This document was produced as part of NCHRP 25-64: "Considering Greenhouse Gas Emissions and Climate Change in Environmental Reviews: Resources for State DOTs." The National Cooperative Highway Research Program (NCHRP) is sponsored by the individual state departments of transportation of the American Association of State Highway and Transportation Officials. NCHRP is administered by the Transportation Research Board (TRB), part of the National Academies of Sciences, Engineering, and Medicine, under a cooperative agreement with the Federal Highway Administration (FHWA). Any opinions and conclusions expressed or implied in resulting research products are those of the individuals and organizations who performed the research and are not necessarily those of TRB; the National Academies of Sciences, Engineering, and Medicine; the FHWA; or NCHRP sponsors.

NCHRP WebResource 3 Appendix A: Annotated Bibliography

Short Reference	Bibliographic Reference	Brief Description	Relevance
APTA (2018)	American Public Transportation Association (2018). Quantifying Greenhouse Gas Emissions from Transit. https://www.apta.com/wp-content/uploads/Standards_Documents/APTA-SUDS-CC-RP-001-09_Rev-1.pdf	This Recommended Practice provides guidance to transit agencies for quantifying their greenhouse gas (GHG) emissions, including both emissions generated by transit and the potential reduction of emissions through efficiency and displacement.	The document provides methods and data relevant to estimating GHG emissions changes associated with proposed projects, including public transportation.
Caltrans (2011)	California Department of Transportation (2011). Guidance on Incorporating Sea Level Rise for Use in the Planning and Development of Project Initiation Documents. https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/ser/guide-incorp-slr-a11y.pdf	As a result of an Executive Order, California state agencies undertaking construction projects in areas vulnerable to sea-level rise (SLR) must plan for potential impacts by considering a range of SLR scenarios for the years 2050 and 2100. This includes considering design, cost, scope, and schedule in project documents. A three-step screening criterion has been developed to assess individual projects: (1) Is the project located on the coast or in an area vulnerable to SLR? (2) Will the project be impacted by the stated SLR? (3) Is the design life of the project beyond the year 2030? Aside from traveler safety concerns, equity considerations are not included in this guidance.	If the determination is made that the project does not need to incorporate SLR considerations, a brief explanation in the project documents (of about a sentence or two in length) should be included. If the project requires further analysis, then the project documents must include a more detailed discussion of SLR and adaptation, including additional funding needed.
Caltrans (2017a)	California Department of Transportation (2017). Air Quality Report Annotated Outline. https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fdot.ca.gov%2F-%2Fmedia%2Fdot-media%2Fprograms%2Fenvironmental-analysis%2Fdocuments%2Fser%2Fair-quality-report-annotated-outline.docx&wdOrigin=BROWSELINK	GHG effects of projects are documented in an air quality report. This includes information on general GHG effects on climate; what California has enacted to reduce GHG emissions; which Regional Transportation Plan/Sustainable Communities Strategy, if any, the project is from; regional emissions associated with the Plan/Strategy; construction emissions; and operational emissions for the existing year, opening year and 20-year design year. Quantitative analysis is to be done for congestion relief and other capacity-increasing projects. For other project types most likely having minimal or no increase in operational GHG emissions, a qualitative discussion should be included about the operation of the project and the low- to no-potential for an increase in GHG emissions.	The Air Quality Report is typically an appendix in the environmental document and summarized in the main body of the environmental document.

Short Reference	Bibliographic Reference	Brief Description	Relevance
Caltrans (2017b)	California Department of Transportation (2017). Northwest State Route 138 Corridor Improvement Project: Final Environmental Impact Report/ Environmental Impact Statement and Section 4(f) Evaluation.	This document is the environmental evaluation for a 37-mile corridor improvement project in southern California.	This Environmental Impact Statement (EIS)provides an example of an environmental document discussing state-level GHG mitigation measures.
Caltrans (2020a)	California Department of Transportation (2020). Transportation Analysis under CEQA First Edition. Evaluating Transportation Impacts of State Highway System Projects. https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/sb-743/2020-09-10-1st-edition-tac-fnl-a11y.pdf	This guidance provides information to support making California Environmental Quality Act (CEQA) significance determinations for transportation impacts of projects on the state highway system. It is intended to balance the needs of congestion management with statewide goals related to infill development, promotion of public health through active transportation, and reduction of GHG emissions. It establishes Caltrans' process for analyzing a transportation project's impacts under CEQA due to increases in vehicle-miles traveled (VMT) attributable to that project and offers an initial list of potential mitigation measures for significant impacts. The guidance delineates that VMT is the most appropriate measure of transportation impacts under CEQA rather than other metrics such as congestion, level of service, etc. It includes guidance related to induced travel, qualitative or quantitative analysis, construction impacts, cumulative and indirect impacts, and mitigation. A list of project-level measures to reduce VMT is included that may be implemented on a project.	The document provides guidance on items to include in the Environmental Impact Report. A "statement of overriding considerations" must be included in the environmental document if the project will result in significant effects that are not avoided or substantially lessened and if those impacts are outweighed by the economic, legal, social, technological, or other benefits of the project, including region-wide or statewide environmental benefits.
Caltrans (2020b)	California Department of Transportation (2020). Caltrans Climate Change Communication Guide. https://dot.ca.gov/programs/transportation-planning/division-of-transportation-planning/air-quality-and-climate-change	This guide articulates best practices that can be used to educate, inform, and strengthen collaboration within Caltrans, among external partners, and with the public on the topic of climate change. The guide presents strategies for communicating with internal staff and partner agencies, as well as strategies for communicating with the broader public. Each section presents a sample checklist, descriptions, and examples drawn from published literature and from Caltrans' own project portfolio. The guide also recommends specific communication channels and presents a set of diagrams to illustrate effective communication in action.	This guide can be a resource for other transportation agencies looking to communicate both internally and externally regarding potential climate change effects related to transportation projects.

Short Reference	Bibliographic Reference	Brief Description	Relevance
Cambridge Systematics Inc. (2019)	Cambridge Systematics, Inc. (2019). Carbon Free Boston Technical Report. Prepared for Boston University – Institute for Sustainable Energy. https://www.boston.gov/sites/default/files/file/2020/08/CFB_Transportation_Technical_Report_051619_0.pdf	This report provides a forecast and scenario analysis of policies to reduce carbon emissions from transportation in the City of Boston to near zero by 2050.	This report provides information on the potential effectiveness of city-level GHG reduction strategies and methods that may be relevant to evaluating them.
Cambridge Systematics, Inc. (2022)	Cambridge Systematics Inc., Good Company, McVoy Associates, LLC, and Zamur and Associates, LLC (2022). *NCHRP WebResource 1: Reducing Greenhouse Gas Emissions: A Guide for State DOTs.* Transportation Research Board, Washington, D.C. https://crp.trb.org/nchrpwebresource1/	This guide presents methods for state departments of transportation (DOTs) to reduce GHG emissions from the transportation sector. The purpose of this guide is to Identify and describe tools, methods, and data sources that state DOTs can use to assess GHG emissions, evaluate GHG reduction opportunities, and develop action plans based on current and desired engagement levels; provide self-assessment rubrics to help state DOTs understand how they can address GHGs through all stages of their activities; and help state DOTs effectively partner, communicate, and report to respond to federal, state, and local GHG reduction initiatives.	This guide includes information on GHG analysis tools, methods, and data sources that may be relevant to project-level GHG analysis. It also describes ways in which consideration of GHG emissions can be institutionalized at all levels of planning, programming, and project development, including environmental review.
CARB (2022)	California Air Resources Board (2022). LCFS Pathway Certified Carbon Intensities. https://ww2.arb.ca.gov/resources/documents/lcfs-pathway-certified-carbon-intensities.	This website provides tables and charts showing estimated lifecycle carbon intensities for numerous fuel types and production pathways certified under the state's low-carbon fuel standard.	This is a useful resource for estimating lifecycle GHG emissions per unit of fuel consumed for various conventional and alternative transportation fuels.
CEQ (1989)	Council on Environmental Quality (1989). Draft Guidance to Federal Agencies Regarding Consideration of Global Climate Change in Preparation of Environmental Documents.	This was an unpublished draft document regarding the consideration of climate change in environmental reviews.	This document represents an early draft of proposed guidance regarding the consideration of climate change in environmental reviews.
CEQ (1997)	Council on Environmental Quality (1997). Draft Guidance Regarding Consideration of Global Climactic Change in Environmental Documents Prepared Pursuant to the National Environmental Policy Act.	This was an unpublished draft document regarding the consideration of climate change in environmental reviews.	This document represents an early draft of proposed guidance regarding the consideration of climate change in environmental reviews.

