpass	SPDI		Enhanced Cloverleaf	DDI
ECONOMIC ACCESS: Ir	ONOMIC ACCESS: Improve economic access and vitality in Chittenden County.									
Connectivity to Areas Planned for Growth	Percentage of land area within 1 mile of interchange that is classified as an ECOS Growth Zone (includes Center, Enterprise, Metro, Village and Suburban Designations)	Percentage of area within 1 mile of interchange in ECOS Growth Zone	N/A		87%	90%	90%		100%	100%
	Total number of projected new jobs in 2050 compared to 2020 within 1 radial mile of the interchange including adopted job projections and secondary growth	Total number of New Jobs within 1 Radial Mile of the Interchange	N/A		3,054	2,461	2,461		4,133	4,133
JOD ACCESS	Total number of projected 2050 jobs within 1 radial mile of the new interchange infrastructure including adopted job projections and secondary growth	Total Number of Jobs Within 1 Radial Mile of Interchange	N/A		11,416	9,592	9,592		27,220	27,220

## Goal: Economic Access

## Chittenden County I-89 2050 Study

## **DRAFT** Second Round Interchange Screening Matrix

			Exit 12B	Exi	t 13		Exit	: 14
Matria	Matuia Description	11:	New	Hybrid + Bike			Enhanced	
Metric		Units	Interchange	Overpass	SPDI		Cloverleaf	DDI
ECONOMIC ACCESS: In				_				
Connectivity to Areas Planned for Growth	Percentage of land area within 1 mile of interchange that is classified as an ECOS Growth Zone (includes Center, Enterprise, Metro, Village and Suburban Designations)	Percentage of area within 1 mile of interchange in ECOS Growth Zone	0	1	1		4	4
	Total number of projected new jobs in 2050 compared to 2020 within 1 radial mile of the interchange including adopted job projections and secondary growth	Total number of New Jobs within 1 Radial Mile of the Interchange	1	0	0		4	4
JOD ALLESS	Total number of projected 2050 jobs within 1 radial mile of the new interchange infrastructure including adopted job projections and secondary growth	Total Number of Jobs Within 1 Radial Mile of Interchange	0	0	0		4	4

# Goal: System Preservation

	Chittenden County I-89 2050 Study									
DRAFT Second Round Interchange Screening Matrix										
Metric	etric Metric Description Units 2050 Base Scenario Exit 12B Exit 12B Hybrid + Bike New Hybrid + Bike Interchange Overpass SPDI							Exit Enhanced Cloverleaf	: <b>14</b> DDI	
SYSTEM PRESERVATIO	N: Preserve and improve the condition and perfor	rmance of the I-89 corridor.			•				-	
Asset Maintenance Cost	Estimated 30-year asset maintenance costs at Exits 12B, 13 & 14 combined	Asset Maintenance Cost (Bridges & Culverts) for Exits 12B, 13, & 14 combined (not including assets replaced with construction)	\$94,151,074		\$88,516,699	\$90,832,324	\$48,464,064		\$74,859,153	\$84,840,338
Construction Cost	Estimated cost for the interchance improvements	Planning-Level Cost Estimate (millions of 2020 dollars) (Includes PE, CON, and contingency)	\$0		\$29,000,000 \$15,00	\$15,000,000	\$61,000,000		\$44,000,000	\$37,000,000
	Estimated cost for the interchange improvements	Remaining MTP Allocation for Interstate and Interchange Projects (MTP Allocation - Cost Estimate)	\$74,300,000		\$45,300,000	\$59,300,000	\$13,300,000		\$30,300,000	\$37,300,000
Maintenance &	Estimated cost for the interchange improvements plus 30-	Total 2050 Cost (inclusive of asset maintenance and new construction costs)	\$94,151,074		\$117,516,699	\$105,832,324	\$109,464,064		\$118,859,153	\$121,840,338
Construction Cost	year asset maintenance costs at Exits 12B, 13 & 14	Incremental Additional Cost	\$0		\$23,365,625	\$11,681,250	\$15,312,990		\$24,708,079	\$27,689,264

## Goal: System Preservation

	Chittenden County I-89 2050 Study									
DRAFT Second Round Interchange Screening Matrix										
			Exit 12B	Exi	t 13		Exit	: 14		
Metric	Metric Description	Units	New Interchange	Hybrid + Bike Overpass	SPDI		Enhanced Cloverleaf	DDI		
SYSTEM PRESERVATION	N: Preserve and improve the condition and perfor	rmance of the I-89 corridor.				-				
Asset Maintenance Cost	Estimated 30-year asset maintenance costs at Exits 12B, 13 & 14 combined	Asset Maintenance Cost (Bridges & Culverts) for Exits 12B, 13, & 14 combined (not including assets replaced with construction)	0	0	4		1	0		
Construction Cost	Estimated cost for the interchange improvements	Planning-Level Cost Estimate (millions of 2020 dollars) (Includes PE, CON, and contingency)	3	4	0		1	2		
Construction Cost		Remaining MTP Allocation for Interstate and Interchange Projects (MTP Allocation - Cost Estimate)								
Maintenance & Construction Cost	Estimated cost for the interchange improvements plus 30- year asset maintenance costs at Exits 12B, 13 & 14 combined	Total 2050 Cost (inclusive of asset maintenance and new construction costs)	1	4	3	4	0	0		
		Incremental Additional Cost								





## **Initial Draft I-89 Corridor Bundles**

Investments	Bundle 1	Bundle 2	Bundle 3
Transit (new service, increased frequency, etc.)	$\checkmark$	$\checkmark$	$\checkmark$
Biking (lanes, paths, signals, etc.)	$\checkmark$	$\checkmark$	$\checkmark$
Walking (sidewalks, paths, crosswalks, signals, etc.)	$\checkmark$	$\checkmark$	$\checkmark$
Transportation Demand Management (park and ride lots, ridesharing, telecommuting, TMA, etc.)	$\checkmark$	$\checkmark$	$\checkmark$
Intelligent Transportation Systems (signage, signals, etc.)	$\checkmark$	$\checkmark$	$\checkmark$
Ramp improvements at Exit 14 - Route 2 WB to 89 NB	$\checkmark$	$\checkmark$	√?
Reduce ramp terminal radii along US 2 to slow speeds	$\checkmark$	$\checkmark$	√?
Either Exit 12B, Exit 13 Hybrid, <i>or</i> Exit 13 Single Point Diamond Interchange		$\checkmark$	$\checkmark$
Either Enhanced Cloverleaf <i>or</i> Diverging Diamond Interchange at Exit 14			$\checkmark$

## **Seeking Input**

## Metrics and Scoring, February-March:

- Are there any additional metrics that should be evaluated at this stage?
- Should some of the metrics be scored on a different basis?

## Next Steps, April:

- Which of Enhanced Cloverleaf or Diverging Diamond Interchange at Exit 14 should be included?
- Which of Exit 12B, Exit 13 Hybrid, or Exit 13 Single Point Diamond Interchange should be included?
- Any other specific suggestions as to what should be included in bundles?



## **Next Steps**



- Second Round Interchange Evaluation
  - Outreach to Underrepresented Populations: February March
  - Other interested committees/groups: February March
  - South Burlington City Council: February 16<sup>th</sup> and March 15<sup>th</sup>
  - Online Public Meeting: March 18<sup>th</sup>
  - South Burlington City Council: April 19<sup>th</sup>
- Advisory Committee Meeting #5: April/May
- Corridor Evaluation & Public/Stakeholder Involvement:
   Spring/Summer/Fall 2021
  - Includes identifying the need for I-89 widening in Bundles 2 and/or 3
- Draft & Final Report: Winter 2022

# Thank you!

## **Stay Connected!**

Please reach out to us if you would like to request a similar presentation for a City Committee, Neighborhood Group, etc.

