

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 and is supported by [Appendix 4.22, Assessment of Induced Demand and Induced Development](#).

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. As a result, only indirect effects from the Build Alternative are considered in this section.

Reasonably foreseeable future actions in the context of the Cape Cod Bridges Program (Program) include continuing maintenance [of the Sagamore and Bourne Bridges and federal navigation channel](#), conducting navigation activities, and performing bridge approach road work required by the Massachusetts Department of Transportation (MassDOT) to connect new replacement bridges to existing roadways.¹

4.22.1.1 Regulatory Background

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

- Federal Highway Administration's (FHWA) Interim Guidance on the Application of Travel and Land Use Forecasting in NEPA (National Environmental Policy Act), March 2010²
- FHWA's Instructions for Reviewing Travel and Land Use Forecasting Analysis in NEPA Documents³

¹ 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](#). March.

<https://www.nae.usace.army.mil/Portals/74/docs/Topics/Cape%20Cod%20Canal%20Bridges/Reports/MRER-Env-Assessment-March2022-FONSI-FINAL.pdf>

² 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

³ 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

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

- Town of Bourne’s Local Comprehensive Plan (2019)⁴
- Cape Cod Commission’s Regional Policy Plan (2019)⁵
- Cape Cod Regional Transportation Plan⁶
- Cape Cod Climate Action Plan⁷

4.22.1.2 Methodology

The indirect effects assessment evaluated potential growth-inducing effects of the Proposed Action that could generate changes in development patterns, travel demand, environmental and human health conditions, or economic conditions in the Study Area. Therefore, the indirect effects analysis 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. The indirect effects analysis assesses the potential for induced regional travel demand and development for the Build Alternative, and the section considers the potential induced environmental and economic impacts of the Build Alternative on the Study Area.

4.22.1.3 Study Area

The Study Area for the 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.

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. This includes the following potential indirect effects, which are outlined as follows and addressed in the subsequent sections:

- **Induced Residential and Commercial Development:**
 - Section 4.22.2.1, Consistency with Comprehensive Plans

⁴ 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>

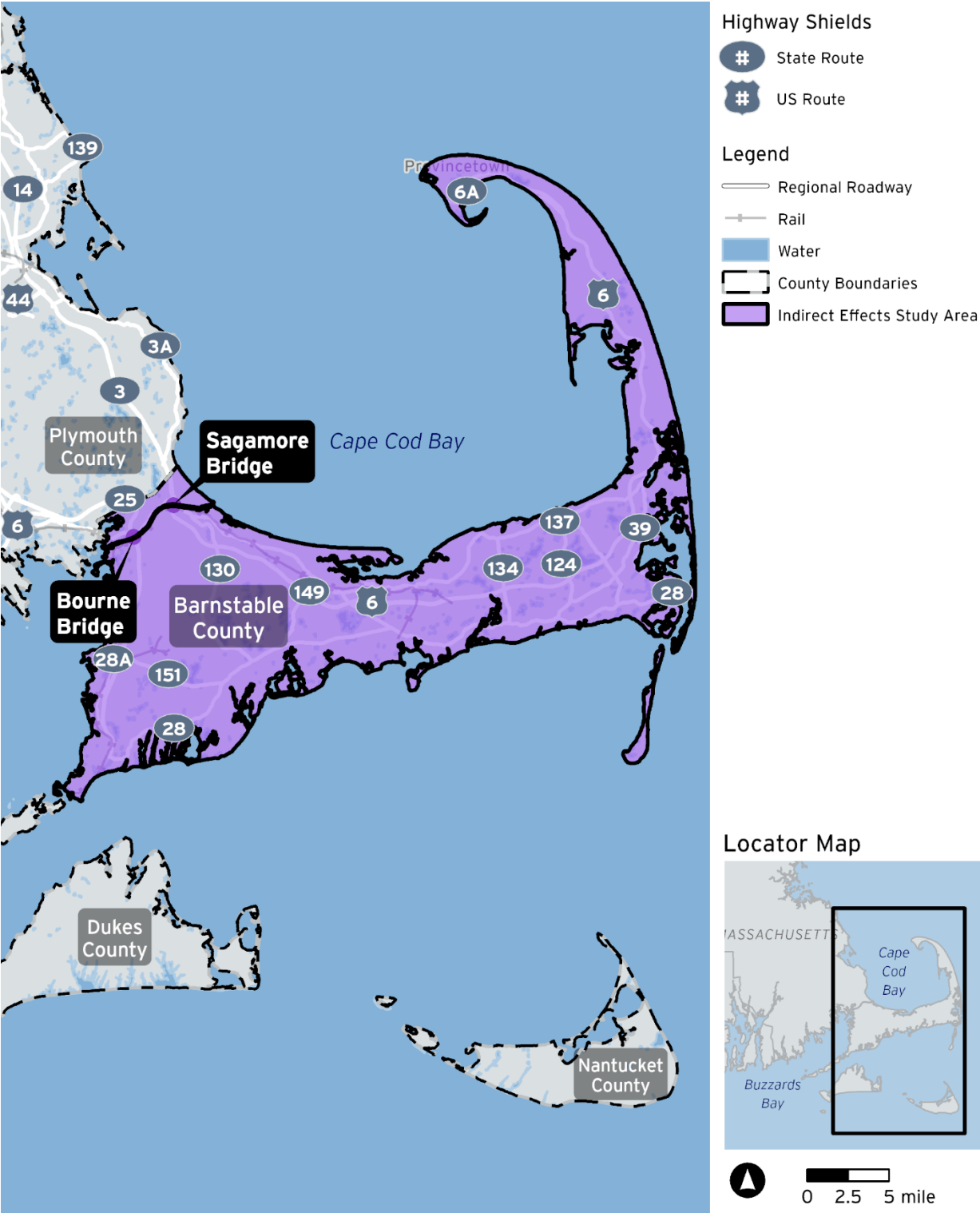
⁵ Cape Cod Commission. 2019. [Regional Policy Plan](https://www.capecodcommission.org/our-work/rpp). <https://www.capecodcommission.org/our-work/rpp>