Short Reference	Bibliographic Reference	Brief Description	Relevance
CEQ (2010)	Council on Environmental Quality (2010). Draft NEPA Guidance on Consideration of Climate Change and GHG Emissions. https://ceq.doe.gov/docs/ceq-regulations-and-guidance/20100218-nepa-consideration-effects-ghg-draft-guidance.pdf	This was the first National Environmental Policy Act (NEPA) guidance on GHG and climate change. It affirmed the applicability of NEPA to consideration of GHG emissions and climate change. It advised agencies to consider opportunities to reduce GHG emissions and adapt their actions to climate change impacts. It specifically mentioned the relationship of climate change effects to proposed design, environmental impacts, mitigation, and adaptation measures. The guidance also set a "reference point" of 25,000 metric tons per year, as essentially a quantified analysis threshold. As part of the draft, CEQ requested comments on the guidance, including input on whether CEQ should provide guidance to agencies on determining whether GHG emissions are "significant" for NEPA purposes.	This was the first Federal guidance that affirmed that GHG emissions and climate change should be considered in NEPA reviews, as well as the first document that essentially pointed out the lack of existing guidance on determining when a project's effects would be "significant" with respect to climate change. The status of the guidance as "draft" for several years simultaneously provided agencies with a rationale for including climate change in environmental review, as well as a reason not to do so, as the guidance was not final. The specifics of the assessment were left to individual agencies and projects, which led to great variability in how the assessments were prepared.
CEQ (2014)	Council on Environmental Quality (2014). Revised Draft Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in NEPA Reviews. https://www.energy.gov/sites/default/files/2014/12/f19/CEQ%20Guidance%20on%20Greenhouse%20Gas%20Emissions%20-%20Revised%20Draft%20for%20Public%20Comment2014-30035.pdf	This revised draft GHG guidance superseded the initial 2010 draft GHG guidance (CEQ 2010). The revised guidance extended the initial guidance to apply to land and resource management activities and to all proposed federal agency actions subject to NEPA. This revised draft guidance included more information on how to account for climate change as compared to the 2010 draft and included existing information, sources of scientific information, tools, and examples. Notably, the revised guidance included consideration of adaptation and resilience and stated that "a NEPA review should consider an action in the context of the future state of the environment." The 2014 Revised Draft guidance also specified that emissions that "may occur as a predicate for the agency action (often referred to as upstream emissions) and as a consequence of the agency action (often referred to as downstream emissions) should be accounted for in the NEPA analysis."	This was the first Federal guidance on addressing GHG emissions under NEPA that provided more specific direction on how the assessment should be conducted and encompassing both GHG emissions and adaptation/resilience.

Short Reference	Bibliographic Reference	Brief Description	Relevance
CEQ (2016)	Council on Environmental Quality (2016). Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. 2016-18620. https://ceq.doe.gov/docs/ceq-regulations-and-guidance/nepa_final_ghg_guidance.pdf	The guidance was prepared to assist federal agencies in analyzing GHGs and climate change in NEPA reviews. The guidance provides an overview of the recommended scope of analyses, quantitative versus qualitative analysis and their uses, rule of reason, and other aspects of review. It provides sources for more detailed information on specific scenarios and directs the reader to methodologies and tools recommended for use in GHG/climate change consideration. This final guidance was very similar to the 2014 Revised Draft guidance (CEQ 2014) with two notable changes. 1) The final guidance removed the 25,000 metric ton per year threshold for quantified analysis, and 2) replaced the text on "upstream" and "downstream" emissions with reference to "indirect effects." The Final Guidance was issued Aug. 1, 2016, withdrawn Apr. 5, 2017, and is under review as of Feb. 19, 2021, for revision and update.	Released for use in NEPA reviews. It specifically provides guidance for considering GHG and climate change in environmental reviews.
CEQ (2019)	Council on Environmental Quality (2019). Draft National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions. Council on Environmental Quality. CEQ-2019–0002. https://www.govinfo.gov/content/pkg/FR-2019-06-26/pdf/2019-13576.pdf	This guidance was drafted with the intent to replace the CEQ (2016) guidance but was never finalized. It noted that GHG emissions may be used as a proxy for assessing climate effects. Quantification was recommended when practicable and when it would not be "overly speculative." The guidance called for assessing indirect effects when there is a "sufficiently close causal relationship between the proposed action and the effect" and indicated that a "but for" causal relationship is insufficient. It recognized GHG emissions as a global cumulative effect and indicated that discussing the project's emissions in the context of GHG inventory information satisfies NEPA's cumulative effect requirements. The guidance allowed for the use of programmatic and tiered approaches. It did not specifically discuss resilience but did note that agencies should consider how the proposed action would be affected by "foreseeable changes to the affected environment under a reasonable scenario." The guidance did not mention EJ (EJ). CEQ rescinded this draft guidance in February 2021.	Former draft national guidance on considering GHG emissions in environmental reviews. Encouraged quantification of GHG emissions as a proxy for climate change effects where practical while limiting the scope of cumulative analysis and discouraging the use of the social cost of carbon.

Short Reference	Bibliographic Reference	Brief Description	Relevance
CEQ (2020)	Council on Environmental Quality (2020). Update to the Regulations Implementing the Procedural Provisions of the National Environmental Policy Act. https://www.govinfo.gov/content/pkg/FR-2020-07-16/pdf/2020-15179.pdf	These NEPA implementing regulations constituted major changes to the environmental review process for Federal projects. Although GHG and climate change were not explicitly mentioned, changes to the definition of "effects" had implications for addressing climate change in NEPA documents. The 2020 implementing regulations repealed the text associated with "indirect" and "cumulative" effects. Other changes effectively encourage greater use of categorical exclusions and environmental assessment, changed or reduced public participation requirements, placed limits on the document length, and altered the requirements for the alternatives analysis by redefining the range of reasonable alternatives as those that, where applicable, "meet the goals of the applicant." The regulations also eliminated the "action-forcing" provisions and placed a focus on the procedural nature of the law. The regulations stated that "While NEPA requires consideration of mitigation, it does not mandate the form or adoption of any mitigation."	While these regulations are no longer in effect, they do provide an indication of the types of changes to NEPA that might be experienced as a result of changes in Federal policy direction, including changes that affect how climate change is considered.
CEQ (2022)	Council on Environmental Quality (2022). National Environmental Policy Act Implementing Regulations Revisions. 87 FR 23453. https://www.federalregister.gov/documents/2022/04/20/2022-08288/national-environmental-policy-act-implementing-regulations-revisions	This rule essentially restores the pre-2020 NEPA rules, requiring consideration of "direct," "indirect," and "cumulative" impacts, reestablishing agency authority to develop and analyze project alternatives, and allowing Federal agencies to go beyond NEPA's minimum requirements in environmental review.	This rule restores certain requirements and authorities that may affect the consideration of climate change and EJ under NEPA.
CEQ (2023a)	Council on Environmental Quality (2023). National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change. https://www.federalregister.gov/documents/2023/01/09/2023-00158/national-environmental-policy-act-guidance-on-consideration-of-greenhouse-gas-emissions-and-climate	This interim guidance assists agencies in analyzing the GHG and climate change effects of their proposed actions under NEPA. It is based on the guidance issued in 2016 and includes additional updates and revisions, including guidance to consider the social cost of carbon.	This guidance specifically addresses how agencies should consider GHG and climate change effects in environmental reviews.

