

## 4 Affected Environment, Environmental Consequences, and Mitigation

### 4.22 Indirect Effects

#### 4.22.1 Introduction

This section assesses the potential indirect effects of the Build Alternative on the Study Area.

Indirect effects are those that are caused by an action and are later in time or farther removed in distance but are still reasonably foreseeable. These effects can include inducing changes in patterns of land use, population density or growth rate as well as other related effects on air, water, and other natural ecosystems. Indirect effects are considered for environmental resources that exhibit induced changes from project activities.<sup>1</sup> As a result, only indirect effects from the Build Alternative are considered in this section.

Past and present activities at Cape Cod Canal include maintenance of the federal navigation channel and routine maintenance of Sagamore and Bourne Bridges. Reasonably foreseeable future actions in the context of the Cape Cod Bridges Program (Program) include the continuation of current maintenance and navigation activities as well as connected bridge approach road work required by the Massachusetts Department of Transportation (MassDOT) to connect new replacement bridges to existing roadways.<sup>2</sup>

##### 4.22.1.1 Regulatory Background

Regulatory context and guidance for consideration of potential indirect effects are derived from the following:

- Federal Highway Administration (FHWA). Guidance for Preparing and Processing Environmental and Section 4(f) Documents. Technical Advisory T 6640.8A. October 1987.<sup>3</sup>

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<sup>1</sup> Federal Highway Administration (FHWA). NEPA and Transportation Decisionmaking: Secondary and Cumulative Impact Assessment in the Highway Project Development Process. April 1992.

[https://www.environment.fhwa.dot.gov/nepa/impact\\_assessment\\_highway\\_dev.aspx](https://www.environment.fhwa.dot.gov/nepa/impact_assessment_highway_dev.aspx)

<sup>2</sup> U.S. Army Corps of Engineers. 2022. [Environmental Assessment and Finding of No Significant Impact for Major Rehabilitation Evaluation. Cape Cod Canal Highway Bridges, Massachusetts](https://www.nae.usace.army.mil/Portals/74/docs/Topics/Cape%20Cod%20Canal%20Bridges/Reports/MRER-Env-Assessment-March2022-FONSI-FINAL.pdf). March. <https://www.nae.usace.army.mil/Portals/74/docs/Topics/Cape%20Cod%20Canal%20Bridges/Reports/MRER-Env-Assessment-March2022-FONSI-FINAL.pdf>

<sup>3</sup> Federal Highway Administration (FHWA). Guidance for Preparing and Processing Environmental and Section 4(f) Documents. Technical Advisory T 6640.8A. October 1987. [https://www.environment.fhwa.dot.gov/Legislation/NEPA/guidance\\_preparing\\_env\\_documents.aspx](https://www.environment.fhwa.dot.gov/Legislation/NEPA/guidance_preparing_env_documents.aspx)

- Federal Highway Administration’s (FHWA) Interim Guidance on the Application of Travel and Land Use Forecasting in NEPA (National Environmental Policy Act), March 2010<sup>4</sup>
- FHWA’s Instructions for Reviewing Travel and Land Use Forecasting Analysis in NEPA Documents<sup>5</sup>

Regional and local context informing the assessment of indirect effects is derived from the following:

- Town of Bourne’s Local Comprehensive Plan (2019)<sup>6</sup>
- Cape Cod Commission’s Regional Policy Plan (2019)<sup>7</sup>
- Cape Cod Regional Transportation Plan<sup>8</sup>
- Cape Cod Climate Action Plan<sup>9</sup>

#### 4.22.1.2 Methodology

The indirect effects analysis qualitatively assesses the potential indirect effects of the Build Alternative on the Study Area. The section evaluates the Build Alternative’s consistency with local and regional comprehensive plans related to economic development, transportation needs, open space, and land use. The section reviews regional development trends and growth assumptions for Barnstable, Dukes, and Nantucket Counties. Lastly, the indirect effects analysis discusses the travel time savings and access changes associated with the Build Alternative and assesses the potential for induced regional travel demand and development for the Build Alternative.

#### 4.22.1.3 Study Area

The Study Area for this indirect effects assessment is Barnstable County (**Figure 4.22-1**). This Study Area was developed to encompass the geographic extent that could be potentially affected by the Build Alternative through indirect effects. The size of the Study Area enables the consideration of effects that occur later in time, or farther in distance, from the Project Limits, but are still reasonably foreseeable.

Note that for the economic evaluation included in the indirect effects analysis, the Study Area briefly expands to also include Nantucket and Dukes Counties.