- Charlie Baker <u>cbaker@ccrpcvt.org</u>
- Eleni Churchill <u>echurchill@ccrpcvt.org</u>



This presentation as well as Interchange Evaluation Matrices and Modelling Results and a separate pdf with Technical Memos for review can be found on this project webpage under Task 4: <u>https://envision89.com/project-overview2</u> Web: www.envision89.com Twitter: @envision89 Facebook: Envision89



		Chittenden C DRAFT Second Roun	County I-89 Id Interchar	2050 : nge Scre	Study ening Mat	rix			
			2050 Base	ľ	Exit 12B	Exi	t 13	Exit	14
Metric	Metric Description	Units	Scenario		New Interchange	Hybrid + Bike Overpass	SPDI	Enhanced Cloverleaf	DDI
SAFETY: Enhance safety	along the I-89 Study Corridor and Adjacent Intercha Meets AASHTO Standard for Ramp Spacing to Next Closest	nges for all users				<b>.</b>			
Ramp Spacing	Interchange	Yes / No % Change in Total Estimated Crashes	N/A	_	Yes	Yes*	Yes	Yes	Yes
Safety Impact	Total Crashes across the Network	Compared to 2050 Base Scenario	N/A	-	-3.2%	-1.3%	0.4%	-5.0%	-2.8%
	Interactive Highway Safety Design Model (IHSDM) Change in Fatal and Injury Crashes across the Network	% Change in Estimated Injury / Fatal Crashes Compared to 2050 Base Scenario	N/A	_	-1.1%	-1.9%	-3.1%	-4.5%	-2.3%
Bike/Ped Safety	Safety improvements for bicyclists and redestrians based on Proposed Accommodations, Number of Conflicts Points, and Type of Conflict Point	Relative Level of Safety Improvement for Bicyclists and Pedestrians	N/A	_	Improved	Significantly Improved	Significantly Improved	Improved	Significantly Improved
Safety / Operational Commentary						*Left Off-Ramp and Left On-Ramp Not Advised	from Interstate to	C-D Road Advised at Current/Future Volumes for Loop	Removes Merge on Mainline
LIVABLE, SUSTAINABLE,	& HEALTHY COMMUNITIES: Promote compact grow	th that supports livable, affordable, v	vibrant, and health	y communiti	es.		Highway	Kamps	
Consistent with Regional	Proportion of 2020 to 2050 Household Growth Located in	Total Secondary Growth Households	0		593	203	203	0	0
Plan	Enterprise, Metro, Village and Suburban Designations)	Proportion of 2020 to 2050 Household Growth Located in Growth Zones Inclusive of Secondary Growth	90.24%		90.40%	90.33%	90.33%	90.24%	90.24%
ROW Impacts	Approximate area of ROW impacts based on limit of disturbance around the interchange	Acres of ROW Disturbance	N/A		4.0	0.2	0.0	0.4	0.1
	Additional Travel Time for Traffic Analysis Zones Identified as EJ	Minutes of Additional Travel Time in 2050	N/A		0.019	0.022	0.011	0.018	0.023
Environmental Justice / Underserved Populations	Average Trip Length in the Model	Average Trip Length in minutes	15.69		15.61	15.66	15.68	15.69	15.72
	Additional Travel Time for EJ TAZs as a Percent of Average Trip Length	% Additional Travel Time per Average Trip in 2050	N/A		0.12%	0.14%	0.07%	0.12%	0.15%
MOBILITY & EFFICIENCY	: Improve the efficiency and reliability of the I-89 Co	rridor and Adjacent Interchanges for	all users.	1					
	Daily trips using new interchange in 2050	Total Trips Using New Interchange in 2050	N/A		24,321	56,198	57,334	49,677	46,924
Interchange Trips	Number of daily trips using the Exit 14 Interchange. (Note: For scoring purposes, larger reductions at Exit 12B and 13 were scored	# of Daily Trips Using Exit 14	51,929	-	47,226	46,654	45,319	49,677	46,924
	higher, while at Exit 14, lower reductions were scored higher)	Percent Change in # of Daily Trips Using Exit 14	N/A	_	-9.1%	-10.2%	-12.7%	-4.3%	-9.6%
		Total VMT	5,207,449	_	5,219,058	5,206,473	5,201,707	5,203,632	5,200,102
VMT	Networkwide change in Vehicle Miles of Travel (VMT) per vehicle trip with interchange improvement and projected	Average Trip Length in miles	8.103		8.087	8.097	8.090	8.097	8.092
	growth compared to the Future Base Model	% Change in average trip length in 2050	N/A		-0.20%	-0.07%	-0.17%	-0.07%	-0.14%
VHT	Networkwide change in Vehicle Hours of Travel (VHT) with	Total VHT	147,758		147,394	147,452	147,636	147,737	147,906
	the Future Base Model	% Change in VHT in 2050	N/A	_	-0.25%	-0.21%	-0.08%	-0.01%	0.10%
I-89 Corridor V/C	Mainline corridor congestion as indicated by the number of miles with v/c of greater than or equal to 0.9	Miles of Mainline with v/c > 0.9	1.34		2.18	1.34	1.34	1.34	1.34
Average Delay	Change in 2050 PM Peak Hour Delay at Exit 14	Change in Average Delay per Trip (seconds)	N/A		-40	-34	-37	-47	-41
Bike/Ped Connectivity	Bicyclist and Pedestrian Connectivity Improvements Across I-	Level of Bike/Ped Connectivity Improvements	N/A		Improved	Significantly	Significantly	Improved	Improved
ENVIRONMENTAL STEW	ARDSHIP: Establish a resilient I-89 Corridor that min	imizes environmental impacts associa	ated with the trans	portation sys	stem.	Improved	Improved		
Wetland Impacts	Approximate area of wetland/wetland buffer impacts based on the estimated limits of disturbance for the interchange	Acres of Impact to VSWI W etlands	N/A	_	0	0.4	0.1	0.1	0
	improvements Approximate area of river corridor, floodway, and 100-year	Acres of Impact to 50 ft Wetland Buffers	N/A	_	0.1	1.0	0.5	0.3	0
<b>River Corridors</b>	flood zone impacts based on the estimated limits of disturbance for the interchange improvements	Acres of Impact to 100-year Flood Zone	N/A	-	0	1.1	0.5	0	0
Natural Habitats	Approximate area of rare, threatened, and endangered (RTE) species impacts based on the estimated limits of disturbance for the interchange improvements	Acres of RTE Impacts	N/A		7	0	0	0	0
Resilience	Percent Change Network Trip Robustness (NTR)	Percent change in robustness	N/A	_	-0.38%	0.81%	0.93%	-0.08%	-0.14%
Fuel Consumption	Total Fuel Consumption Across Model Network (based on 2050 projection assuming MTP Investments and 90% electric	Total Gallons of Fuel Consumed per Day in 2050 % Change in Gallons of Evel Consumed per	40,744		40,835	40,736	40,699	40,714	40,686
	vehicle fleet)	Day in 2050	N/A		0.22%	-0.02%	-0.11%	-0.07%	-0.14%
Connectivity to Areas	Percentage of land area within 1 mile of interchange that is	Percentage of area within 1 mile of		]					
Planned for Growth	classified as an ECOS Growth Zone (includes Center, Enterprise, Metro, Village and Suburban Designations) Total number of projected new jobs in 2050 compared to 2020	interchange in ECOS Growth Zone	N/A	_	87%	90%	90%	100%	100%
Job Access	within 1 radial mile of the interchange including adopted job projections and secondary growth Total number of projected 2050 jobs within 1 radial mile of the	ווווויזייטט איזאיז א איז איזער א Mile of the Interchange	N/A	-	3,054	2,461	2,461	4,133	4,133
	new interchange infrastructure including adopted job projections and secondary growth	Total Number of Jobs Within 1 Radial Mile of Interchange	N/A		11,416	9,592	9,592	27,220	27,220
SYSTEM PRESERVATION	: Preserve and improve the condition and performar	nce of the I-89 corridor. Asset Maintenance Cost (Bridges & Culverte)							
Asset Maintenance Cost	Estimated 30-year asset maintenance costs at Exits 12B, 13 & 14 combined	for Exits 12B, 13, & 14 combined (not including assets replaced with construction)	\$94,151,074		\$88,516,699	\$90,832,324	\$48,464,064	\$74,859,153	\$84,840,338
Construction Cost	Estimated cost for the interchange improvements	2020 dollars) (Includes PE, CON, and contingency)	\$0		\$29,000,000	\$15,000,000	\$61,000,000	\$44,000,000	\$37,000,000
Maintenance &	Estimated cost for the interchange improvements plus 30-year	Total 2050 Cost (inclusive of asset maintenance and new construction costs)	\$94,151,074	_	\$117,516,699	\$105,832,324	\$109,464,064	\$118,859,153	\$121,840,338
Construction Cost	asset maintenance costs at Exits 12B, 13 & 14 combined	Incremental Additional Cost	\$0		\$23,365,625	\$11,681,250	\$15,312,990	\$24,708,079	\$27,689,264

 $\underline{\textit{Note:}}$  The grey cells include data for information purposes only.