Short Reference	Bibliographic Reference	Brief Description	Relevance
CEQ (2023b)	Council on Environmental Quality (2023). National Environmental Policy Act Implementing Regulations Revisions Phase 2: Proposed Rule. 8 FR 49924, https://www.federalregister.gov/documents/2023/07/31/2023-15405/national-environmental-policy-act-implementing-regulations-revisions-phase-2	This "Bipartisan Permitting Reform Implementation Rule" is proposed to revise CEQ's regulations for implementing the procedural provisions of NEPA, including implementing the Fiscal Responsibility Act's amendments to NEPA. CEQ proposes the revisions to provide for an effective environmental review process that promotes better decision-making, ensures full and fair public involvement, provides for an efficient process and regulatory certainty, and provides for sound decision-making grounded in science, including consideration of relevant environmental and climate change, and EJ effects.	These revisions would codify the interim Guidance on Consideration of Greenhouse Gas Emissions and Climate Change issued in January 2023. They also contain other provisions that could affect or relate to GHG and climate change effects analysis, such as various provisions to improve procedural efficiency and codification of longstanding principles such as consideration of "reasonably foreseeable" environmental effects.
The Climate Registry (2020)	The Climate Registry (2020). Default Emission Factors. https://www.theclimateregistry.org/	The Climate Registry provides a variety of emission factors for different types of transportation fuels and vehicles, including CO_2, CH_4, and N_2O.	This is a useful reference for factors of GHG content per unit of fuel (gallon or unit of energy) and grams per mile emission factors.
Colorado DOT (2019)	Colorado DOT (2019). Air Quality Project-Level Analysis Guidance. https://www.codot.gov/programs/environmental/air-quality/assets/cdot-aq-plag	This document provides detailed guidance on how to conduct project-level air quality analysis, including GHG analysis, for transportation projects in Colorado.	This document provides an example of one state's approach to considering GHG emissions in environmental review.
Colorado DOT (2021)	Colorado Transportation Commission (2021). Rules Governing Statewide Transportation Planning Process And Transportation Planning Regions 2 CCR 601-22. https://www.codot.gov/business/rules/documents/2-ccr-601-22_redline_8-13-21.pdf	This is a set of rules, approved in December 2021, that requires Colorado DOT and the Metropolitan Planning Organizations in Colorado to determine the total GHG emission increase or decrease expected from future regionally significant transportation projects and take steps to ensure that GHG emission levels do not exceed set reduction amounts. It requires GHG emissions modeling of MPO long-range plans (and CDOT in non-MPO areas) for four specific future years. The analysis must show the plans meet established emission levels for each MPO and CDOT in non-MPO areas. Failure to meet the emission levels requires the addition of GHG mitigation measures to the plan to attain the emission levels. Continued failure to meet the emission levels requires prioritization of GHG-reducing projects and diversion of certain Federal funds to projects that reduce GHG emissions. CDOT is also required to work with disproportionately impacted communities in the project planning, environmental study, and project delivery phases of transportation capacity projects.	The rules do not directly address project-level environmental review. It is expected that environmental documents for regionally significant transportation projects will address this requirement and document that the project is included in a compliant plan.

Short Reference	Bibliographic Reference	Brief Description	Relevance
Colorado DOT (2023)	Colorado DOT (2023). CDOT NEPA Manual, Version 7. https://www.codot.gov/programs/environmental/nepa-program/nepa-manual	This document provides policies and procedures to meet NEPA requirements for transportation projects in Colorado. Section 9.2, new for Version 7, provides guidance on GHG emissions and mitigation.	This document provides an example of one state's approach to considering GHG emissions in environmental review.
Cutter et al. (2009)	Cutter, S. L., Emrich, C. T., Webb, J. J., & Morath, D. (2009). Social Vulnerability to Climate Variability Hazards: A Review of the Literature. Final Report to Oxfam America.	This paper discusses the state of knowledge on social vulnerability to climate hazards.	This research can provide information on which populations may be most affected by climate change and how.
Delaware DOT (2017)	Delaware DOT (2017). Strategic Implementation Plan for Climate Change, Sustainability & Resilience for Transportation. https://deldot.gov/Publications/reports/SIP/pdfs/SIP_FINAL_2017-07-28.pdf?cache=1632853283757	This report is DelDOT's first attempt to develop a strategy and plan to promote a more resilient and sustainable transportation system. Of 19 recommendations, five can be considered related to project-level, air quality, and/or energy-related: Integrate climate resiliency into project development, traffic, bridge, and highway design; build transportation enhancements to accommodate impacts of climate change; incorporate climate impacts into cost-effective investment in infrastructure; reevaluate the prioritization process for projects in the Capital Transportation Program to consider climate change effects and resiliency; evaluate driving restrictions for air quality events; develop revised maintenance schedule in response to air quality events; evaluate low emission vehicle deployment; and evaluate alternative energy technology in facilities.	The report does not directly address project-level environmental review, but it does provide recommendations for integrating climate resiliency into project development.
District of Columbia DOT (2012)	District of Columbia DOT (2012). Environmental Policy and Process Manual, Chapter 14, Air Quality Policy and Regulations. https://ddotsites.com/documents/environment/Files/Chapters/Chapter_14_-_Air_Quality_Policy_and_Regulations.pdf	This manual from the District of Columbia DOT (DDOT) explains that qualitative discussion of the GHG emissions associated with a project is to be included in the air quality analysis. The qualitative discussion of GHG emissions should include both direct and indirect impacts.	This analysis is typically part of the Air Quality Report in an appendix in the environmental document and summarized in the main body of the environmental document.

Short Reference	Bibliographic Reference	Brief Description	Relevance
District of Columbia DOT (2013)	District of Columbia DOT (2013). Climate Change Adaptation Plan. https://ddot.dc.gov/sites/default/files/dc/sites/ddot/publication/attachments/ddot_climate_adaptation_plan.pdf	DDOT's Climate Change Adaptation Plan develops and identifies strategies to ensure DDOT's transportation infrastructure can withstand the changes in climate and extreme weather conditions. Temperature, sea-level rise, precipitation, and storms were identified as the key climate variables that affect the District's transportation system. DDOT performed a qualitative vulnerability assessment and identified vulnerable transportation assets in sensitive climate areas. A list of strategies and action items was compiled to reduce vulnerability and help adapt the transportation system to climate change.	The document does not directly address project-level environmental review. Climate change adaptation is to be incorporated into all stages of the project development process, including the environmental review stage.
EJIWG (2016)	Federal Interagency Working Group on EJ and NEPA Committee (2016). Promising Practices for EJ Methodologies in NEPA Reviews. https://www.epa.gov/environmentaljustice/ej-iwg-promising-practices-ej-methodologies-nepa-reviews	This report constitutes a compilation of "promising practices" and recommendations for agencies on addressing EJ in NEPA reviews. The report outlines actions that can be taken to meaningfully engage affected communities, including minority and low-income populations, during various stages of NEPA project review. The report specifies guiding principles and specific steps for (1) defining the affected environment, (2) identifying potentially affected minority and low-income populations; (3) assessing potential impacts; (4) assessing potential alternatives; (5) determining whether potential impacts are disproportionately high and adverse; and (6) developing mitigation and monitoring measures. Regarding climate change: "Agencies may wish to consider how impacts from the proposed action could potentially amplify climate change-related hazards (e.g., storm surge, heat waves, drought, flooding, and sea-level change) in minority populations and low-income populations in the affected environment, and vice versa. Agencies may benefit by considering climate resilience in the proposal's design and alternatives."	The report can serve as a resource in further developing plans for meaningful community engagement and analysis of impacts, including disproportionally high and adverse impacts on EJ communities. It also provides examples of where climate change and EJ considerations could overlap.