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<sup>4</sup> Federal Highway Administration. March 2010. [Interim Guidance on the Application of Travel and Land Use Forecasting in NEPA](https://www.environment.fhwa.dot.gov/nepa/Travel_LandUse/travel_landUse_rpt.aspx). [https://www.environment.fhwa.dot.gov/nepa/Travel\\_LandUse/travel\\_landUse\\_rpt.aspx](https://www.environment.fhwa.dot.gov/nepa/Travel_LandUse/travel_landUse_rpt.aspx)

<sup>5</sup> Federal Highway Administration. February 2018. [Instructions for Reviewing Travel and Land Use Forecasting Analysis in NEPA Documents](https://www.environment.fhwa.dot.gov/nepa/Travel_LandUse/forecasting_reviewer_guidance.aspx). [https://www.environment.fhwa.dot.gov/nepa/Travel\\_LandUse/forecasting\\_reviewer\\_guidance.aspx](https://www.environment.fhwa.dot.gov/nepa/Travel_LandUse/forecasting_reviewer_guidance.aspx)

<sup>6</sup> Cape Cod Commission. 2019. [Town of Bourne Local Comprehensive Plan](https://www.capecodcommission.org/our-work/town-of-bourne-local-comprehensive-plan). <https://www.capecodcommission.org/our-work/town-of-bourne-local-comprehensive-plan>

<sup>7</sup> Cape Cod Commission. 2019. [Regional Policy Plan](https://www.capecodcommission.org/our-work/rpp). <https://www.capecodcommission.org/our-work/rpp>

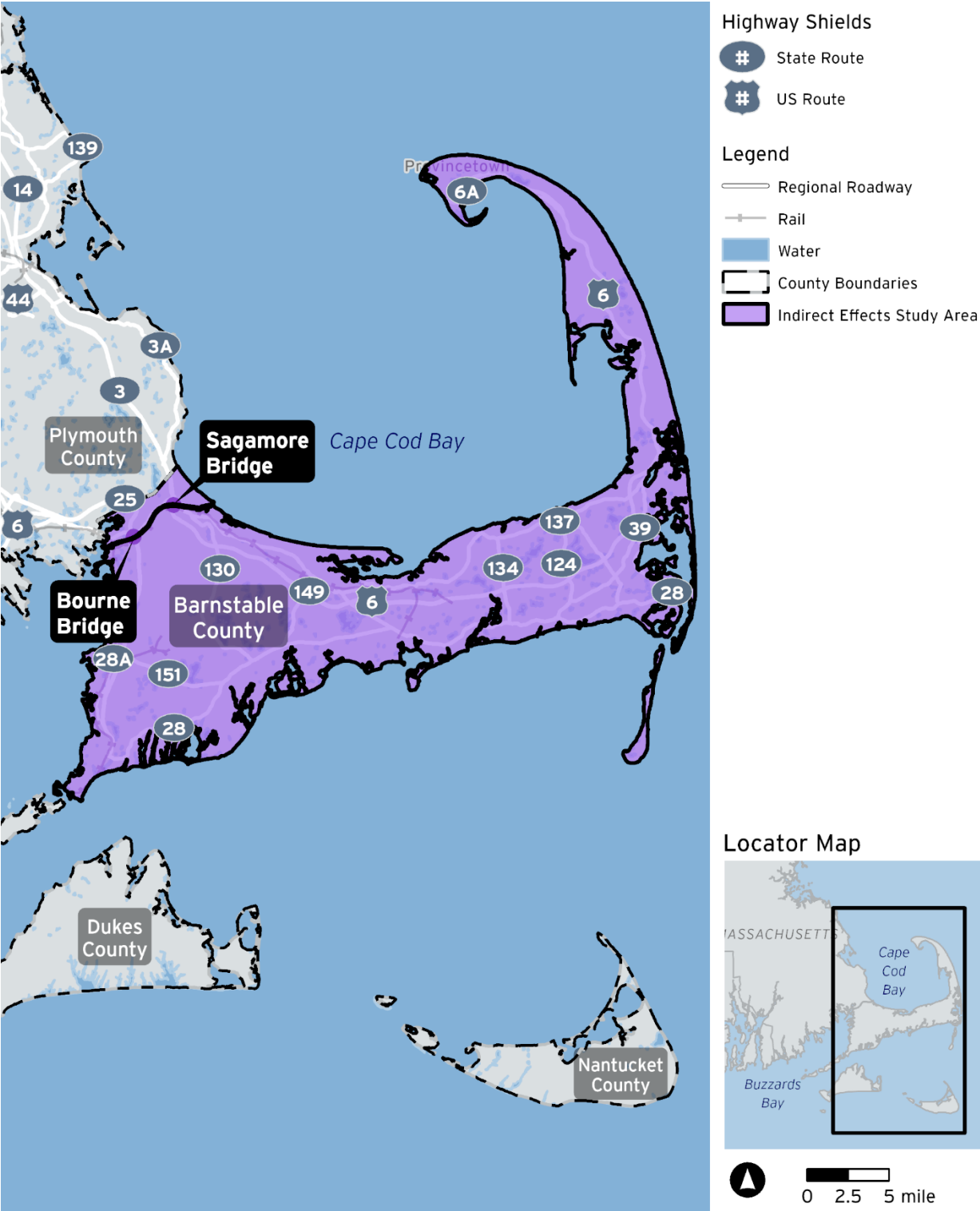
<sup>8</sup> Cape Cod Commission. 2024. [Cape Cod 2024 Regional Transportation Plan](https://www.capecodcommission.org/our-work/rtp/). <https://www.capecodcommission.org/our-work/rtp/>