		Chittenden County I-	89 2050 S	tudy	v		
	DMAPT	Secona Rouna Interch	Exit 12B		x it 13	Exi	t 14
Metric	Metric Description	Units	New Interchange	Hybrid + Bike Overpass	SPDI	Enhanced Cloverleaf	DDI
SAFETY: Enhance safety	along the I-89 Study Corridor and Adjacent Intercha	anges for all users					
Ramp Spacing	Interchange	Yes / No	4	3	4	4	4
Safety Impact	Total Crashes across the Network	Compared to 2050 Base Scenario	3	1	0	4	2
Safety inipact	Interactive Highway Safety Design Model (IHSDM) Change in Fatal and Injury Crashes across the Network	% Change in Estimated Injury / Fatal Crashes Compared to 2050 Base Scenario	0	1	2	4	1
Bike/Ped Safety	Safety Improvements for Bicyclists and Pedestrians based on Proposed Accommodations, Number of Conflicts Points, and Type of Conflict Point	Relative Level of Safety Improvement for Bicyclists and Pedestrians	2	4	4	2	4
Safety / Operational Commentary				*Left Off-Ramp and Left On-Ramp Not Advised	Declassify I-189 from Interstate to Limited Access State	C-D Road Advised at Current/Future Volumes for Loop	Removes Merge on Mainline
LIVABLE, SUSTAINABLE,	& HEALTHY COMMUNITIES: Promote compact grov	vth that supports livable, affordable,	vibrant, and healt	hy communities.	l Highway	Kamps	
Consistent with Regional	Proportion of 2050 Households Located in ECOS Growth	Total Secondary Growth Households					
Plan	Enterprise, Metro, Village and Suburban Designations)	Proportion of 2050 Households Located in Growth Zones Inclusive of Secondary Growth	4	4	4	4	4
ROW Impacts	Approximate area of ROW impacts based on limit of disturbance around the interchange	Acres of ROW Disturbance	0	3	4	3	4
	Additional Travel Time for Traffic Analysis Zones Identified as EJ	Minutes of Additional Travel Time in 2050					
Environmental Justice / Underserved Populations	Average Trip Length in the Model	Average Trip Length in minutes					
	Additional Travel Time as a Percent of Average Trip Length	% Additional Travel Time per Average Trip in 2050	2	2	2	2	2
MOBILITY & EFFICIENCY	: Improve the efficiency and reliability of the I-89 Co	prridor and Adjacent Interchanges for	all users.		! [		
	Daily trips using new interchange in 2050	Total Trips Using New Interchange in 2050					
Interchange Trips	Number of daily trips using the Exit 14 Interchange	# of Daily Trips Using Exit 14					
		Exit 14	2	3	4	0	3
	Networkwide change in Vehicle Miles of Travel (VMT) per	Total VMT					
VMT	vehicle trip with interchange improvement and projected growth compared to the Future Base Model	Average Trip Length in miles					
		% Change in average trip length in 2050	4	0	3	0	2
VHT	Networkwide change in Vehicle Hours of Travel (VHT) with interchange improvement and projected growth compared to	Total VHT					
	the Future Base Model	% Change in VHT in 2050	4	4	2	1	0
I-89 Corridor V/C	Mainline corridor congestion as indicated by the number of miles with v/c of greater than or equal to 0.9	Miles of Mainline with $v/c > 0.9$	0	4	4	4	4
Average Delay	Change in 2050 PM Peak Hour Delay at Exit 14	Change in Average Delay per Trip (seconds)	2	0	1	4	2
Bike/Ped Connectivity	Bicyclist and Pedestrian Connectivity Improvements Across I- 89 Based on Existing and Proposed Accomodations	Level of Bike/Ped Connectivity Improvements	2	4	4	2	2
ENVIRONMENTAL STEW	ARDSHIP: Establish a resilient I-89 Corridor that mir	nimizes environmental impacts associ	ated with the tran	sportation system	1.		
Wetland Impacts	the estimated limits of disturbance for the interchange	Acres of Impact to VSWI W etlands Acres of Impact to 50 ft Wetland Buffers	4	0	4 2	4	4
	Approximate area of river corridor, floodway, and 100-year	Acres of Impact to River Corridors	4	1	0	4	4
River Corridors	disturbance for the interchange improvements	Acres of Impact to 100-year Flood Zone	4	0	2	4	4
Natural Habitats	Approximate area of rare, threatened, and endangered (RTE) species impacts based on the estimated limits of disturbance for the interchange improvements	Acres of RTE Impacts	0	4	4	4	4
Resilience	Percent Change Network Trip Robustness (NTR)	Percent change in robustness	0	4	4	1	0
Fuel Consumption	Total Fuel Consumption Across Model Network (based on 2050 projection assuming MTP Investments and 90% electric	Total Gallons of Fuel Consumed per Day in 2050 % Change in Gallons of Fuel Consumed per	0	2	A	4	1
ECONOMIC ACCESS: Imi	venicle fleet) prove economic access and vitality in Chittenden Co	Day in 2050 unty.	0	3	4	4	4
Connectivity to Areas Planned for Growth	Percentage of land area within 1 mile of interchange that is classified as an ECOS Growth Zone (includes Center, Enterprise, Metro, Village and Suburban Designations)	Percentage of area within 1 mile of interchange in ECOS Growth Zone	0	1	1	4	4
	Total number of projected new jobs in 2050 compared to 2020 within 1 radial mile of the interchange including adopted job	Total number of New Jobs within 1 Radial Mile of the Interchange	1	0	0	4	4
Job Access	Total number of projected 2050 jobs within 1 radial mile of the new interchange infrastructure including adopted job	Total Number of Jobs Within 1 Radial Mile of Interchance	0	0	0	4	4
SYSTEM PRESERVATION	projections and secondary growth Preserve and improve the condition and performation	nce of the I-89 corridor.					
Asset Maintenance Cost	Estimated 30-year asset maintenance costs at Exits 12B, 13 & 14 combined	Asset Maintenance Cost (Bridges & Culverts) for Exits 12B, 13, & 14 combined (not	0	0	4	1	0
Construction Cost	Estimated cost for the interchange improvements	Planning-Level Cost Estimate (millions of 2020 dollars) (Includes PE, CON, and	3	4	0	1	2
		contingency) Total 2050 Cost (inclusive of asset	1			0	0
Maintenance & Construction Cost	Estimated cost for the interchange improvements plus 30-year asset maintenance costs at Exits 12B, 13 & 14 combined	maintenance and new construction costs)		4	3	U	U









Exit 14 DDI





## MEMORANDUM

To: Charlie Baker, Eleni Churchill, Jason Charest
 From: David Saladino, Karen Sentoff, Jeff Bachiochi
 Date: February 11, 2021
 Subject: Technical Memo on Estimating Construction and Asset Maintenance Costs & Consistency with Regional Plan Metrics

This memorandum provides an overview of the following elements of the second-round interchange evaluation currently being conducted for the Chittenden County I-89 2050 Study:

- Summary of Construction and Asset Maintenance Cost Estimation Metrics
- Summary of Consistency with Regional Plan Metric

### Summary of Construction and Asset Maintenance Cost Estimation Metrics

To align with the goal of preserving and improving the condition and performance of the I-89 corridor, metrics regarding the construction capital costs and asset maintenance costs were included in the interchange evaluation. The approximate capital costs for design and construction include the costs to construct, reconstruct, or decommission any existing infrastructure within each respective alternative's footprint. This analysis offers a way to compare the relative costs of each interchange alternative by considering both (a) the capital cost and (b) the cost to maintain the existing infrastructure <u>outside</u> of each project footprint.

Between 2020 and 2050, it is expected that substantial investment will be needed to maintain the existing infrastructure that exists within the study area. The most significant maintenance costs over this timeframe are expected for existing bridges and culverts. For the purpose of this evaluation, an "analysis area" was defined to be all the bridges and culverts that fall within the footprint of any of the five interchange concepts. Asset maintenance costs outside this analysis area would be same for all alternatives and were therefore neglected.

In coordination with the VTrans Asset Management Bureau, network-level information, engineering judgement, and historic unit-costs of likely treatments were used to approximate expected maintenance costs assigned to each existing bridge and culvert based on its age and condition. From this evaluation, a total cost to maintain all assets within the analysis area was found to be approximately \$94 million, which is effectively the maintenance cost of a 'No-Build' scenario between 2020 and 2050 for the existing bridges and culverts located at the three interchanges being evaluated.