Short Reference	Bibliographic Reference	Brief Description	Relevance
EOP (2021a)	Executive Office of the President (2021). Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis. Document number 2021-01765. https://www.federalregister.gov/documents/2021/01/25/2021-01765/protecting-public-health-and-the-environment-and-restoring-science-to-tackle-the-climate-crisis	This Executive Order (13990) instructs federal agencies to reassess their practices. Moving ahead, the following factors should be prioritized and/or considered in agency guidance: protecting public health and the environment, EJ, emissions reductions, lowering exposure to pollution and chemicals, holding polluters accountable, restoring and protecting national monuments, and creating union jobs. It discusses the value of considering the social costs of climate pollution and establishes an Interagency Working Group on the Social Cost of Greenhouse Gases. In accordance with this, the EO specifies regulations that should be suspended, revised, or rescinded. It also revoked various executive orders from the previous administration and rescinded the 2019 Draft GHG guidance (CEQ 2019).	Broadly summarizes the Federal objectives related to climate change, EJ, and public health.
EOP (2021b)	Executive Office of the President (2021). Interim Implementation Guidance for the Justice40 Initiative. https://www.whitehouse.gov/wp-content/uploads/2021/07/M-21-28.pdf	This interim guidance provides initial recommendations to achieve the Executive Order 14008 goal. The Executive Order states that “40 percent of the overall benefits” of federal investments from covered programs should flow to disadvantaged communities. The memo provides guidance on defining “Disadvantaged Communities,” defines “Covered Program” and “Covered Investment,” provides additional examples of “Benefits,” summarizes reporting requirements, and lists pilot programs to maximize benefits to EJ communities. Of relevance to the current study, the consideration of whether a community is disadvantaged should include “high transportation cost burden and/or low transportation access.” Moreover, covered programs include “climate change” and “clean transportation,” as well as associated training and workforce development. The memo provides examples of benefits, including benefits under climate change and clean transportation categories.	The guidance provides recommendations on how agencies can implement the Justice40 Initiative, with specific recommendations relevant to climate change and transportation.
FHWA (2006)	Federal Highway Administration (2006). How to Engage Low-Literacy and Limited-English-Proficiency Populations in Transportation Decisionmaking. https://www.fhwa.dot.gov/planning/public_involvement/publications/	This report documents “best practices” in identifying and engaging low-literacy and limited-English-proficiency populations in transportation decision-making.	This resource can help planners develop effective strategies for engaging EJ communities in environmental analysis, including consideration of GHG emissions and climate change effects.

Short Reference	Bibliographic Reference	Brief Description	Relevance
FHWA (2012)	FHWA (2012). Actions to Address EJ in Minority Populations and Low-Income Populations. Order 6640.23A. https://www.fhwa.dot.gov/legsregs/directives/orders/664023a.cfm	This FHWA directive establishes policies and procedures for the FHWA to use in complying with Executive Order 12898, Federal Actions to Address EJ in Minority Populations and Low-Income Populations.	This order provides direction for determining whether low-income and minority populations are present and for determining whether those populations would experience disproportionately high and adverse impacts as a result of a project.
FHWA (2015a)	Federal Highway Administration (2015). EJ Reference Guide. https://www.fhwa.dot.gov/environment/environmental_justice/publications/reference_guide_2015/fhwahep15035..pdf	This document is intended to help transportation agency staff ensure compliance with EJ requirements in all stages of the FHWA project, program, and policy planning, development, and implementation. It includes sources of demographic, transportation, and environmental data; methods for analysis; planning considerations; public involvement strategies; addressing EJ during NEPA review, design, right-of-way acquisition, construction, and maintenance and operations stages of a project. The guide also includes requirements and recommendations for consulting with Tribal Governments.	Provides guidance, resources, and recommendations for transportation agency staff considering EJ in their work.
FHWA (2015b)	FHWA (2015). Public Involvement Techniques for Transportation Decision-Making. https://www.fhwa.dot.gov/planning/public_involvement/publications/	This guide provides a variety of tools to secure meaningful input from the public on transportation plans, programs, and projects, and it can help agencies improve their overall public involvement techniques.	This resource can help planners develop effective strategies for engaging the public in environmental analysis, including consideration of GHG emissions and climate change effects.
FHWA (2016a)	Federal Highway Administration (2016). Planning and Environmental Linkages – Questions and Answers. https://www.fhwa.dot.gov/hep/guidance/pel/pelqa2016.pdf	The FHWA developed these questions and answers to provide information and guidance on the implementation of Planning and Environmental Linkages (PEL). The document describes PEL and its benefits, provides examples of “planning products” that may be used in environmental review, conditions that must be met to use such planning products, and provides guidance on public involvement, ADA, EJ, fiscal constraint, and programmatic mitigation plans. The document appendix includes links to state and MPO examples of PEL Public Participation Practices.	Provides an overview of PEL, implementation guidance, and sources of additional information and examples relevant to PEL.

Short Reference	Bibliographic Reference	Brief Description	Relevance
FHWA (2016b)	Federal Highway Administration (2016). FHWA Implementation of CEQ Guidance on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in NEPA. Office of Planning, Environmental and Realty, September 30, 2016.	This presentation provides additional guidance from FHWA on interpreting the 2016 CEQ guidance specifically for Federal-aid highway projects.	The presentation notes that FHWA "strongly encourages a planning level approach to GHG emissions analysis" when one is available. With respect to the impacts of climate change on a proposed project, FHWA recommends considering the design of a proposed project and potential mitigation measures that would increase the resiliency of the proposal to climate change, which may have been assessed in a regional impacts and adaptation study.
FHWA (2016c)	Federal Highway Administration (2016). Climate Change and EJ: Considerations for Transportation Decision-making. https://www.fhwa.dot.gov/environment/environmental_justice/publications/ej_and_climate/index.cfm	This document explains how transportation agencies at the federal, state, and local levels can reduce negative impacts of climate change on low-income populations and minority populations (EJ communities), through stakeholder inclusion, proactive planning, risk mapping, and the careful consideration of community needs in emergency operations procedures.	This resource can help planners develop effective strategies for engaging EJ communities in environmental analysis, including consideration of GHG emissions and climate change effects.
FHWA (2016d)	Federal Highway Administration (2016). Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents. Memorandum. https://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/msat/index.cfm Frequently Asked Questions (FAQ) Conducting Quantitative MSAT Analysis for FHWA NEPA Documents. https://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/moves_msat_faq.cfm	These documents together provide guidance on when and how to conduct a mobile source air toxics (MSAT) analysis for projects subject to the NEPA process.	The MSAT guidance has been used by some agencies to help define the process and methods for GHG analysis since similar tools and methods can be applicable.

Short Reference	Bibliographic Reference	Brief Description	Relevance
FHWA (2016e)	Federal Highway Administration (2016). Asset Management Plans and Periodic Evaluations of Facilities Repeatedly Requiring Repair and Reconstruction Due to Emergency Events. Final Rule. 81 FR 73196. https://www.federalregister.gov/documents/2016/10/24/2016-25117/asset-management-plans-and-periodic-evaluations-of-facilities-repeatedly-requiring-repair-and	This rule establishes requirements related to the implementation of risk-based asset management plans, the establishment of minimum standards for pavement and bridge asset management systems, and periodic evaluations to determine if reasonable alternatives exist to roads, highways, or bridges that repeatedly require repair and reconstruction activities.	This rule calls for state DOTs to include lifecycle planning in their asset management planning and states that lifecycle planning should incorporate "current and future environmental conditions including extreme weather events, climate change, and seismic activity" that could affect an asset's performance over its lifetime.
FHWA (2016f)	Federal Highway Administration (2016). Hydraulic Engineering Circular No. 17 (HEC-17), 2nd Edition: Highways in the River Environment – Floodplains, Extreme Events, Risk and Resilience. https://www.fhwa.dot.gov/engineering/hydraulics/pubs/hif16018.pdf	This circular provides guidance and methods for assessing river impacts on transportation, focusing on floods, floodplain policies, extreme events, risk, and resilience.	This is a resource that can be used to inform the assessment of project-level vulnerability to climate change effects.
FHWA (2017a)	Federal Highway Administration (2017a). Synthesis of Approaches for Addressing Resilience in Project Development. https://www.fhwa.dot.gov/environment/sustainability/resilience/ongoing_and_current_research/teacr/	The report is designed to facilitate the integration of climate considerations into a range of transportation engineering design projects. Chapter 3 discusses where and how climate considerations can be integrated into the transportation project development process. The document recommends considering climate change impacts and adaptation early in the project development process (planning, scoping, and preliminary design/engineering) to ensure that climate resilience is incorporated into the project design to the extent possible and appropriate. It describes key elements of an adaptation study and notes that the level of detail should be scaled to the project at hand. Other chapters address using climate information, completing engineering assessments and design, conducting economic analysis, and evaluating additional considerations. Resources include links to FHWA-funded climate change vulnerability and resiliency case studies, FHWA engineering manuals, and state and local regulations and guidelines.	The document notes the relation of the resilience approaches discussed to the NEPA process. It states that if the engineering-informed adaptation studies are developed prior to undertaking the state or federal environmental review, the studies will help streamline and focus the environmental review on the issues identified as most important or significant. However, the engineering-informed adaptation studies should not bias the process by pre-determining a single course of action as the only feasible alternative.