<sup>9</sup> Cape Cod Commission. 2021. [Cape Cod Climate Action Plan](https://www.capecodcommission.org/our-work/climate-action-plan/). <https://www.capecodcommission.org/our-work/climate-action-plan/>

#### 4.22.2 Indirect Effects

This section evaluates effects of the Build Alternative that occur later in time, or farther in distance, from the Project Limits, but are still reasonably foreseeable. Beneficial indirect effects of the Build Alternative identified in this section include the provision of economic benefits to local and regional economies, the preservation of natural resources on Cape Cod, the creation of reliable mobility opportunities through the implementation of connected and resilient infrastructure, and regional travel time savings resulting in economic and social benefits. Lastly, this section evaluates the potential for the Build Alternative to create induced travel demand or induced development as a result of the proposed infrastructure improvements.

Figure 4.22-1. Indirect Effects Study Area



Source: Massachusetts Department of Transportation, 2024

#### 4.22.2.1 Consistency with Comprehensive Plans

The Build Alternative would be consistent with the Town of Bourne's Local Comprehensive Plan<sup>10</sup> for goals relating to economic development, transportation needs, open space, and land use. [Table 4.22-1](#) describes this consistency.

Table 4.22-1. Build Alternative: Consistency with the Town of Bourne's Local Comprehensive Plan

| Topic                                        | Build Alternative: Consistency with the Local Comprehensive Plan                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Economic Development</b>                  | The Build Alternative's proposed shared-use paths, bike and pedestrian connections would align with the Town of Bourne's vision to support lucrative recreational activities (e.g., boating, golf) and boost the local economy by providing multimodal network connections across the region, and improved access to jobs, schools, and local businesses. <sup>[*]</sup>                                                                                                                                                              |
| <b>Adequacy of Infrastructure</b>            | The Build Alternative would align with the Local Comprehensive Plan's (LCP) goals for infrastructure by improving the flow of through traffic crossing the town of Bourne, replacing the aging canal bridges and the Bourne Bridge Rotary with a conventional highway interchange, by increasing the elevation of the highway bridges by approximately three feet to account for fluctuations in relative sea level, and by incorporating design features into Program elements to maximize adaptation and resiliency. <sup>[*]</sup> |
| <b>Open Space Impacts</b>                    | The Build Alternative would support the LCP's open space goals by minimizing impacts to open space and enhancing public access through shared-use paths that would provide additional network connections to local roadways. The Build Alternative would also be consistent with the LCP's goal to protect the public rights for fishing, navigation, and recreation, and would maintain and improve navigational passage through Cape Cod Canal. <sup>[*]</sup>                                                                      |
| <b>Compatibility with Adjacent Land Uses</b> | Significant alterations to adjacent land uses are not anticipated as a result of the Build Alternative's proposed bridge replacements. Construction impacts would be minimized, which would support the LCP's land use and zoning goals. Additionally, the Build Alternative would support LCP's goals of ensuring that future development respects the town's historic traditions by identifying measures to mitigate the loss of the historic bridges, and by developing the design in coordination with the public. <sup>[*]</sup> |

<sup>[\*]</sup> Massachusetts Department of Transportation. April 2023. Environmental Notification Form. Cape Cod Bridges Program, Bourne, MA.

<sup>10</sup> Cape Cod Commission. 2019. [Town of Bourne Local Comprehensive Plan](https://www.capecodcommission.org/our-work/town-of-bourne-local-comprehensive-plan). <https://www.capecodcommission.org/our-work/town-of-bourne-local-comprehensive-plan>

The Build Alternative would be consistent with the Cape Cod Regional Policy Plan,<sup>11</sup> the Cape Cod Regional Transportation Plan,<sup>12</sup> and the Cape Cod Climate Action Plan<sup>13</sup> for goals relating to economic development, transportation needs, and open space. **Table 4.22-2** describes this consistency.