The fundamental principle guiding this assessment was to see how spending capital funds at an interchange can reduce future maintenance costs for the broader system. For each interchange alternative, there are several assets that would be repaired, replaced, or decommissioned as part of the construction or reconstruction of the interchange, and the sum of those maintenance costs can be assigned to each interchange alternative as "saved" maintenance costs.

When considering the likely time delay between this study and the start of a capital improvement project, it is not realistic to assume that 100% of those maintenance costs could be avoided. Therefore, this analysis assumes that 25% of these "saved" maintenance costs will be spent prior to project implementation, regardless of the chosen alternative.

**Figure 1** below shows the three construction and asset maintenance cost metrics included in the second round interchange evaluation matrix. The three metrics were calculated as follows:

- **Construction Cost**: Estimated cost for the interchange improvements, including engineering, construction, and contingency. Costs also include replacement or rehabilitation of existing assets (i.e., bridges and culverts) within each project footprint.
- Asset Maintenance Cost: Sum of (a) maintenance costs for assets outside the project footprint, plus (b) the unavoidable maintenance costs of assets within the project footprint (i.e., 25% of the "saved" maintenance costs).
- Maintenance & Construction Cost: Construction cost plus asset maintenance cost.

#### Figure 1: Draft Construction and Asset Maintenance Cost Metrics



## Summary of Consistency with Regional Plan Metric

The CCRPC's ECOS Regional Plan has a goal of directing 90% of future household growth to areas planned for growth (i.e., areas designated as Center, Enterprise, Metro, Village and Suburban in the ECOS Plan). To evaluate the consistency of the five interchange alternatives with this goal, the magnitude and location of projected household growth associated with each interchange alternative was evaluated.

The projected household growth was assumed to be the number of households added between 2020 and 2050 inclusive of Secondary Growth for each scenario at the Transportation Analysis Zone (TAZ) level. In this context, Secondary Growth is defined as the added land development that is anticipated to occur because of the enhanced accessibility and connectivity provided by the interchange investment. This development could be new to the area or attracted from growth that would have occurred in another part of the county. Secondary Growth associated with the interchange alternatives was estimated based on feedback from a Delphi Panel which was convened on July 28, 2020. A technical memorandum describing the Delphi Panel approach and estimation of Secondary Growth is provided as an attachment to this memo.

**Figure 2** below shows the following consistency with Regional Plan metrics included in the second round interchange evaluation matrix:

- **Total Secondary Growth Households**: The total number of additional households projected to be added from 2020 to 2050 as a result of the Secondary Growth associated with each interchange alternative. These values are provided for informational purposes and are not scored in the overall evaluation matrix.
- Proportion of 2020 to 2050 Household Growth Located in Growth Zones Inclusive of Secondary Growth: This metric identifies the proportion of new residential growth (2020-2050) falling within a designated growth area for each interchange alternative. To calculate this metric, the TAZ boundaries were overlaid with the areas targeted for growth in the ECOS Plan, which include Center, Enterprise, Metro, Village and Suburban land use designations. A TAZ, and therefore its households, were included in the area targeted for growth if there was at least 90% coverage of the TAZ within a designated growth zone. For those TAZs with partial coverage by growth areas, it was assumed that 80% of the households would be directed to those areas targeted for growth and 20% would fall in areas designated as Rural. Those TAZs that had complete coverage by the Rural land use designation were considered outside of the growth areas. As noted in the table below, 90.24% of household growth between 2020 and 2050 is expected to occur in designated growth areas in the 2050 Base Scenario (i.e., no interchanges and no Secondary Growth). The additional Secondary Growth households associated with the Exit 12B and Exit 13 alternatives largely fall within designated growth areas and result in metric values slightly higher than the 2050 Base Scenario.

Chittenden County I-89 2050 Study										
DRAFT Second Round Interchange Screening Matrix										
2050 Base Exit 12B Exit 13								Exit 14		
Metric	Metric Description	Metric Description Units				Hybrid + Bike Overpass	SPDI		Enhanced Cloverleaf	DDI
LIVABLE, SUSTAINABL	E, & HEALTHY COMMUNITIES: Promote compact	growth that supports livable, afford	able, vibrant, and h	ealthy con	nmunities.					
Consistent with Regiona	Proportion of 2020 to 2050 Household Growth Located in Growth Zones Inclusive of Secondary Growth (includes	Total Secondary Growth Households	0		593	203	203		0	0
Plan	Center, Enterprise, Metro, Village and Suburban Designations)	Proportion of 2020 to 2050 Household Growth Located in Growth Zones Inclusive of Secondary Growth	90.24%		90.40%	90.33%	90.33%		90.24%	90.24%



## MEMO

TO:	Charlie Baker and Eleni Churchill, CCRPC
FROM:	Jonathan Slason, Benjamin Swanson, and Stephen Lawe, RSG
CC:	David Saladino, VHB
DATE:	February 11, 2021
SUBJECT:	I-89 Secondary Land Use

## Introduction

Direct, indirect, and cumulative impacts are required to be considered in transportation projects as established in the Council of Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR §§ 1500-1508). The emphasis of this memorandum is to summarize the activities to evaluate indirect effects, specifically around land use and development, of the proposed transportation investments being considered in the Interstate 89 (I-89) Corridor project.

Per FHWA, "Indirect effects are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems." (40 CFR § 1508.8)<sup>1</sup>

The concept of indirect effects is effectively encapsulated by the following graphic (Figure 1), which shows there are anticipated and likely actions that are a result of the initial project actions that result in indirect effects. Case law has determined that these likely actions should be based on reasonableness and how 'ordinary' persons would act and need not to consider all conceivable impacts.<sup>2</sup> Note that CEQ regulations use "impact" and "effect" synonymously (40 CFR §1508.8).

<sup>&</sup>lt;sup>1</sup> https://www.environment.fhwa.dot.gov/nepa/QAimpact.aspx

<sup>&</sup>lt;sup>2</sup> Sierra Club v. Marsh, 976 F.2d 763, 767 (1st Cir. 1992)

#### FIGURE 1: DIRECT VS. INDIRECT EFFECTS



#### Source: FHWA

FHWA uses the terms "secondary impacts" and "indirect impacts" interchangeably. For the purposes of the I-89 Project, the team uses "secondary" as the preferred term used herein.

## Secondary Growth

The secondary growth impacts associated with the proposed transportation projects are evaluated by first considering the direct effects of the projects, then making reasonable forecasts of the secondary land use and economic effects, and lastly analyzing the resulting changes in travel demand.

The project team convened a Delphi panel to evaluate the potential secondary land use effects<sup>3</sup> of the Interstate 89 (I-89) Corridor project within Chittenden County. The panel's meeting was held on the morning of July 28, 2020 over the Zoom video conferencing platform. Six panel members with expertise in commercial and residential development as well as community planning were present. Stephen Lawe of RSG led panel members

Delphi Panel: Outside experts and/or stakeholders are engaged in a collaborative discussion, typically through a structured process that also includes professional planners. The collaborative process is used to develop an estimate of the likely effects of a transportation project on land use. (AASHTO Assessing Indirect Effects and Cumulative Impacts under NEPA, 2016)

through a facilitated and structured set of questions and open conversation.

The following six panel members with expertise in commercial and residential development as well as community planning were present:

- Brian Shupe, Executive Director, Vermont Natural Resources Council
- Paul Conner, AICP, Director of Planning & Zoning, City of South Burlington
- Dean Pierce, Director of Planning & Zoning, Town of Shelburne

<sup>&</sup>lt;sup>3</sup> Secondary growth, in this context, is the land development that is anticipated to occur because of the infrastructure project. This development could be new to the area or attracted from growth that would have occurred in another part of the county.

- Chris Snyder, President, Snyder Homes
- Jeff Nick, President, NAI J.L. Davis Realty
- Bart Frisbee, President, Sterling Homes

The group discussed the land use changes that would likely occur if investments were made in the I-89 corridor. These investments focused on a set of preliminary projects including: a potential interchange at Vermont Route 116 (VT 116) known as Exit 12B, additional ramps creating new connections at Exit 13, operational enhancements at Exit 14 as well as a new northbound off-ramp configuration at Exit 14. Additionally, the effect of widening the segment of I-89 between Exit 14 and Exit 15 was also considered.