Short Reference	Bibliographic Reference	Brief Description	Relevance
FHWA (2017b)	Federal Highway Administration (2017b). Developing and Advancing Effective Public Involvement and EJ Strategies for Rural and Small Communities. https://www.fhwa.dot.gov/planning/public_involvement/publications/	This research included working with transportation planners, practitioners, and other decision-makers in rural areas and small communities to develop effective, locally appropriate, replicable strategies for public involvement in transportation planning and programming, especially to engage EJ communities.	This resource can help planners develop effective strategies for engaging EJ communities in environmental analysis, including consideration of GHG emissions and climate change effects.
FHWA (2017c)	FHWA (2017c). Vulnerability Assessment and Adaptation Framework, Third Edition. Federal Highway Administration, Office of Planning, Environment, and Realty. FHWA-HEP-18-020. https://www.fhwa.dot.gov/environment/sustainability/resilience/adaptation_framework/	FHWA developed this report to help transportation agencies and their partners assess the vulnerability of transportation infrastructure and systems to extreme weather and climate effects and to help agencies integrate climate adaptation considerations into transportation decision-making. The report is a collection of resources and includes examples from vulnerability assessments conducted nationwide. The examples include five FHWA climate change resilience pilot projects conducted from 2010 to 2011 and 19 pilot projects conducted from 2013 to 2015, as well as various related studies conducted by FHWA and other transportation agencies. The framework provides a structured process for conducting vulnerability assessments. The resources provided can be used for a range of applications, from project-specific or corridor-level analyses to state or MPO-level studies.	As discussed in the report, transportation agencies can use the data and the results of vulnerability assessments and engineering-informed adaptation studies to inform their analysis of climate change impacts in NEPA reviews. Agencies may also be able to use the results of a vulnerability assessment to develop and select project alternatives that minimize vulnerabilities or to develop adaptation strategies as mitigation measures.
FHWA (2020)	Federal Highway Administration (2020). Hydraulic Engineering Circular No. 25 (HEC-25): Highways in the Coastal Environment: Assessing Extreme Events. https://www.fhwa.dot.gov/engineering/hydraulics/pubs/hif19059.pdf	This manual provides technical guidance for planning, design, and operation of highways in a coastal environment.	The manual describes methods to quantify exposure and vulnerability to potential climate change effects, including sea-level rise, storm surge, and wave action, and discusses common planning and design issues.
FHWA (2022a)	FHWA (2022). Virtual Public Involvement. https://www.fhwa.dot.gov/planning/public_involvement/vpi/	Provide resources for methods of virtual public involvement.	This resource can help planners develop effective strategies for engaging the public in environmental analysis, including consideration of GHG emissions and climate change effects.

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FHWA (2022b)	FHWA (2022). Promising Practices for Meaningful Public Involvement in Transportation Decision-Making, https://www.transportation.gov/priorities/equity/promising-practices-meaningful-public-involvement-transportation-decision-making	This guidebook details ways state DOTs and others can encourage and maintain "meaningful public involvement" in transportation projects from start to finish.	This guide contains practices that can help USDOT funding recipients meet the requirements of meaningful public involvement and participation under Title VI of the Civil Rights Act of 1964, NEPA, and other existing requirements.
FHWA (undated)	Federal Highway Administration. Sustainability Website, Climate Change in NEPA Case Studies https://www.fhwa.dot.gov/environment/sustainability/resilience/case_studies/index.cfm	The FHWA sustainability website contains a wealth of information on resilience studies, studies on integrating resilience into agency operations, studies on available tools and engineering approaches to resiliency, FHWA and FTA vulnerability and adaptation case studies, and case studies of climate change and resilience considerations under NEPA. Four case studies are included that document climate change under NEPA.	The FHWA sustainability website provides a great collection of resources for considering climate change in transportation projects and program planning, design, implementation, and maintenance, as well as on the integration of climate change considerations into agency-wide operations and policies. The website also provides case studies of how projected climate change impacts were considered in the environmental review of transportation projects prior to the issuance of the final 2016 CEQ guidance.
FTA (2012)	Federal Transit Administration (2012). EJ Policy Guidance for Federal Transit Administration Recipients. FTA Circular 4703.1. https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/FTA_EJ_Circular_7.14-12_FINAL.pdf	Provides detailed procedures for conducting an EJ analysis, with specific guidance on EJ analysis for NEPA. Key components are gathering community data and information, public engagement, evaluation of effects, alternative selection, and mitigation. The document provides a discussion of EJ principles and the relationship between EJ and Title VI. It also explains how EJ principles apply specifically to transportation planning/projects and suggests effective strategies for scoping and analyses, public engagement, and written components of EJ in environmental review.	The guidance has been used in numerous NEPA projects led by FTA and FRA.

Short Reference	Bibliographic Reference	Brief Description	Relevance
FTA (2017)	Federal Transit Administration (2017). Greenhouse Gas Emissions from Transit Projects: Programmatic Assessment. Federal Transit Administration Report No. 0097. https://www.transit.dot.gov/sites/fta.dot.gov/files/2021-01/FTA_Report_No._0097.pdf	This programmatic assessment reports on whether certain types of proposed transit projects merit detailed analysis of their GHG emissions at the project level and provides an optional source of data to reference in future environmental documents for specific projects. The report includes a GHG emissions Typology Matrix – a lookup table to estimate partial lifecycle emissions for the construction, operations, and maintenance phases of sample projects by project type (e.g., bus rapid transit, light rail). The tool accounts for the GHG benefits of personal vehicle emissions displaced as a result of ridership increases with the transit project.	Provides an optional programmatic framework for addressing GHG emissions in project-specific environmental reviews for common types of transit projects.
HDOT (2021)	Hawaii DOT (2021). Hawaii Highways Climate Adaptation Action Plan: Strategies for a More Resilient Future. https://hidot.hawaii.gov/wp-content/uploads/2021/07/HDOT-Climate-Resilience-Action-Plan-and-Appendices-May-2021.pdf	This study is HDOT's first step in acting comprehensively across the agency to recognize and fully consider changing climatic conditions. Among other agency-wide steps, HDOT would follow an adaptive design process for projects exposed to climate-related hazards; consider climate change in technical and process guidance; amend internal manuals to streamline procedures related to developing adaptive project designs and operational strategies; develop or amend programmatic agreements, particularly those that improve efficiency in environmental review processes, as they reflect changing future environmental conditions; create an environmental office, at the branch level or higher, that has broad responsibility for HDOT's environmental, climate adaptation, and system resilience effort.	The report does not directly address project-level environmental review. The formation of an environmental office is expected to result in project-level adaptation and resilience decisions to be documented in environmental reviews.
ICF (2020)	ICF (2020). *Caltrans Greenhouse Gas Emissions and Mitigation Report*. Prepared for California Department of Transportation. https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/office-of-smart-mobility-and-climate-change/ghg-emissions-and-mitigation-report-final-august-2-2020-revision9-9-2020-a11y.pdf	This report documents current Caltrans activities that reduce GHG emissions and identifies future opportunities for further reducing GHG emissions.	This report provides an example of an emissions inventory for a transportation agency and an assessment of emission reduction opportunities. Some of these opportunities are relevant to project-level GHG assessment and mitigation analysis.