**Table 4.22-2. Build Alternative: Consistency with Regional Plans**

| Topic                             | Build Alternative: Consistency with Regional Plans                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Economic Development</b>       | To improve the efficiency and reliability of freight movement and support economic stability, the Regional Transportation Plan’s objectives include reducing delays, improving travel time reliability on the freight network, and minimizing Cape Cod Canal bridge maintenance impacts. By replacing the functionally obsolete bridges, the Build Alternative would address the existing poor traffic operations and the ongoing maintenance needs of the existing bridges while ensuring a stable and robust regional economy. <sup>[*]</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Adequacy of Infrastructure</b> | <p>The Build Alternative would align with the Regional Policy Plan’s goal of developing infrastructure to meet the region’s needs while protecting regional resources and promoting long-term sustainability and resiliency. The bridges are being designed to maximize sustainability and resiliency, facilitate more efficient traffic operations to improve travel flow on and off the Cape during emergency events, and to provide for safer and more reliable navigation at the bridge sites.<sup>[*]</sup> Furthermore, the Build Alternative would enable multimodal transportation options and improve safety for all modes.<sup>[*]</sup></p> <p>The Build Alternative would align with the Cape Cod Climate Action Plan’s strategies to address vulnerabilities in public infrastructure and manage development in coastal areas by incorporating stormwater improvements, including best management practices and green infrastructure, to provide water quality treatment measures.<sup>[*]</sup></p> |
| <b>Open Space Impacts</b>         | The Build Alternative would be consistent with the open space and cultural heritage goals of the Cape Cod Regional Policy Plan. Significant alterations to adjacent land uses, including operational and construction impacts to maritime uses, are not anticipated as a result of the Build Alternative’s proposed bridge replacements. The replacement bridges would each have a shared-use path, which would connect residents and visitors to open space recreational areas on both sides of the canal. To address the Regional Policy Plan’s cultural heritage goal, the Program would include a Memorandum of Agreement to incorporate measures to mitigate for the demolition of the historic bridges. <sup>[*]</sup>                                                                                                                                                                                                                                                                                      |

<sup>[\*]</sup> Massachusetts Department of Transportation. April 2023. Environmental Notification Form. Cape Cod Bridges Program, Bourne, MA.

<sup>11</sup> Cape Cod Commission. 2019. [Regional Policy Plan](https://www.capecodcommission.org/our-work/rpp). <https://www.capecodcommission.org/our-work/rpp>

<sup>12</sup> Cape Cod Commission. 2024. [Cape Cod 2024 Regional Transportation Plan](https://www.capecodcommission.org/our-work/rtp/). <https://www.capecodcommission.org/our-work/rtp/>

<sup>13</sup> Cape Cod Commission. 2021. [Cape Cod Climate Action Plan](https://www.capecodcommission.org/our-work/climate-action-plan/). <https://www.capecodcommission.org/our-work/climate-action-plan/>

#### 4.22.2.2 Regional Development Trends and Growth Assumptions

To evaluate the potential impact of the Build Alternative on future development and growth, this section assesses regional development trends and growth assumptions of Barnstable County (the Indirect Effects Study Area), Dukes County, and Nantucket County.

According to annual county-based population estimates produced by the U.S. Census Bureau:<sup>14, 15</sup>

- The Barnstable County population decreased by 2% from 2010 to 2019, increased by 12% from 2019 to 2021, and increased by <1% from 2021 to 2024.
- The Dukes County population increased by 5% from 2010 to 2019, increased by 21% from 2019 to 2021, and decreased by approximately 1% annually from 2021 to 2024.
- The Nantucket County population also increased by 11% from 2010 to 2019, increased 27% from 2019 to 2021, and decreased <1% from 2021 to 2024.

The decrease in population growth seen in Barnstable County from 2010 to 2019 can likely be attributed to the historical pattern of retirees moving to Cape Cod, countered by younger adults leaving Cape Cod for work or school. As of 2020, Barnstable County's median age was 55 years, significantly higher than Massachusetts median age of 40 years. Additionally, as of 2023, 34% of the population was aged 65 and over (compared to 18.5% of the Massachusetts population), while only 13.7% were under 18 (compared to 19.2% of the Massachusetts population).<sup>16</sup>

Although population grew over 1% in Barnstable County from 2019 to 2021, in all other years from 2000 to 2024, population growth grew at a rate of <1% per year. An average annual growth rate of less than 1% per year is expected to have little to no potential for land use change in the Study Area,<sup>17</sup> and can likely be attributed to limited and seasonal employment opportunities on Cape Cod combined with the high cost of living and housing.