The panel landed on three secondary land use scenarios associated with I-89 investments:

- 1. Exit 14 University Mall: Modest amount of commercial growth in and around the mall.
- 2. Exit 13, 14, interstate widening between Exits 14 and 15: Slight residential growth north of the project area and in downtown Burlington.
- 3. **Exit 12B**: Significant commercial and residential growth proximate to project with a modest regional growth in residential development.

The degree of change in the land use was quantified by the panel using the terms *slight*, *modest*, and *significant*. The I-89 project team translated the terms into magnitudes of change from the baseline future conditions, with a slight change less than 10%, a modest degree of change would result in a 10–20% difference, and a significant change would result in something more than 20%.

The future baseline conditions from which these changes are compared to is based on the forecast growth that the CCRPC has developed within the most recent ECOS Metropolitan Transportation Long Range Plan (MTP) adopted June 20, 2018.<sup>4</sup> The panel and the initial forecasts all used a 15-year horizon out to 2035 to estimate the secondary growth effects. The out year of 2035 is close enough to envision without being too close to today's specific conditions. The 2020-2035 forecasted growth was then projected out to 2050 to align with the project's horizon year. A discussion of the 2035-2050 growth projections are discussed later in the memo.

Table 1 lists the amount of secondary growth associated with each of the above scenarios by 2035 based on input from the Delphi panel. The growth is identified as that which would be reallocated from forecasted growth elsewhere in the county and growth that would be in addition to the established control totals identified in the future baseline conditions.

<sup>&</sup>lt;sup>4</sup> ECOS. 2017. "2018 Chittenden County ECOS Plan: Supplement 5 – Metropolitan Transportation Plan." Adopted 6/20/2018. Available at: <u>http://www.ecosproject.com/wp/wp-</u>content/uploads/2017/09/ECOSPlan\_MTPSupplement5\_Final\_20180615.pdf.

SECONDARY GROWTH SCENARIO	NEW RESIDENTIAL (HH)	REALLOCATED RESIDENTIAL (HH)	NEW COMMERCIAL (EMP)	REALLOCATED COMMERCIAL (EMP)
1) <b>Exit 14 U Mall</b> . Modest commercial growth in and around U Mall.	_	_	78	78
2) Exit 13, 14, Widening btwn. Exits 14 and 15. Slight residential growth north and in downtown.	101	-	-	-
Franklin County growth	31	-	-	-
3) <b>Exit 12B</b> . Significant commercial and residential proximate to project, modest regional growth in residential.	186	155	450	450

#### TABLE 1: SECONDARY LAND USE BY 2035—SUMMARY OF RESULTS

Notes: HH – Household EMP - Employees U Mall – University Mall

## Scenario 1: Exit 14 University Mall<sup>5</sup>

Panel members agreed that improvements at Exit 14 could create modest new commercial land use growth in the area. This is because the improvements would create an off-ramp through the current University Mall property and intersect Dorset Street at either the Market Street or Garden Street intersection. Panel members also indicated that the magnitude of secondary growth is likely to be 50/50 in terms of reallocating already planned growth in the county versus creating new growth in the county.

Figure 2 shows the numbered traffic analysis zones (TAZs) in the project vicinity. Approximately 780 new employees are included in the CCRPC forecast for these TAZs through 2035.

<sup>&</sup>lt;sup>5</sup> The University Mall Exit 14 scenario was removed from further consideration after the secondary growth Delphi panel process.



FIGURE 2: TAZS IN THE PROJECT VICINITY (EXIT 14 U. MALL RAMP)

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Source: RSG (background via ArcGIS Online)

The panel identified that the Exit 14 ramp would generate a modest increase in secondary commercial growth. Table 2 shows the percentage increase of secondary growth that would be added to the 780 employees in the impacted TAZs.

% INCREASE	SECONDARY GROWTH EMPLOYMENT
10% (modest)	78
15% (modest)	117
20% (modest)	156
25% (significant)	196

### TABLE 2: SCENARIO 1 EMPLOYMENT GROWTH

The panel's proposed modest amount of secondary growth has been interpreted to mean that a 20% increase could be plausible, resulting in 156 additional employees in the affected area. The project team suggests using the higher end of the modest range as this reflects the opportunity for reimagining what the area would look like if this ramp went in.

Of the 156 employees attributed to secondary growth associated with the Exit 14 University Mall ramp, 78 would come from previously forecast growth in the county and 78 would be new employees in excess of the countywide control totals.

## Scenario 2: Exit 13, 14, Widening between Exit 14 and Exit 15— Slight Residential Growth North and in Downtown Burlington

Scenario 2 accounts for the land use changes associated with any of the improvements at Exit 13, Exit 14 (excluding the University Mall ramp), and interstate mainline widening between Exit 14 and Exit 15. The degree of land use change is not expected to vary whether one or more of these changes were to occur (i.e., the total land use change is the same regardless of whether Exit 13 is pursued in addition to interstate widening, or whether only one of the improvements are made).

The panel indicated that these improvements would result in slight changes in residential land uses in central areas (Burlington and South Burlington) and areas to the north (Colchester, Milton, and Franklin County). This scenario assumes that the secondary residential growth would be new growth to the county, above the forecast control totals.

The effect on travel time savings is a valuable proxy to estimate the degree of impact any change in transportation capacity is likely to have. The effects of the additional capacity associated with any of these projects (Exit 14, Exit 13, and mainline widening between Exit 14 and 15), was estimated to have up to 2–3 minutes of travel time savings to a few locations.<sup>6</sup>

To estimate the degree of change warranted by this travel time savings, a sample trip to the north between Burlington and St. Albans is used. An existing travel time of 34

<sup>&</sup>lt;sup>6</sup> The regional travel demand model, which was run early in the project, showed the travel time savings for a mainline widening between Exit 13 and Exit 16 resulted in a time savings of <2 minutes at the Franklin county border during the PM peak hour.

minutes between Burlington and St. Albans could potentially require 2 or 3 fewer minutes, or a reduction of approximately 6% (in the absence of induced traffic and secondary growth). This is estimated by the isochrones in Figure 3 and Figure 4 which compares the area to the north that is reachable when the origin of the trip shifts 2-3 minutes further north (from Battery Street to Prospect Street).





Source: Travel Time App



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FIGURE 4: ISOCHRONE 2–3 MINUTES CLOSER TO ST. ALBANS (PROSPECT/MAIN)

Source: Travel Time App<sup>7</sup>

The panel's belief of slight residential growth was evaluated for levels of 2.5%, 5%, and 7.5% increases in residential household units in excess of the forecast growth. The amount of forecast growth and secondary growth is shown for each geography in Table 3.

<sup>&</sup>lt;sup>7</sup> TravelTime. "Map Demo." Available at: <u>https://app.traveltime.com/search/0\_lat=44.47618&0\_lng=-73.20561&0\_title=Pomodoros%2C%20South%20Burlington%2C%20VT%2C%20USA&0\_mode=driving</u>.



SCENARIO 2	FORECAST GROWTH (2020–2035)	2.5%	5.0%	7.5%
	Central			
Burlington	1,683	42	84	126
South Burlington	1,135	28	57	85
Net Increase	2,818	70	141	211
% of Anticipated				
County Growth	_	1.0%	2.1%	3.1%
(6,829)				
	Points No	rth		
Colchester	814	20	41	61
Milton	422	11	21	32
Net Increase	1,236	31	62	93
% of Anticipated				
County Growth	_	0.5%	0.9%	1.4%
(6,829)				
Total county growth	_	101	203	304
% of Anticipated				
County Growth	_	1.5%	3.0%	4.5%
(6,829)				
	Franklin Co	ounty		
Net Increase	1,228	31	61	92
	All Area	S		
Net increase				
(central & north	_			
Chittenden Ctny.,				
Franklin Ctny.)		132	264	396
Total % of NW				
Vermont Growth	8.057			
(8,057 HH units	0,000	4.004	0.001	
torecast 2020-2035)		1.6%	3.3%	4.9%
Total % of State				
Growth (10,000 HH	—			
forecast 2020-2035)		1.3%	2.6%	4.0%

#### **TABLE 3: SCENARIO 2 HOUSEHOLD GROWTH**

Notes: HH – Household NW – Northwest

The increase in access seen in areas of the county is supported by the panel's assertion that areas central and north of the improvements would experience a slight degree of change associated with the improvement in travel time.