⁶ Cape Cod Commission. 2024. [Cape Cod 2024 Regional Transportation Plan](https://www.capecodcommission.org/our-work/rtp/). <https://www.capecodcommission.org/our-work/rtp/>

⁷ 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/>

- [Section 4.22.2.2, Regional Development Trends and Growth Assumptions](#)
- [Section 4.22.2.4, Induced Development](#)
- **Induced Economic Growth:**
 - [Section 4.22.2.1, Consistency with Comprehensive Plans](#)
 - [Section 4.22.2.4, Induced Development](#)
 - [Section 4.22.2.5, Other Indirect Effects](#)
- **Induced Environmental and Human Health Effects:**
 - [Section 4.22.2.1, Consistency with Comprehensive Plans](#)
 - [Section 4.22.2.5, Other Indirect Effects](#)
- **Induced Travel Demand:**
 - [Section 4.22.2.3, Induced](#) Travel Demand

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 Plan⁸ for goals relating to economic development, transportation needs, open space, and land use. As summarized in Table 4.22-1, this consistency indicates that the Build Alternative would not result in indirect effects associated with induced economic growth, induced development, or induced environmental and human health effects under the Local Comprehensive Plan.

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
Economic Development	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. ^[*]
Adequacy of Infrastructure	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. ^[*]
Open Space Impacts	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. ^[*]
Compatibility with Adjacent Land Uses	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. ^[*]

^[*] Massachusetts Department of Transportation. April 2023. Environmental Notification Form. Cape Cod Bridges Program, Bourne, MA.

⁸ 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,⁹ the Cape Cod Regional Transportation Plan,¹⁰ and the Cape Cod Climate Action Plan¹¹ for goals relating to economic development, transportation needs, and open space. As summarized in Table 4.22-2, this consistency indicates that the Build Alternative would not result in indirect effects associated with induced economic growth or induced environmental and human health effects under these regional plans.

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

Topic	Build Alternative: Consistency with Regional Plans
Economic Development	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. ^[*]
Adequacy of Infrastructure	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.^[*] Furthermore, the Build Alternative would enable multimodal transportation options and improve safety for all modes.^[*] 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.^[*]
Open Space Impacts	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. ^[*]

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

⁹ Cape Cod Commission. 2019. [Regional Policy Plan](https://www.capecodcommission.org/our-work/rpp). <https://www.capecodcommission.org/our-work/rpp>

¹⁰ Cape Cod Commission. 2024. [Cape Cod 2024 Regional Transportation Plan](https://www.capecodcommission.org/our-work/rtp/). <https://www.capecodcommission.org/our-work/rtp/>

¹¹ 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

This section assesses [the potential effects of the Build Alternative on induced development and economic growth in the context of existing](#) regional development trends and growth assumptions for 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:^{12, 13}

- 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).¹⁴

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,¹⁵ 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 2030, 2040, and 2050. The updated analysis determined that the demand for housing in Barnstable

¹² 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>

¹³ 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>

¹⁴ 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_

¹⁵ 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>

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 2030.¹⁶ As a result, residential housing in Barnstable County is expected to be at or above capacity,¹⁷ 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,¹⁸ wastewater infrastructure limitations,¹⁹ water supply constraints,²⁰ 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,²¹ and the 2018 Cape Cod Emergency Traffic Plan,²² 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.²³