When considering estimated housing growth, a 2012 Cape Cod Commission buildout analysis determined that 27,842 units were available for development in Barnstable County, and a 2017 UMass Donahue Institute housing market analysis estimated potential future demand for 26,000 residential units over a 10-year period. An updated housing market analysis was released in 2023 by the UMass Donahue Institute's analysis which predicted housing unit demand and supply in Barnstable County for

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<sup>14</sup> U.S. Census Bureau, Population Division. March 2020. [Annual Estimates of the Resident Population for Counties in Massachusetts: April 1, 2010, to July 1, 2019 \(CO-EST2019-ANNRES-25\)](https://www.census.gov/data/datasets/time-series/demo/popest/2010s-counties-total.html). <https://www.census.gov/data/datasets/time-series/demo/popest/2010s-counties-total.html>

<sup>15</sup> U.S. Census Bureau, Population Division. March 2024. [Annual Estimates of the Resident Population for Counties: April 1, 2020, to July 1, 2024 \(CO-EST2024-POP25\)](https://www.census.gov/data/tables/time-series/demo/popest/2020s-counties-total.html). <https://www.census.gov/data/tables/time-series/demo/popest/2020s-counties-total.html>

<sup>16</sup> U.S. Census Bureau. [QuickFacts: Barnstable County, MA](https://www.census.gov/quickfacts/fact/table/barnstablecountymassachusetts/AGE295221?utm_). [https://www.census.gov/quickfacts/fact/table/barnstablecountymassachusetts/AGE295221?utm\\_](https://www.census.gov/quickfacts/fact/table/barnstablecountymassachusetts/AGE295221?utm_)

<sup>17</sup> ECONorthwest & Portland State University. 2001. [A Guidebook For Evaluating the Indirect Land Use and Growth Impacts of Highway Improvements: Final Report](https://www.oregon.gov/odot/Programs/ResearchDocuments/AGuidebookforUsingIndirLand.pdf). April. Prepared for Oregon Department of Transportation. <https://www.oregon.gov/odot/Programs/ResearchDocuments/AGuidebookforUsingIndirLand.pdf>

2030, 2040, and 2050. The updated analysis determined that the demand for housing in Barnstable County is projected to exceed housing supply through 2050. Based on a projection of 2020 population figures, the gap between supply and demand for housing units in Barnstable County is estimated at 13,273 units in 2025 and 13,436 in 2030.<sup>18</sup> As a result, residential housing in Barnstable County is expected to be at or above capacity,<sup>19</sup> and any near-term housing growth is expected to consume the remaining supply of developable land regardless of the Program. Residential development in Barnstable County is further stymied by high construction costs,<sup>20</sup> wastewater infrastructure limitations,<sup>21</sup> water supply constraints,<sup>22</sup> and municipal service capacity constraints.

In addition to these housing growth limitations, the existing Barnstable County road network has several bottlenecks that would limit the impact of bridge replacement on future growth and development. According to the 2024-2044 Cape Cod Metropolitan Planning Organization Regional Transportation Plan,<sup>23</sup> and the 2018 Cape Cod Emergency Traffic Plan,<sup>24</sup> there has been a steady increase in traffic throughout Barnstable County, and a proliferation of challenges managing these traffic conditions due to restrictions in route options and capacity. Therefore, despite small, anticipated improvements in travel time, it is unlikely for the Build Alternative to significantly improve access to Barnstable County and increase the number of visitors and development opportunities.<sup>25</sup>