Travel time is just one of many factors that influences whether an individual changes travel patterns, let alone where they live and work. As such, changes in capacity do not directly affect the underlying land development patterns in a linear or straightforward way, which is why the Delphi panel approach is valuable.

However, recent research<sup>8</sup> points to a related aspect, which examines how expanding capacity may result in that capacity serving new traffic over time, thereby increasing overall net vehicle miles traveled (VMT). According to this research, induced demand is

<sup>&</sup>lt;sup>8</sup> Volker, J. M. B., Lee, A. E., and S. Handy. 2020. "Induced Vehicle Travel in the Environmental Review Process." Transportation Research Record: Journal of the Transportation Research Board, 2674(7), 468–479. Available at: <u>https://journals.sagepub.com/doi/10.1177/0361198120923365</u>.

often underestimated during the project planning process. Among the study's findings was that between 5–21% of the increase in VMT was associated with an increase in population. It follows that some of that change will not only be existing users, but future users (new households).

The estimated travel savings of 6% in travel time influences the degree of secondary growth, estimated at an increase of 1.6% additional households in northwest Vermont (above table). The relationship between a 1.6% growth in households associated with a 6% travel time savings, is a ratio of 1.6%:6% relationship (new households to travel time savings). This is ratio new households to travel time is 26% (1.6 divided by 6), which is slightly more than 5-21% increase in VMT associated with new residents noted in the above research.<sup>9</sup> Since traffic volume is more responsive (individuals can quickly shift travel modes or the time they travel) than land use, this response is reasonable given the estimated change in travel time associated with these improvements.

Therefore, the slight amount (2.5% additional) of estimated secondary growth of 132 households in key locations within northwestern Vermont by 2035 appears to be reasonable.

## Scenario 3: Exit 12B—Significant Commercial and Residential Proximate to Project, Modest Residential (Regionally)

Scenario 3 considers the effects of a new interchange at the existing VT 116 overpass. The Delphi panel identified that the Exit 12B interchange would significantly affect secondary growth in the area immediately surrounding the new interchange and modestly affect residential growth in the nearby region.

The interchange was the focus of a 2010 scoping study that analyzed several interchange configurations and future traffic operations. Since that time, it has been included in a handful of other studies and evaluations. The most recent of these is the VT 116/Kimball Avenue/Tilley Drive Land use & Transportation Plan. This study, referred to here as the Tilley Drive study<sup>10</sup> included Tilley Drive and the areas adjacent to the potential interchange on the south side of I-89. The study included a build out estimation developed through consultation with area property owners and the City. The commercial and residential build out tables from that investigation are shown in Table 4 and Table 5, respectively.

In both cases, the one-third build out scenarios are similar to the I-89 CCRPC MTP forecast numbers for 2050. This suggests that these zones are forecast to achieve one-third of their "build-out" potential by 2050 in the absence of significant changes in the forecasts' assumptions. If Exit 12B were to be built, this *would* result in a significant

<sup>&</sup>lt;sup>9</sup> These ratios are elasticities often used in transportation planning to communicate the degree of response one variable has onto another. For example a 10% change in gas price may reduce VMT by 1%, this is a 0.1 elasticity. This study identifies a 0.26 inelastic response of housing associated with the change in travel time. <sup>10</sup> Chittenden County Regional Planning Commission. 2020. "VT 116/Kimball Ave/Tilley Drive Land Use & Transportation Plan." Available at: <u>https://www.ccrpcvt.org/wp-content/uploads/2020/07/Kimball-Tilley-Council-Presentation-2020-07-06.pdf</u>.

change in the network and the market fundamentals of the parcels in and around the interchange.

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	2015	STUDY BUILD OUT NUMBERS			CCRPC MTP	
AREA NAME	BASE	1/3	2/3	Full Build	2035 Forecast	2050 Forecast
Meadowland PUD/Dynapower	1,306	1,642	1978	2,313	1,620	1,840
Rye	95	107	119	131	157	202
Technology Park	711	1,293	1,875	2,457	968	1,150
UVM-MC	207	395	583	771	319	398
Hill Farm	0	395	790	1,185	136	229
O'Brien Farm	17	80	143	205	107	170
Subtotals	2,336	3,911	5,487	7,062	3,307	3,989

#### TABLE 4: TILLEY DRIVE STUDY—COMMERCIAL BUILD OUT (EMPLOYEES)

#### TABLE 5: TILLEY DRIVE STUDY—RESIDENTIAL BUILD OUT (HOUSEHOLDS)

COMMON LAND	2015	STUDY BUILD OUT NUMBERS			CCRPC MTP	
AREA NAME	BASE	1/3	2/3	Full Build	2035 Forecast	2050 Forecast
Meadowland PUD/Dynapower	9	9	9	9	9	10
Rye	271	288	306	323	383	480
Technology Park	0	0	0	0	0	0
UVM-MC	6	76	146	216	27	45
Hill Farm	1	223	444	666	29	53
O'Brien Farm	214	447	681	914	329	426
Subtotals	501	1,043	1,586	2,128	777	1,014

### Commercial

The Tilley Drive study evaluated the most affected properties near the Exit 12B interchange and benchmarked the secondary growth that could be realized. Given that by 2050 only the one-third build out is anticipated to be reached, the project team recommends that the difference between the one-third build out and the two-third build out (1,576) represents the amount of secondary growth associated with the construction of the Exit 12B interchange by 2050 (roughly 45 new employees annually from 2015). However, to remain consistent with the panel, by 2035, an estimated 900 new employees (20 years at 45 per year) are to be added due to secondary growth, an increase of 27% over the 2035 CCRPC forecast. The project team combined the secondary growth of 900 employees with the existing MTP forecast growth of 971 employees. This resulted in an estimate of 1,871 new employees in this area by 2035. The 1,871 figure represents 57% of the total forecast employee growth in South Burlington by 2035.



### Is this reasonable?

- Commercial land use is much more sensitive to travel time and access changes. The project team used the regional travel demand model<sup>11</sup> to reinforce and quantify the Delphi panel's input. The model compared the effects in the network of an existing 22-minute trip from Tilley Drive to eastern edge of the county via I-89. With Exit 12B in place, there were the following changes:
  - Four (4) zones most affected with > 5 minutes of travel time savings (23–26% savings).
  - Seven (7) zones with over 4 minutes of time savings (19–26% savings).
  - Sixteen (16) zones with over 2 minutes of time savings (9–26% savings).
  - Thirty-four (34) zones with over 1 minute of travel time savings (5–26% savings).

Figure 5 shows the existing travel time from Google Maps from Tilley Drive to the county boundary on I-89 that the project team analyzed in the regional travel demand model.



FIGURE 5: 22-MINUTE TRIP FROM EXIT 12B TO CHITTENDEN COUNTY BORDER ON I-89

Source: Google Maps

<sup>&</sup>lt;sup>11</sup> Chittenden County Regional Planning Commission. 2020. "Modeling." Available at: <u>https://www.ccrpcvt.org/our-work/transportation/transportation-resources/modeling/.</u>

Figure 6 shows the changes in travel time with the Exit 12B interchange for specific TAZs in the travel demand model.

### FIGURE 6: CCRPC TRAVEL DEMAND MODEL—EXIT 12B TRAVEL TIME CHANGES



#### Source: RSG

The secondary growth of 900 new employees is an increase of 27.4% over the forecasted growth in South Burlington (Table 6). Given the amount of travel time savings (maxes out around 26%), this appears reasonable given the panel's insight there is high demand for accessible commercial land proximate to Exit 12B.

	FORECAST CHANGE BY 2035 (EMP GROWTH)	SECONDARY GROWTH (EMP)	TOTAL GROWTH (FORECAST + SECONDARY)
Growth in Employees	-	900	1,871
South Burlington	3,290	27.4%	56.9%
Chittenden County	19,669	4.6%	9.5%
Vermont	28,754	3.1%	6.5%

### **TABLE 6: SCENARIO 3 SECONDARY GROWTH—EMPLOYEES**

### New vs. Relocation Employment Growth

The total employment change (1,871) is 57% of the total CCRPC forecast employee growth in South Burlington by 2035. This magnitude suggests that some of the secondary growth (900) would be due to a shift from elsewhere in the county, with the remainder being new commercial growth in Chittenden County above the county control total.