Short Reference	Bibliographic Reference	Brief Description	Relevance
INDOT (2018)	Indiana DOT (2018). *I-69 Evansville to Indianapolis Tier 2 Studies Section 6—Final Environmental Impact Statement*. https://www.in.gov/indot/projects/i69/section-6-martinsville-to-indianapolis/project-documents/	This document is the EIS for a major highway project study.	This EIS provides an example of how GHG and climate change effects have been evaluated within NEPA.
IPCC (2018)	The Intergovernmental Panel on Climate Change (2018). *Special Report: Global Warming of 1.5°C*. https://www.ipcc.ch/site/assets/uploads/sites/2/2022/06/SR15_Full_Report_HR.pdf	This IPCC Special Report discusses the impacts of global warming of 1.5°C above pre-industrial levels and related global GHG emission pathways in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.	IPCC reports are considered authoritative in terms of climate change science and prediction scenarios and can be used as a general reference in NEPA analyses and documents.
IPCC (2021)	The Intergovernmental Panel on Climate Change (2021). *Sixth Assessment Report (AR6) Climate Change 2021: The Physical Science Basis*. https://www.ipcc.ch/report/ar6/wg1/	The IPCC provides regular assessments of the scientific basis of climate change, its impacts and future risks, and options for adaptation and mitigation. AR6 is IPCC's sixth report. The Physical Science Basis portion of the report was published in 2021 and provides a global summary of climate indicators, climate scenario models, and projections. Other components of AR6, including "Impacts, Adaptation, and Vulnerability" and "Mitigation of Climate Change," are forthcoming in 2022. The previously completed Fifth Assessment Report (AR5) contains the most recent synthesis of global information regarding climate change mitigation and adaptation.	IPCC reports are considered authoritative in terms of climate change science and prediction scenarios and can be used as a general reference in NEPA analyses and documents.
Jain et al. (2017)	Jain, S. et al. (2017). "How Did Environmental Impact Statements Address Climate Change in 2016?" Sabin Center for Climate Change Law. https://climate.law.columbia.edu/sites/default/files/content/docs/Jain-et-al-2017-02-How-Did-Federal-EISs-Address-Climate-Change-in-2016_0.pdf	This paper analyzed how NEPA EIS documents evaluated climate change after the 2016 CEQ guidance on GHG emissions was finalized. The study was based on a survey of 31 documents, with one project led by a transportation agency (the Federal Aviation Administration). The paper reviewed aspects of climate assessment in the NEPA documents, including scope of action (connected projects and tiered review), qualitatively/quantitatively disclosed direct and indirect emissions, the impact of climate change on the projects, mitigation and adaptation measures, comparison of alternatives, social cost of emissions, disclosure of information sources and uncertainty, consistency of the project with GHG reduction plans and policies.	This paper summarized how GHGs and climate change were addressed in NEPA documents shortly after the 2016 CEQ guidance was finalized.

Short Reference	Bibliographic Reference	Brief Description	Relevance
Lynn, MacKendrick, and Donoghue (2011)	Lynn, K., MacKendrick, K., & Donoghue, E. M. (2011). *Social Vulnerability and Climate Change: Synthesis of Literature*. U.S. Department of Agriculture, Forest Service. https://www.fs.usda.gov/treesearch/pubs/38465	This report provides a synthesis of research on how climate change could impact vulnerable communities.	This report provides information that may be relevant to transportation agencies considering how climate change effects related to a proposed project or program could impact vulnerable communities.
Maine Climate Council (2020)	Maine Climate Council (2020). Four-Year Plan for Climate Action. https://climatecouncil.maine.gov/future/sites/maine.gov.future/files/inline-files/MaineWontWait_December2020.pdf	Among several strategies for dealing with climate change, Maine recognizes the need to invest in climate-ready infrastructure. This includes implementing design standards for resilience in infrastructure projects with appropriate guidance and standards for different types of infrastructure. This would be based on a statewide vulnerability assessment. This document also addresses climate change equity issues by proposing to set equity outcomes for proposed actions, monitoring progress, and then making recommendations to ensure that programs and benefits reach the intended populations and communities.	The document does not directly address project-level environmental review. However, it does include general strategies for considering climate change, along with associated equity issues related to infrastructure investment.
Maryland DOT (2020a)	Maryland DOT (2020). 2020 Maryland Department of Transportation Greenhouse Gas Reduction Act Plan. https://www.mdot.maryland.gov/OPCP/MDOT_GGRA_Plan.pdf	Maryland DOT expects to reduce greenhouse gas emissions from Maryland's transportation sector by 40% from 2006 by 2030, in keeping with Maryland's legislative requirement to reduce greenhouse gas emissions 40% by 2030 from 2006 levels. This plan modeled three scenarios: reference case; an "on-the-books" scenario, which includes committed plans programs and projects and various State and MPO strategies; and an "emerging and innovative" scenario, which includes expanded MDOT programs, increased electric vehicle (EV) penetration, and new partnerships and technologies. Under the 'emerging and innovative" scenario, it is possible to reach the emission target, but it will require new and expanded funding and partnerships. Under this scenario, 22 strategies are identified with projected emission benefits and costs.	The report does not directly address project-level environmental review. The plan's discussion on infrastructure design to reduce emissions through design principles and practical and innovative project implementation is expected to be reflected in future environmental review documents.

Short Reference	Bibliographic Reference	Brief Description	Relevance
Maryland DOT (2020b)	Maryland DOT (2020). I-495 & I-270 Managed Lanes Study: Draft Environmental Impact Statement and Draft Section 4(f) Evaluation. Appendix I Air Quality Technical Report. https://oplanesmd.com/deis/#DEIS	This document is the draft EIS for a major highway project study, showing how GHG emissions are compared across multiple alternatives.	This EIS provides an example of how GHG and climate change effects have been evaluated within NEPA.
Maryland DOT (2022)	Maryland DOT (2022). I-495 & I-270 Managed Lanes Study: Final Environmental Impact Statement and Section 4(f) Evaluation. Appendix K Air Quality Technical Report. https://oplanesmd.com/FEIS/#FEIS	This document is the final EIS for a major highway project study, showing the final comparison of GHG emissions for the preferred vs. no-build alternative.	This EIS provides an example of how GHG and climate change effects have been evaluated within NEPA.
Massachusetts DOT (2020)	Massachusetts DOT (2020). Transportation Improvement Program Greenhouse Gas Assessment and Reporting Guidance Document. https://www.mass.gov/service-details/mpo-ghg-assessment-and-reporting-guidance	All projects on Transportation Improvement Plans (TIPs) in Massachusetts are subject to a GHG assessment. The MPO must determine the direction of the GHG impact and its cause. Most of the projects require quantitative determination using Congestion Mitigation and Air Quality (CMAQ) spreadsheets, a reporting template, and a spreadsheet of emission factors provided by MassDOT.	This document describes requirements for assessing GHGs for TIP projects but does not directly address documentation in environmental reviews.
Massachusetts EOEA (2010, 2021)	Massachusetts Executive Office of Energy and Environmental Affairs (2010, revised 2021). Summary of the Final Revisions to the MEPA Greenhouse Gas Emissions Policy and Protocol. https://www.mass.gov/files/documents/2016/08/rp/ghg-policy-final-summary.pdf	Projects that require an Environmental Impact Report under the Massachusetts Environmental Policy Act (MEPA) must quantify emissions and reduce GHG emissions to the maximum amount feasible. Assumptions, methodology, and inputs are determined by individual agencies to best quantify the GHG effects of the project. Requirements for analysis include: a description of the public health impact of the proposed project; measures to minimize public health damage; and a description of adverse public health consequences that cannot be avoided.	This document describes state-level GHG reporting requirements for projects evaluated under the Massachusetts Environmental Policy Act.