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- <sup>18</sup> Cape Cod Commission. 2023. [Cape Cod Housing Needs](https://capecodcommission.org/resource-library/file/?url=/dept/commission/team/Website_Resources/housing/CC-Housing-Needs-Assessment-2023.pdf&_gl=1*a51bx9*_ga*NzA5NzU0NDZlE3Mjk1NDAwMzc.*_ga_LTW77CPM1M*MTc0MTE5NDYwNi4yNC4xLjE3NDExOTYyOTUuMC4wLjA). UMass Donahue Institute. [https://capecodcommission.org/resource-library/file/?url=/dept/commission/team/Website\\_Resources/housing/CC-Housing-Needs-Assessment-2023.pdf&\\_gl=1\\*a51bx9\\*\\_ga\\*NzA5NzU0NDZlE3Mjk1NDAwMzc.\\*\\_ga\\_LTW77CPM1M\\*MTc0MTE5NDYwNi4yNC4xLjE3NDExOTYyOTUuMC4wLjA](https://capecodcommission.org/resource-library/file/?url=/dept/commission/team/Website_Resources/housing/CC-Housing-Needs-Assessment-2023.pdf&_gl=1*a51bx9*_ga*NzA5NzU0NDZlE3Mjk1NDAwMzc.*_ga_LTW77CPM1M*MTc0MTE5NDYwNi4yNC4xLjE3NDExOTYyOTUuMC4wLjA).
- <sup>19</sup> U.S. Army Corps of Engineers. 2022. [Environmental Assessment and Finding of No Significant Impact for Major Rehabilitation Evaluation. Cape Cod Canal Highway Bridges, Massachusetts](https://www.nae.usace.army.mil/Portals/74/docs/Topics/Cape%20Cod%20Canal%20Bridges/Reports/MREREnvAssessm ent.pdf). March. <https://www.nae.usace.army.mil/Portals/74/docs/Topics/Cape%20Cod%20Canal%20Bridges/Reports/MREREnvAssessm ent.pdf>
- <sup>20</sup> County of Barnstable. 2023. [Barnstable County HOME Consortium Program Year 2023 Annual Action Plan](https://www.capecod.gov/wp-content/uploads/2022/03/AAP-2023-Approved.pdf). July. <https://www.capecod.gov/wp-content/uploads/2022/03/AAP-2023-Approved.pdf>
- <sup>21</sup> Cape Cod Commission. [Our Work: Wastewater](https://www.capecodcommission.org/our-work/wastewater/). Accessed December 2024. <https://www.capecodcommission.org/our-work/wastewater/>
- <sup>22</sup> Cape Cod Commission. 2015. [Cape Cod Area Wide Water Quality Management Plan Update](https://www.capecodcommission.org/resource-library/file/?url=/dept/commission/team/208/208%20Final/Cape_Cod_Area_Wide_Water_Quality_Management_Plan_Update_June_15_2015.pdf). June. [https://www.capecodcommission.org/resource-library/file/?url=/dept/commission/team/208/208%20Final/Cape\\_Cod\\_Area\\_Wide\\_Water\\_Quality\\_Management\\_Plan\\_Update\\_June\\_15\\_2015.pdf](https://www.capecodcommission.org/resource-library/file/?url=/dept/commission/team/208/208%20Final/Cape_Cod_Area_Wide_Water_Quality_Management_Plan_Update_June_15_2015.pdf)
- <sup>23</sup> Cape Cod Commission. [Cape Cod Regional Transportation Plan 2024-2044](https://www.capecodcommission.org/our-work/rtp). <https://www.capecodcommission.org/our-work/rtp>
- <sup>24</sup> Commonwealth of Massachusetts. 2018. [Cape Cod Emergency Traffic Plan](https://www.mass.gov/doc/cape-cod-emergency-traffic-plan/download). July. <https://www.mass.gov/doc/cape-cod-emergency-traffic-plan/download>
- <sup>25</sup> U.S. Army Corps of Engineers. 2022. [Environmental Assessment and Finding of No Significant Impact for Major Rehabilitation Evaluation. Cape Cod Canal Highway Bridges, Massachusetts](https://www.nae.usace.army.mil/Portals/74/docs/Topics/Cape%20Cod%20Canal%20Bridges/Reports/MREREnvAssessm ent.pdf). March. <https://www.nae.usace.army.mil/Portals/74/docs/Topics/Cape%20Cod%20Canal%20Bridges/Reports/MREREnvAssessm ent.pdf>

#### 4.22.2.3 Travel Time Savings and Access Changes

According to results of the network-level traffic analysis found in **Section 4.2, Transportation, Traffic, and Safety**, overall network travel time for the Build Alternative is estimated to reduce to 2,240 hours of total travel time compared to the 2,879 hours of total travel time estimated for the No Build Alternative.<sup>26</sup> This indicates that vehicular mobility within the Indirect Effects Study Area for the 2050 Build Alternative is anticipated to be more efficient than the 2050 No Build Alternative.

The traffic analysis also measured travel time between origin and destination (O-D) points to determine the efficiency of travel along major routes on and near the bridges for the No Build Alternative and Build Alternative. Travel times along all major O-D routes, including cross-canal crossings, are estimated to improve for the 2050 Build Alternative compared to the 2050 No Build Alternative. These estimated reductions in travel times along O-D routes reflect improved accessibility within the Study Area for the Build Alternative.

In addition to vehicular travel time savings and access improvements, the Build Alternative proposes several access improvements for bicyclist and pedestrian travelers, described in detail in **Section 4.3, Pedestrian and Bicycle Facilities**. According to the bicyclist and pedestrian analysis, new bicyclist and pedestrian connections on and near Sagamore Bridge would enable safe and comfortable access for residential neighborhoods to access the Sagamore Park and Ride Lot, the bus depot, and the Canal Service Road for recreational use. On and near Bourne Bridge, new bicyclist and pedestrian connections would provide safe and comfortable access for residents to access local schools, the bus depot, local businesses, and recreational facilities.

#### 4.22.2.4 Induced Travel Demand

This section examines the potential for the Build Alternative to result in induced travel demand due to proposed Program improvements. **Section 4.2, Transportation, Traffic, and Safety**, provides additional detail regarding the estimation of induced travel demand.

As noted in the FHWA's Interim Guidance on the Application of Travel and Land Use Forecasting in NEPA,<sup>27</sup> four different components contribute to induced demand, including change in the number of trips, travel routes, mode of travel, and time of travel.