The panel suggested that an estimate of 50% of the secondary growth is a good basis for secondary growth that is new to the county because of the Exit 12B investment. Therefore, the 900-employee secondary growth comprises the following:

- 450 new employees in the Exit 12B area would be relocated from elsewhere in the county (already part of the countywide control total).
- 450 new employees in the Exit 12B area would be new jobs in the county adding to the countywide control total.

### Residential

### Localized Residential Effects

The panel indicated that there would be a significant amount of residential secondary growth in the area immediately proximate to the Exit 12B interchange. The increase would occur in the areas planned for residential growth with the assumption that if the interchange were to go in, allowable densities would increase to accommodate market demand for additional housing.

The residential build out analysis for the Exit 12B area, summarized in Table 5, shows that the one-third Tilley Drive forecasts are similar to the 2050 CCRPC forecast. Like the commercial growth, the difference between the one-third and two-third forecasts is an estimate of secondary growth that would occur because of the Exit 12B interchange.

The panel agreed that the Exit 12B area is a desirable place to meet the latent demand for residential land in the county. If housing can be constructed to meet the market (e.g., entry level, affordable, accessible), it would be reasonable to expect housing unit growth above and beyond the forecast. The forecast imbalance between jobs in the county versus housing suggests that more housing in the county would find demand.

The residential secondary growth associated with Exit 12B is the difference between the one-third and the two-third build out estimated from the Tilley Drive study. This change is anticipated to occur over a period of years (perhaps by 2050 with current market conditions) in the absence of an Exit 12B investment—averaging an annual net increase of 15 households per year. Of the total difference between the one-third and two-third build out (543), an estimated 310 housing units of secondary growth would occur by 2035. This represents an increase of 40% over the 2035 forecast.

### Is this reasonable?

The MTP forecast for the Exit 12B area includes an increase of 276 households through 2035. With the secondary growth of 310 there would be a total of 586 new households in this area by 2035. The residential forecast and secondary growth in the Tilley Drive area immediately proximate to the Exit 12B area would experience a 117% increase from

2015 levels. The 586 new households also represent 51.6% of the total forecast growth in households in South Burlington by 2035.

	FORECAST CHANGE BY 2035 (HH GROWTH)	SECONDARY GROWTH (HH)	TOTAL GROWTH (FORECAST + SECONDARY)
Growth in Households	-	310	586
South Burlington	1,135	27.3%	51.6%
Chittenden County	6,829	4.5%	8.6%
Vermont	10,000	3.1%	5.9%

#### TABLE 7: SCENARIO 3 SECONDARY GROWTH—PROXIMATE RESIDENTIAL

Notes: HH – Household

### New vs. Relocation Employment Growth

The panel indicated that the Exit 12B housing demand is intended to meet the latent demand in the county and mitigate the jobs-to-housing imbalance. A 50/50 split is estimated for the secondary growth in housing, with 155 household units being reallocated from elsewhere in the county and 155 household units new to the county in excess of the control totals.

### **Regional Residential Effects**

The panel indicated that in addition to the commercial and residential effects immediately proximate to the Exit 12B interchange, there would be a modest amount of increased residential growth in the region affected by the increased access that the interchange provides.

The degree of change at the regional level is based on the amount of secondary growth proximate to the interchange, which is estimated to be 310 new household units in excess of the forecasts.

The project team selected the high end of the modest range based on an estimate of what degree of growth is reasonable. At 20% of 155 (the new secondary growth in excess of the county control totals), there would be approximately 31 new households added to the control totals and forecasts for TAZs, which would benefit from improved access to the interstate at Exit 12B, excluding those already receiving growth in the earlier analysis.

The panel suggested that this growth would be entirely new to the county. The 31 new households will need to be allocated to the specific TAZs based on the amount of travel time savings as a measure for attractiveness. They aggregate to municipality as shown in Table 8.

MUNICIPALITY	ADDITIONAL HH BY 2035
South Burlington	11
Shelburne	9
Williston	7
Other	4

### TABLE 8: ADDITIONAL HOUSEHOLDS, BY MUNICIPALITY

It may seem improbable that there was not more growth in communities south of the Exit 12B project area. The change in travel time based on modeled travel times to a point on I-89 with and without Exit 12B in place<sup>12</sup> was used to inform the relative attractiveness that specific TAZs have within the county. It was determined that outside of the immediate area surrounding Exit 12B there were a handful of TAZs in South Burlington, Shelburne, and Williston that are most affected by the Exit 12B interchange. A handful of other TAZs spread around St. George, Hinesburg, and Charlotte comprise the remaining zones.

### Scenario 3 Summary

## Commercial Growth (2020-2035)

- Secondary growth: 900 new employees to the study area.
- 450 new employees into the county.
- 450 employees reallocated from growth anticipated elsewhere in the county.

## Residential Growth: Proximate (2020-2035)

- Secondary growth: 310 new household units.
- 155 household growth to occur at Exit 12B from growth anticipated to have occurred elsewhere in county.
- 155 household growth to occur at Exit 12B that is new to the county.

## Residential Growth: Regional (2020-2035)

• 31 household growth that is new to the county.

## Expansion to 2050

The second task in the development of the secondary land use is the extension of the growth estimated by 2035 out to the future planning year of 2050. The initial three secondary growth scenarios to 2035 are developed by changing the baseline forecasts developed in the ECOS MTP. The expansion to 2050 follows the same logic by using the baseline forecasts that were established for 2035 to 2050 and then applying the

<sup>&</sup>lt;sup>12</sup> The analysis run by RSG for the purposes of the Delphi panel and the secondary growth analysis. This analysis is shown in Figure 6.

same percentage changes. The details for each scenario are described below in each section. The total secondary growth between today and 2050 is the sum of the changes between 2020 and 2035 plus the changes between 2035 and 2050.

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The summary of the secondary growth between 2035 and 2050 for the three improvement scenarios is shown in Table 9.

SECONDARY GROWTH SCENARIO	NEW RESIDENTIAL (HH)	REALLOCATED RESIDENTIAL (HH)	NEW COMMERCIAL (EMP)	REALLOCATED COMMERCIAL (EMP)
1) <b>Exit 14 U Mall</b> . Modest commercial growth in and around U Mall.	_	-	75	75
2) Exit 13, 14, Widening btwn. Exits 14 and 15. Slight residential growth north and in downtown.	107	-	-	-
Franklin County growth	33	-	-	-
3) <b>Exit 12B</b> . Significant commercial and residential proximate to project, modest regional growth in residential.	139	116	338	337

#### TABLE 9: SECONDARY LAND USE 2035 - 2050 - SUMMARY OF RESULTS

Notes: HH – Household EMP - Employees U Mall – University Mall

## Scenario 1: Exit 14 University Mall<sup>5</sup>

The secondary land use associated with the relocation of the northbound off-ramp routing through the University Mall property is estimated to result in additional employment surrounding the improvement.

The secondary land use growth between 2035 and 2050 is estimated by using the 20% modest change in employment identified by the panel. The base forecast in the MTP for the TAZs of interest (see Figure 2) has a change of 750 additional employees. The secondary growth is estimated to be 150 new employees in these TAZs, with 75 being new to the county and 75 being relocated from other TAZs in the county.

## Scenario 2: Exit 13, 14, Widening between Exit 14 and Exit 15—Slight Residential Growth North and in Downtown Burlington

The secondary land use associated with the capacity increases and reconfigurations of Exit 13 and Exit 14 and any widening of the I-89 mainline between Exit 14 and Exit 15 is expected to increase demand for regional residential growth and in downtown Burlington.

The secondary land use growth between 2035 and 2050 is estimated by using the 2.5% slight change in residential dwellings identified by the panel. The same logic used to develop the secondary growth between 2020-2035 is used to estimate the secondary growth between 2035 and 2050.

The results are summarized in Table 10.

SCENARIO 2	FORECAST GROWTH (2035–2050)	2.5%
	Central	
Burlington	1,625	41
South Burlington	1,276	32
Net Increase	2,901	73
% of Anticipated Chittenden County Growth (7,166)	_	1.0%
	Points North	
Colchester	903	23
Milton	486	12
Net Increase	1,389	35
% of Anticipated County Growth (7,166)	_	0.48%
Total county growth	—	107
% of Anticipated Chittenden County Growth (7,166)	_	1.50%
	Franklin County	
Net Increase	<b>1,322</b> <sup>13</sup>	33
	All Areas	
Net Increase		140

#### TABLE 10: SCENARIO 2 HOUSEHOLD GROWTH – 2035 TO 2050

The base forecast in the MTP for the area of interest in scenario 2 is expected to increase by 4,290 households in Chittenden County and 1,322 in Franklin County. Applying the 2.5% increase in households across these areas results in an increase of 140 households total, with 107 in Chittenden County and 33 in Franklin County.