Short Reference	Bibliographic Reference	Brief Description	Relevance
Massachusetts EOEA (2021a)	Massachusetts Executive Office of Energy and Environmental Affairs (2021). Transition Rules for Public Involvement Requirements for EJ Population. https://www.mass.gov/doc/transition-rules-for-public-involvement-requirements-for-environmental-justice-populations-june-2021/download	This set of rules describes how to implement the requirements for meaningful public involvement by EJ populations during the environmental review process laid out by the Massachusetts "Climate Roadmap Act." Projects must provide a narrative identifying EJ populations within 1 mile of the project site and describing whether the project is reasonably likely to negatively affect such populations. If the project is anticipated to affect air quality, the project must identify EJ populations within 5 miles of the project site and describe whether the project is reasonably likely to negatively affect such populations. If the project documents indicate that the project is reasonably likely to negatively affect EJ populations, the project sponsor must describe any measures taken to promote public involvement by such populations and any additional steps the project sponsor intends to take during the course of environmental review to increase public involvement.	The outcome of the public involvement effort would typically be described in the project's environmental document. Air quality impacts are referenced, but not specifically GHG emissions or climate effects.
Massachusetts EOEA (2021b)	Massachusetts Executive Office of Energy and Environmental Affairs (2021). MEPA Interim Protocol on Climate Change Adaptation and Resiliency. https://www.mass.gov/doc/mepa-interim-protocol-on-climate-change-adaptation-and-resiliency-effective-oct-1-2021/download	This guidance implements an Executive Order to state agencies to "strengthen the resilience of communities, prepare for the impacts of climate change, and proactively plan for and mitigate damage from extreme weather events." It is part of an effort to develop resilience standards, guidelines, and a project risk screening tool using the best available climate science data and projections for projects in Massachusetts in three critical areas: sea-level rise/storm surge, extreme precipitation (urban or riverine flooding), and extreme heat. It also adds a new section to Massachusetts' environmental notification forms, entitled "Climate Change Adaptation and Resiliency Section," intended to gather project-level data in a standardized manner to inform the environmental review process and assist in evaluating the accuracy and effectiveness of the resilience design standards.	The outcome of the assessment to meet the Climate Change Adaptation and Resiliency Section requirements would typically be described in the project's environmental document.
McGraw et al. (2021)	McGraw, J., Haas, P., Ewing, R., and S. Sabouri (2021). *TCRP Research Report 226: An Update on Public Transportation's Impacts on Greenhouse Gas Emissions.* Transportation Research Board, Washington, D.C. https://doi.org/10.17226/26103	This report provides information on public transportation's GHG benefits and how they can be estimated. The report discusses GHG savings associated with transportation efficiency (reduced personal vehicle travel) as well as land use efficiency supporting shorter and fewer trips. The report considers the full lifecycle of GHG emissions associated with transit vehicles and displaced automobile use.	This report can assist agencies in evaluating GHG effects associated with projects that include a public transportation component.

Short Reference	Bibliographic Reference	Brief Description	Relevance
Minnesota DOT (undated)	Minnesota DOT (undated). Greenhouse Gas Emissions Analysis Process. https://www.dot.state.mn.us/project-development/subject-guidance/greenhouse-gas-analysis/process.html	This website provides information about Minnesota DOT's requirements for evaluating GHG emissions for highway projects. It also provides links to a categorical exclusion standard attachment and the Minnesota Infrastructure Carbon Estimator tool.	Provides an example of how one state agency is considering GHG emissions in environmental reviews.
Minnesota DOT (2020)	Minnesota DOT (2020). Transportation Resilience Report: Current Practices and Opportunities for MnDOT. https://edocs-public.dot.state.mn.us/edocs_public/DMResultSet/download?docId=22712268	This report documents MnDOT's focus on infrastructure vulnerability and policies that incorporate changing weather patterns into infrastructure design, along with their recognition that other aspects of climate change will need to be considered to advance the resilience of its transportation network. It has developed a Slope Vulnerability Assessment and Stabilization Guide, an Extreme Flood Vulnerability Assessment, a flood mitigation program, and an Aquatic Organism Passage Guide. It also considers geomorphic design in floodplain culverts, stormwater, and erosion control to protect assets, salt management, and native and resilient plants. MnDOT identifies projects with adjacent vulnerable populations with a view that increasing transportation equity will have the added benefit of improving community resilience. It plans to incorporate the best practices of adaptive capacity to climate change to more directly capture the benefit to vulnerable populations.	This document discusses transportation resilience practices but does not directly address adaptation/resilience in environmental reviews.
Morris and Fragala (2010)	Morris, A. and L. Fragala (2010). *NCHRP Synthesis 407 Effective Public Involvement Using Limited Resources*. Transportation Research Board of the National Academies, Washington D.C. https://doi.org/10.17226/14411	This synthesis was prepared to report on the state of the practice and to identify effective public involvement using limited resources. It provides information about staff and agency experiences in the application of effective and cost-effective strategies and implementation techniques used to engage the public in the development of transportation plans and projects, as well as strategies found to be ineffective.	This resource can help planners develop effective strategies for engaging the public in environmental analysis, including consideration of GHG emissions and climate change effects.

Short Reference	Bibliographic Reference	Brief Description	Relevance
Multistate (2019)	Comments of the Attorneys General of California, Colorado, Connecticut, Delaware, the District of Columbia, Illinois, Maine, Maryland, Massachusetts, Minnesota, New Mexico, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, Vermont, and Washington on the 2019 Draft National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions (2019). https://oag.ca.gov/system/files/attachments/press-docs/NEPA%20GHG%20Guidance%20Multistate%20Comments_8-26-19.finalsubmission-w-Attachments.pdf	Eighteen states and the District of Columbia submitted comments opposing the 2019 Draft Guidance on Consideration of GHG Emissions and urging CEQ to revise and readapt the previous (2016) guidance. The commenters argued that the Draft 2019 Guidance is inconsistent with NEPA, that it failed to address climate change and its impacts (although it focused on GHGs), and that it undermined NEPA's disclosure requirements. The commenters argue that the guidance increases uncertainty and creates new legal risks for projects. The comments provide examples of case law, including *Sierra Club v. FERC*, where the court found that FERC must consider the indirect impacts of a project, including upstream and downstream GHG emissions, and argue that the Draft 2019 Guidance is inconsistent with such case law. Commenters also point out that tools for quantifying GHG emissions have been widely available for some time and have improved. The commenters point out that CEQ, without justification, changed its policy regarding the use of the social cost of carbon and that the guidance discourages mitigation and fails to address adaptation and resiliency. Notably, the commenters encourage consistency between NEPA and state environmental analysis.	Provides a summary of the perspective of more than a third of the states on addressing GHG and climate change under NEPA. The States call for clear and consistent guidance and instructions on performing analysis and note that the 2019 guidance creates confusion and "moves in the wrong direction, muddying the waters on the analysis of climate change impacts under NEPA and creating new legal risks for actions subject to NEPA."
New York City (2021)	New York City Mayor's Office of Environmental Coordination (2021). City Environmental Quality Review 2021 Technical Manual, Chapter 18: Greenhouse Gas Emissions and Climate Change. https://www1.nyc.gov/assets/oec/technical-manual/18_Greenhouse_Gas_Emissions_2021.pdf	The main focus of this guidance is on GHG emissions. It includes guidance for when and how to assess GHG emissions for projects from all sectors of the economy. Mobile source emissions include emissions from transportation projects and from direct and indirect sources (direct emissions from fleet vehicles owned or leased and operated by the applicant, indirect emissions from other vehicle trips to or from the project site) for economic development projects. For these types of projects, assessments include obtaining trip generation estimates, calculating VMT for each vehicle type and facility type, calculating emissions for the project's build year and each facility type, and assessing qualitatively how the project helps achieve New York City's goals for reducing mobile source GHG emissions. Construction emissions should be discussed qualitatively using best practices to minimize emissions.	This analysis would be typically presented in an EIS. However, on a case-by-case basis, depending on the project, this assessment may be provided for a lower-class environmental document.