As this analysis demonstrates, regional development and growth in Barnstable County are constrained by limitations in housing capacity; high costs associated with living, housing, and construction; constraints on utility and municipal services; and bottlenecks in the regional roadway network. Therefore, given existing regional development trends and growth assumptions, the Build Alternative is

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- ¹⁶ 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.
- ¹⁷ 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>
- ¹⁸ 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>
- ¹⁹ Cape Cod Commission. [Our Work: Wastewater](https://www.capecodcommission.org/our-work/wastewater/). Accessed December 2024. <https://www.capecodcommission.org/our-work/wastewater/>
- ²⁰ 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
- ²¹ Cape Cod Commission. [Cape Cod Regional Transportation Plan 2024-2044](https://www.capecodcommission.org/our-work/rtp). <https://www.capecodcommission.org/our-work/rtp>
- ²² 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>
- ²³ 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>

not anticipated to contribute to induced development and economic growth within the Study Area, as other non-Program-related factors limit these outcomes.

4.22.2.3 Induced Travel Demand

This section examines the potential for the Build Alternative to result in induced travel demand due to proposed Program improvements.

As noted in FHWA's Interim Guidance on the Application of Travel and Land Use Forecasting in NEPA,²⁴ induced demand is growth in traffic volumes that results from an increase in capacity. Five different components contribute to induced demand:

- Number of trips
- Mode of travel
- Travel routes
- Length of trips
- Time of travel

In general, the Build Alternative would improve traffic operations and safety conditions for the traveling public through geometric upgrades and the separation of local and regional traffic movements in the immediate vicinity of the replacement Sagamore and Bourne Bridges. While travel time reductions under the proposed design may generate additional localized trips within the network, any resulting change in bridge crossing volumes is expected to be minimal and captured within the growth assumptions and adjustment factors applied to future traffic projections.

Change in Number of Trips

Change in number of trips is the most significant potential source of induced demand. However, there are several factors that limit new trip-making. Factors limiting visitor growth include availability and cost of seasonal rentals, occupancy limits of major attractions, and parking constraints, among others.

Improvements to traffic operations are limited to the bridges and interchanges directly north and south of the canal. The Build Alternative traffic analysis indicates travel times savings of up to 10-15 minutes in the peak periods and even less during the off-peak times. As presented in **Section 4.2, Transportation, Traffic and Safety**, some congestion would remain in the peak periods. These limited reductions are generally insufficient to stimulate new trip-making beyond what is already captured in the forecast.

Additionally, because Cape Cod attracts visitors from the greater New England region and beyond, improvements in travel times in the immediate vicinity of the replacement Sagamore and Bourne Bridges would represent only a minimal reduction in the overall trip duration. For these reasons, any

²⁴ 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

change in the number of trips to Cape Cod that would otherwise not occur due to congestion would be insignificant.

Change in Mode of Travel

Within the Study Area, impacts due to changes in mode of travel are anticipated to be minimal because vehicular traffic comprises most trips across the canal with few other modal options. Improved traffic operations would improve bus travel times and reliability, which may make public transportation a more attractive travel mode. With improved pedestrian and bicycle facilities, there are also opportunities to shift shorter vehicular trips to alternative modes.

Change in Travel Route and Length of Trips

Sagamore and Bourne Bridges comprise the only two roadway access points to and from Cape Cod. Therefore, the travel route choices are limited to one bridge or the other, and trip lengths are limited to the extents of Cape Cod and the neighboring islands. While travel time reductions under the proposed design may generate additional localized trips within the network, any resulting change in bridge crossing volumes is expected to be minimal and captured within the growth assumptions and adjustment factors applied to future traffic projections, regardless of any potential changes to travel route or length of trips.

Change in Time of Travel

Today, visitors with flexible schedules tend to determine their time of travel based on congestion. For example, if there is consistent congestion at 5 p.m. on a weekday, visitors may choose to travel earlier in the day or after the afternoon peak period to avoid sitting in traffic. This results in “peak spreading,” a phenomenon that is most apparent in the vicinity of the bridges during summer weekends and other popular vacation times. With improved traffic operations, people may choose to shift their travel time. This behavior may produce a higher concentration of trips during the peak hour and a sharper decline in trips outside of the peak, but it does not increase total daily travel, a finding confirmed by the Program’s travel demand model outputs.

Conclusion

Overall, the Build Alternative is not expected to result in meaningful induced travel demand, as projected operational improvements are limited in scope, modest in magnitude, and insufficient to generate new trips or significant increase daily Cape Cod Canal crossings. While some redistribution of travel timing or minor shifts in mode may occur, the total number of trips and overall travel demand are anticipated to remain consistent with forecasted conditions.