## Scenario 3: Exit 12B—Significant Commercial and Residential Proximate to Project, Modest Residential (Regionally)

The secondary growth by 2050 associated with the new interchange uses the previous detailed analysis that comprised the VT 116/Kimball Avenue/Tilley Drive Land Use & Transportation Plan. This plan informed the secondary growth by 2035 by estimating what portion of the build out of the adjacent area is likely by 2035.

The build out analysis of the area adjacent to the interchange indicated that a 1/3 build out aligned with the baseline 2050 forecasts included in the ECOS MTP. The degree of

<sup>&</sup>lt;sup>13</sup> Household change by 2050 estimated by multiplying the average change in households in the Central region (3%) and the Points North (12%) by the change forecast by 2035.
change in the area identified by the Delphi panel aligned well with the difference between the 2/3 build out and the 1/3 build out. The total amount of secondary growth in the area proximate to the Exit 12B area by 2050 is the total change between those two build outs - 1,575 employees and 542 households. The build out numbers are shown in Table 4 and Table 5 above.

The secondary growth expected between 2035 and 2050 is the total change minus what is expected by 2035.

	TOTAL (2020-2050)	2020-2035	2035-2050
Employees	1,575	900	675
Households	542	310	232

#### TABLE 11: SCENARIO 3 SECONDARY GROWTH BY 2050

The secondary growth in employment and households between 2035 and 2050 is expected to be comprised of 50% growth new to the county and 50% taken from growth that was assumed elsewhere in the county.

An additional 23 households are also expected to be associated with secondary growth impacts of the new interchange slightly further away from the immediate project area. The number of households (23) is estimated to be a 20% increase of the 116 new households moving into the county (50% of the 232 households).

Summary of scenario 3 Secondary Growth between 2035 and 2050:

## Commercial Growth (2035-2050)

- Secondary growth: 675 new employees to the study area.
- 338 new employees into the county.
- 337 employees reallocated from growth anticipated elsewhere in the county.

#### Residential Growth: Proximate (2035-2050)

- Secondary growth: 232 new household units.
- 116 household growth to occur at Exit 12B from growth anticipated to have occurred elsewhere in county.
- 116 household growth to occur at Exit 12B that is new to the county.

#### Residential Growth: Regional (2035-2050)

• 23 household growth that is new to the county.

# Land Use Allocation Process of the Secondary Growth

The secondary growth between 2020 and 2050 is allocated to the TAZs within the regional model using a process akin to the original allocation of land use used to develop the baseline future forecasts in the ECOS MTP.

Each of the three secondary land use growth scenarios is assessed individually and are mutually exclusive.

#### Scenario 1: Exit 14 University Mall

The secondary growth in scenario 1 is focused within the TAZs immediately proximate to the University Mall Exit 14 off-ramp. Because some of that growth is comprised from relocated growth there is a countywide analysis that subtracts half of the growth in the focused area from other growth in the county.

The removed employment growth throughout the county is based on the relative employment attractiveness. A total of 55 TAZs across the county sent some of the expected growth to the scenario 1 study area, with an average value of -.15 and the maximum of -3.95 employees in any one zone. The land use analysis uses fractional units throughout the development of the model inputs until a rounding to integers is done at the end, just before using in the model. Figure 7 shows the countywide relocation, with very minor negative values spread around and more significant positive values in the University Mall study area.

FIGURE 7: 2050 SCENARIO 1 - RELOCATED EMPLOYMENT COMPARED TO 2050 BASE

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The total increase in employment in the area proximate to the new ramp is allocated in proportion using both the absolute number of employees and the percent change the TAZ experiences over the time periods. This is demonstrated in Table 12 for the secondary growth between 2035 and 2050.

TAZ	FORECAST 2035	FORECAST 2050	CHANGE	% CHANGE	WEIGHT BY GROWTH	WEIGHT BY FUTURE SIZE	% CHANGE: WEIGHTING (75% GROWTH AND 25% SIZE)	TOTAL INCREASE (2035- 2050)
707	404	405	1	0.25%	0.13%	7%	2%	2.9
708	1,470	1,643	173	11.77%	6.20%	30%	12%	18.1
722	480	543	63	13.13%	6.91%	10%	8%	11.4
723	115	128	13	11.30%	5.95%	2%	5%	7.6
724	239	270	31	12.97%	6.83%	5%	6%	9.5
725	542	581	39	7.20%	3.79%	10%	5%	8.2
726	116	132	16	13.79%	7.26%	2%	6%	9.1
727	703	860	157	22.33%	11.76%	15%	13%	19.0
734	18	22	4	22.22%	11.70%	0%	9%	13.3
736	328	548	220	67.07%	35.32%	10%	29%	43.4
737	393	424	31	7.89%	4.15%	8%	5%	7.5
							Total	150

TABLE 12: ALLOCATION OF SECONDARY GROWTH (2035-2050)

#### Scenario 2: Exit 13, 14, Widening between Exit 14 and Exit 15—Slight Residential Growth North and in Downtown Burlington

Scenario 2 secondary growth only involves new residential growth above and beyond the regional control totals. This requires only a consideration as to which TAZs are eligible to receive that growth and then how to allocate it to those TAZs. The ECOS plan identifies areas that are intended to meet 90% of the region's growth. Only these TAZs identified for this growth are used to receive the additional households identified in scenario 2. In the end, 74 TAZs met the criteria, which included being identified for growth and within the communities of Burlington, Colchester, Milton, South Burlington, and Winooski.

The average TAZ received 1.4 households with no TAZ receiving more than 8.9 households. The distribution of the households is shown in Figure 8.



FIGURE 8: 2050 SCENARIO 2 – ADDITIONAL HOUSEHOLDS COMPARED TO 2050 BASE

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# Scenario 3: Exit 12B—Significant Commercial and Residential Proximate to Project, Modest Residential (Regionally)

The allocation of the secondary growth associated with the Exit 12B interchange is more complex involving several steps. These include accounting for relocated households and employment, new households and employment, and new household growth regionally.

The change in PM peak hour travel times associated with the Exit 12B interchange is used in conjunction with the original land use allocation process used in the ECOS MTP. The travel times account for how the interchange changes travel time to the southeastern county boundary along I-89. Several origins and destinations were reviewed during the secondary growth investigation and the I-89 project team determined this destination had the most significant changes due to the interchange at Exit 12B.

The land use allocation process used in the ECOS MTP considered the percent of the TAZ developed and the amount of development that could be possible (considering zoning, resource constraints, and other limitations imposed by the local government). The relocation process used the travel time and previous allocation process to develop an overall value for how 'attractive' the TAZs is (or isn't) for household or employment growth.

Areas least attractive to growth are the TAZs sending the most growth that will be relocated to the area surrounding Exit 12B, while those most attractive will be the ones receiving the relocated land uses. The households removed or added to a zone use the overall attractiveness value of the TAZ relative to all other TAZs in the county (through normalization) to guide how much is removed or added to any specific TAZ.

#### Households

The relocated households to the Exit 12B area were removed from 217 TAZs in the county and added to 86 TAZs. The new regional households that are further away from Exit 12B investment are added to 40 TAZs.

The secondary growth in households by 2050 is summarized in Table 13.

	RELOCATED HOUSEHOLDS	NEW PROXIMATE HOUSEHOLDS	NEW REGIONAL HOUSEHOLDS
2020-2035	155	155	31
2035-2050	116	116	23
Total	271	271	54

#### TABLE 13: SECONDARY GROWTH IN HOUSEHOLDS

Figure 9 shows the total change between scenario 3 secondary growth and the 2050 base forecast.

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## Employment

The relocated employment to the Exit 12B area were removed from 194 TAZs in the county and added to 42 TAZs.

The secondary growth in employment by 2050 is summarized in Table 14.

	RELOCATED EMPLOYEES	NEW PROXIMATE EMPLOYEES
2020-2035	450	450
2035-2050	338	337
Total	788	787

TABLE 14: SECONDARY GROWTH IN EMPLOYMENT

Figure 10 shows the total change between the scenario 3 secondary growth and the 2050 base forecast.



FIGURE 10: 2050 SCENARIO 3 - EMPLOYMENT COMPARED TO 2050 BASE

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