Induced travel demand could occur from new trips due to latent demand or from modifications of existing travel patterns. Trips due to latent demand are identified as new trips that drivers would make if travel conditions improved, such as less congestion or higher design speeds. Socioeconomic factors including changes in households and employment as well as growth in visitor trips can also contribute to latent demand. Based on the most recent 2020 census data, population growth on Cape Cod is

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<sup>26</sup> The network travel times are the summation of the travel times for all vehicles within the network.

<sup>27</sup> Federal Highway Administration. 2010. [Interim Guidance on the Application of Travel and Land Use Forecasting in NEPA](https://www.environment.fhwa.dot.gov/nepa/Travel_LandUse/travel_landUse_rpt.aspx). March. [https://www.environment.fhwa.dot.gov/nepa/Travel\\_LandUse/travel\\_landUse\\_rpt.aspx](https://www.environment.fhwa.dot.gov/nepa/Travel_LandUse/travel_landUse_rpt.aspx)

expected to remain stagnant and in some areas are expected decline by the year 2050.<sup>28</sup> Factors limiting visitor growth include availability and cost of seasonal rentals, occupancy limits of major attractions, and parking constraints, among others.

In addition, improvements to traffic operations are limited to the bridges and the interchanges directly north and south of the canal. Many visitor trips are long distance in nature, where visitors travel from mainland Massachusetts, New England, and beyond, and involve stays of multiple days. Therefore, changes in travel times are expected to only affect a short portion of a trip. For these reasons, it is not anticipated that there would be a significant increase in the number of trips that would otherwise not travel to Cape Cod due to congestion.

This assessment is supported by the traffic analysis conducted in **Section 4.2, Transportation, Traffic, and Safety**, in which the average annual daily traffic crossing Sagamore and Bourne Bridges for both 2050 No Build Alternative and 2050 Build Alternative conditions is estimated at 129,200 vehicles per day, illustrating that travel time improvements anticipated by this Program are not anticipated to generate additional trips to Cape Cod.

In addition to trips due to latent demand, potential induced travel demand can result from changing travel patterns. The following describes three common causes of induced travel demand that are not due to new travel, but to modifications of existing trip activities:<sup>29</sup>

- Travel routes (route redistribution, where a driver travels across the replacement bridge as a new route instead of using a previous non-bridge-related route) – The bridges provide the only vehicular access across Cape Cod Canal; therefore, it is impossible for there to be induced travel demand resulting from route redistribution.
- Mode of travel (modal shifts from one form of transportation to another, where a transit rider shifts to driving a private vehicle to travel across the bridge) – Improved traffic operations would improve bus travel times and reliability, which may make public transportation a more attractive mode of travel. With improved bicycle and pedestrian facilities, there are also opportunities to convert shorter vehicular trips to alternative modes. However, impacts due to a change in mode of travel are anticipated to be minimal because vehicular traffic would still make up most trips across the canal.
- Time of travel (shifts from off-peak-hour travel to peak-hour travel, where a driver deliberately travels on the bridges during off-peak hours to avoid congestion and then returns to peak-hour travel after the bridge replacement) – Based on traffic modeling conducted for the No Build Alternative and Build Alternative conditions, approximately 25% of the summer Saturday peak-period trip demand could shift to off-peak hours due to added congestion caused by expected

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<sup>28</sup> UMass Donahue Institute. 2024. [Massachusetts Population Projections 2000-2050](https://donahue.umass.edu/business-groups/economic-public-policy-research/massachusetts-population-estimates-program/population-projections). <https://donahue.umass.edu/business-groups/economic-public-policy-research/massachusetts-population-estimates-program/population-projections>

<sup>29</sup> The Massachusetts Department of Transportation (MassDOT) examined whether these modifications could apply to the replacement Sagamore or Bourne Bridges. MassDOT. 2023. Environmental Notification Form. Cape Cod Bridges Program, Bourne, MA. April.

seasonal visitor growth. This trip demand could then switch back to peak-hour travel after the bridge completion and travel conditions improve. Based on modeling for the Build Alternative, the travel shifts back to the peak-period traffic would likely occur during the peak summer months and would occur mostly during the Saturday peak. However, the total number of daily vehicle trips are not anticipated to increase.