4.22.2.4 Induced Development

This section examines the potential for the Build Alternative to result in induced commercial development and economic growth due to proposed Program improvements.

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 permanent 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,²⁵ 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 space²⁶ 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.

4.22.2.5 Other Indirect Effects

This section discusses the potential for the Build Alternative to result in additional indirect effects, including economic growth and environmental and human health 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 and pollution, and new permanent stormwater control measures. These benefits of the Build Alternative would contribute to improved public health outcomes within the Study Area over the long term.

As described in **Section 4.7, Community Facilities**, the Build Alternative would not result in the physical displacement of any community facilities within the Study Area. The replacement bridges would maintain the existing number of through-traffic lanes, with auxiliary lanes added only to improve interchange safety and meet current design standards and would not provide new access to undeveloped areas. As a result, it would not result in population changes that would increase demand for existing community services. Furthermore, **Section 4.22.2.2** identifies constraints on residential development, including high-construction costs, wastewater infrastructure limitations, water supply

²⁵ Average across all sectors in Cape Cod and the Islands, calculated in **Section 4.5, Socioeconomics**.

²⁶ Estimated using retail, office, and industrial commercial space estimates in Barnstable County using CoStar Property Information Systems, September 2024. <https://www.costar.com>

constraints, and municipal service capacity limitations. Because these constraints limit induced residential growth, the Program would not result in increased demand for community services, such as schools, public safety, or utilities.

4.22.2.6 Indirect Effects Summary

This section provides a summary of the indirect effects anticipated because of the Build Alternative, as described in previous sections of the indirect effects analysis. While MassDOT considered the Build Alternative's potential to result in reasonably foreseeable indirect effects to all environmental impact categories considered in the *Final Environmental Impact Statement*, MassDOT determined that the reasonably foreseeable indirect effects of the Build Alternative would include economic growth, positive human health effects, and the potential for minor environmental effects. The Build Alternative is not anticipated to result in induced travel demand or residential and commercial development 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	Indirect Effects Evaluation Summary	Explanation of Result
Section 4.2, Transportation, Traffic, and Safety	Evaluation: Induced travel demand Result: No induced travel demand anticipated (refer to Section 4.22.2.3).	Improves vehicular mobility for 2050 conditions, including reduced network travel time and along major origin-destination routes. (refer to Section 4.22.2.3). However, travel times savings are modest and limited to the immediate Project Limits, resulting in insignificant changes due to the Build Alternative.
Section 4.3, Pedestrian and Bicycle Facilities	Evaluation: Induced travel demand Result: No induced travel demand anticipated (refer to Section 4.22.2.3).	Minimal effects associated with mode shift from vehicles to alternative modes could occur, but the majority of traffic is expected to remain vehicular (refer to Section 4.22.2.3).
Section 4.5, Socioeconomics	Evaluation: Economic growth Result: Economic effects anticipated (refer to Section 4.5.4, Build Alternative).	Construction expenditures would contribute to indirect economic effects associated with supply chain response and increased household spending from wages earned (refer to Section 4.5.4.2, Economic Impacts of Construction). Creates jobs on Cape Cod and the Islands (Martha's Vineyard and Nantucket) by 2050 (refer to Section 4.5.4.1, Operational Impacts).

Section	Indirect Effects Evaluation Summary	Explanation of Result
Section 4.6, Land Use, Zoning, and Community Cohesion	Evaluation: Induced commercial and residential development Result: No induced commercial or residential development anticipated (refer to Section 4.22.2.2).	Factors, such as high cost of living and housing, seasonal employment, utility and municipal service constraints , and regional transportation bottlenecks, would likely constrain visitation and development within Barnstable County regardless of the Build Alternative (refer to Section 4.22.2.2).
Section 4.7, Community Facilities	Evaluation: Induced commercial and residential development Result: No induced commercial or residential development anticipated (refer to Section 4.22.2.5).	The Build Alternative would result in insignificant changes in demand for existing community services (refer to Section 4.22.2.5).
Section 4.9, Wetlands and Floodplains	Evaluation: Indirect environmental effects Result: Potential indirect environmental effects (refer to Section 4.22.2.5, Indirect Effects)	Potential unintended introduction of invasive plant species due to construction activities (refer to Section 4.22.2.5, Indirect Effects).
Section 4.20, Public Health	Evaluation: Indirect environmental and human health effects Result: Positive indirect environmental and human health effects anticipated (refer to Section 4.22.2.5).	Improves public health outcomes over the long term through active transportation safety and mobility, reduced likelihood of exposure to hazardous materials and pollution, and new permanent stormwater control measures (refer to Section 4.22.2.5).