#### 4.22.2.5 Induced Development

**Section 4.5, Socioeconomics**, reports and describes the predicted induced economic impacts and associated induced development for the No Build Alternative and Build Alternative for the year 2050. The socioeconomic analysis estimated the creation of 21 jobs on Cape Cod and the Islands (Martha's Vineyard and Nantucket) in 2050 due to operational transportation improvements of the Build Alternative. If this estimated job increase is translated into potential land effects, at an average of 500 square feet per job,<sup>30</sup> the impact would be approximately 10,500 square feet of new development. In Barnstable County alone there was 26,836,000 square feet of commercial space<sup>31</sup> as of September 2024. Therefore, an additional 10,500 square feet would be an incremental impact of 0.039%, which represents a negligible induced development effect of the Build Alternative. This finding is consistent with the land use and community facility assessments in **Section 4.6, Land Use, Zoning, and Community Cohesion**, and **Section 4.7, Community Facilities**, which illustrate that the Build Alternative would not result in induced development due to direct or indirect effects.

#### 4.22.2.6 Other Indirect Effects

As discussed in **Section 4.5, Socioeconomics**, the socioeconomic effects of construction expenditures of the two bridges includes consideration of indirect and induced effects on business output, household earnings, employment, gross domestic product, and state, local, and federal taxes. Indirect effects capture the supply chain response, while induced effects reflect increased household spending from wages earned. Refer to **Table 4.5-18** for the economic and fiscal effects of the Program, which includes consideration of indirect and induced effects.

The Build Alternative would not result in indirect effects to inland wetlands or coastal resource areas that would result in changes to the functions and values in terms of the overall wetland hydrology, cover type, or fragmentation. The Build Alternative would not result in isolated fragments of wetlands or waterways. Potential indirect effects include the unintended introduction of invasive plant species as discussed in **Section 4.9, Wetlands and Floodplains**.

As discussed in **Section 4.20, Public Health**, the Build Alternative would provide substantial operational benefits that would positively contribute to public health, including traffic safety and operations, active transportation safety and mobility, reduced likelihood of exposure to hazardous materials, new permanent stormwater control measures, and a reduction in operational noise effects. These benefits

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<sup>30</sup> Average across all sectors in Cape Cod and the Islands, calculated in **Section 4.5, Socioeconomics**.

<sup>31</sup> Estimated using [retail, office, and industrial commercial space estimates in Barnstable County using CoStar Property Information Systems](https://www.costar.com), September 2024. <https://www.costar.com>

of the Build Alternative would contribute to improved public health outcomes within the Study Area over the long term.

#### 4.22.2.7 Indirect Effects Summary

This section evaluates the Build Alternative’s consistency with comprehensive plans, regional development trends and growth assumptions, anticipated travel time savings and access changes, and the potential for induced travel development demand. While MassDOT considered the Build Alternative’s potential to result in reasonably foreseeable indirect effects to all environmental impact categories considered in the DEIS, MassDOT determined that the reasonably foreseeable indirect effects of the Build Alternative would include economic, environmental, and transportation benefits, and result in negligible travel and development demand effects. [Table 4.22-3](#) summarizes those indirect effects that would result from the Build Alternative.

Table 4.22-3. Build Alternative: Summary of Indirect Effects

| Section                                                      | Summary of Indirect Effects                                                                                                                                                                                                                                                                                                                                     |
|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Section 4.2, Transportation, Traffic, and Safety</b>      | Improves vehicular mobility for 2050 conditions, including reduced network travel time and along major origin-destination routes (refer to <a href="#">Section 4.22.2.3</a> ).<br>No induced travel demand anticipated (refer to <a href="#">Section 4.22.2.4</a> ).                                                                                            |
| <b>Section 4.3, Pedestrian and Bicycle Facilities</b>        | New bicyclist and pedestrian connections would promote multimodal access to surrounding facilities and network connections across the region (refer to <a href="#">Section 4.22.2.3</a> ).<br>Minimal effects associated with mode shift from vehicles to alternative modes could occur (refer to <a href="#">Section 4.22.2.4</a> ).                           |
| <b>Section 4.5, Socioeconomics</b>                           | Construction expenditures would contribute to indirect economic effects associated with supply chain response and increased household spending from wages earned (refer to <b>Section 4.5.2, Affected Environment</b> ).<br>Creates 21 jobs on Cape Cod and the Islands (Martha's Vineyard and Nantucket) by 2050 (refer to <a href="#">Section 4.22.2.5</a> ). |
| <b>Section 4.6, Land Use, Zoning, and Community Cohesion</b> | No indirect effects anticipated.<br>Other factors, such as high cost of living and housing, seasonal employment, and other transportation bottlenecks, would likely constrain visitation and development within Barnstable County regardless of the Build Alternative (refer to <a href="#">Section 4.22.2.2</a> ).                                             |
| <b>Section 4.9, Wetlands and Floodplains</b>                 | Potential unintended introduction of invasive plant species (refer to <b>Section 4.9.4.2, Indirect Effects</b> ).                                                                                                                                                                                                                                               |
| <b>Section 4.20, Public Health</b>                           | Improves public health outcomes over the long term.                                                                                                                                                                                                                                                                                                             |