Short Reference	Bibliographic Reference	Brief Description	Relevance
New York State DEC (2009)	New York State Department of Environmental Conservation (2009). Draft Guide for Assessing Energy Use and Greenhouse Gas Emissions in an Environmental Impact Statement. https://www.dec.ny.gov/regulations/56552.html	This document provides instructions to Department of Environmental Conservation (DEC) staff for reviewing an EIS pursuant to the State Environmental Quality Review Act when the EIS includes a discussion of energy use or GHG emissions. Other state and local agencies may choose to use relevant parts of this guide when serving as SEQR lead agency for a project subject to an EIS that includes a discussion of energy use or GHG emissions.	This document provides one of the first examples of state guidance on addressing GHG emissions as part of a state environmental review process.
New York State DEC (2020)	New York State Department of Environmental Conservation (2020). New York Community Risk and Resiliency Act Implementation Guidance. https://www.adaptationclearinghouse.org/resources/new-york-community-risk-and-resiliency-act-implementation-guidance.html	In November 2020, the New York DEC released a series of four guidance documents to implement part of the New York Community Risk and Resiliency Act (CRRA), as amended by the New York State Climate Leadership and Community Protection Act. The CRRA requires that state agencies consider future climate impacts as a part of certain planning, permitting, and funding actions. The CRRA also requires that the DEC issue guidance for state agencies and other audiences to implement the CRRA. In accordance with that requirement, DEC issued four guidance documents related to reducing flooding risk, estimating guideline elevations, and smart growth public infrastructure assessment. While these guidance documents were developed by DEC to facilitate the implementation of the New York Community Risk and Resiliency Act, much of the information presented is applicable to other jurisdictions that seek to manage floodplains in accordance with climate risks.	Provides guidance to New York State agencies, including the state DOT, on including different resilience, flooding, and sea-level rise criteria into project design, permitting, and funding decisions, including under New York State's Environmental Quality Review Act, as required by state law.
NHDOT (2014)	New Hampshire DOT (2014). New Hampshire DOT's Potential Impacts of Climate Change on Transportation Infrastructure. https://www.nh.gov/dot/climate-change/documents/climate-change-report-2014.pdf	The purpose of this report is to help maintain and improve the integrity and function of NHDOT transportation systems by developing a strategy through which NHDOT could reduce the impact of climate change on their assets and programs. The document provides an overview of climate change in New Hampshire, a prioritized list of NHDOT assets, programs, policies, and activities that may be impacted by climate change, and an action plan providing adaptation strategies to help set priorities for the agency and increase resiliency.	This document provides an example of a state DOT's programmatic study of potential climate change effects.

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NCDOT (2021a)	North Carolina DOT (2021). Resilience Strategy Report. https://www.ncdot.gov/initiatives-policies/Transportation/transportation-resilience/Documents/ncdot-resilience-policy.pdf	These documents describe an effort to assess infrastructure in North Carolina's multimodal transportation network and identify and mainstream resilience efforts across NCDOT activities. They describe recent project development and design efforts. NCDOT plans to Identify and pilot resilience screening review for major projects and key transportation assets. NCDOT is to consider resiliency in its organization and the state's transportation system. It shall enhance resilience in all day-to-day organizational activities.	The strategy does not directly address project-level environmental review but does provide information that could be used to document climate effects in the review process.
NCDOT (2021b)	North Carolina DOT (2021). NC Moves 2050 Plan. https://www.ncdot.gov/initiatives-policies/Transportation/nc-2050-plan/Documents/nc-moves-final-plan.pdf	This long-range plan considers climate change and resiliency and indicates the state must prepare for more extreme weather events, coordinate closely with other agencies, and ensure infrastructure will withstand harsher future conditions. It finds that it must mainstream risk/resiliency practices to maintain a high-quality transportation system. It seeks to share Information and data to help evaluate risks and inform funding decisions for future projects. A risk-based analysis will support the development of investment recommendations and decisions for a more resilient system.	This document does not discuss project-level environmental reviews, but it does generally address the need to consider climate effects in infrastructure development.
Oregon DOT and Multnomah County (2021)	Oregon DOT and Multnomah County (2021). Earthquake Ready Burnside Bridge Draft Environmental Impact Statement. https://www.multco.us/earthquake-ready-burnside-bridge/draft-environmental-impact-statement	This draft EIS evaluates a project to provide a community with a reliable river crossing after a major earthquake. Chapter 3 includes findings from Air Quality, Climate Change, and EJ technical reports.	This is an example of a project in which the Purpose and Need is itself focused on increasing the community's resilience.
Oregon DOT (2018a)	Oregon DOT (2018). Air Quality Manual: Project Level. https://www.oregon.gov/odot/GeoEnvironmental/Docs_Environmental/Air-Quality-Manual.pdf	Project-level GHG analyses are typically conducted for Environmental Impact Statements (EISs) and some Environmental Assessments (EAs). These analyses are not typically performed for Categorical Exclusions (CEs). When a quantitative analysis is performed for a project, operational, construction, and maintenance emissions are calculated. These emissions are then used to derive a cumulative (or "net") change in emissions over the life of the project. This guidance also suggests that for some projects, it is advisable to include a discussion on climate impacts and reference relevant data such as vulnerability assessment maps.	This analysis is typically part of the Air Quality Report in an appendix in the environmental document and summarized in the main body of the environmental document as a technical "pull-out".

Short Reference	Bibliographic Reference	Brief Description	Relevance
Oregon DOT (2018b)	Oregon DOT (2018). Oregon Greenhouse Gas Modeling and Analysis Tools. https://www.oregon.gov/odot/Planning/Documents/GHG_Tools_Overview.pdf	This document describes GHG analysis tools that can be used across a spectrum of needs, including at the strategic, tactical, and operational levels. The document discusses capabilities and limitations of each tool.	Some of the tools are relevant to project-level GHG analysis, while others are intended for planning or systems-level analysis.
Oregon DOT (2021)	Oregon DOT (2021). Climate Action Plan 2021–2026. https://www.oregon.gov/odot/Programs/Documents/Climate_Action_Plan_2021-2026.pdf	Oregon DOT's Climate Action Plan references a number of Oregon DOT activities to address climate change effects. The plan notes that Oregon was one of several states piloting an NCHRP study (NCHRP 15-61, Applying Climate Change Information to Hydrologic and Hydraulic Design of Transportation Infrastructure, which investigated the level of effort and significance of design change(s) using climate projections for an existing coastal bridge with both inland and coastal hydrology inputs. In addition, Oregon DOT is prioritizing research into coastal adaptation, outlining areas at risk, mitigation options, and management strategies for planning and project development. Oregon DOT's Transportation and Growth Management Program is addressing GHG reduction and equity considerations by trying to identify historically and currently underserved communities and addressing how the impacts to those communities will be assessed and participation encouraged. Oregon DOT also has provided funding for organizations that represent currently or historically underserved communities to help ensure the representation of diverse perspectives and voices as it develops rules and policies to reduce GHG pollution.	This document describes actions to reduce GHG emissions, improve resilience to climate effects, and address climate equity but does not directly address adaptation/resilience in environmental reviews.
PANYNJ (2018)	Port Authority of New York and New Jersey (2018). PANYNJ Climate Resilience Design Guidelines (v1.2), 2018 Clean and Resilient Development. https://www.panynj.gov/port-authority/en/about/Environmental-Initiatives/climate-resilience.html	This guidance focuses on sea-level rise and describes steps to maximize resilience at Port Authority facilities. The steps described are the following: Determine the applicability of the Climate Resilience Guidelines; include climate resilience in project documents; establish the project's design flood elevation; develop resilient design strategies; and, for some projects, conduct a climate risk-enhanced benefit-cost analysis (the incremental cost of designing for resilience compared to projected avoided losses over time due to flood-related failures). The project documents referred to in Step 2 are for the project proposal, consultant services, design criteria/performance criteria/basis of design documents, and requirements and provisions for work.	Environmental documents are not included as such, but the environmental review is likely to be part of the documents, especially project proposals and/or consultant services.

Short Reference	Bibliographic Reference	Brief Description	Relevance
Pennsylvania DOT (2017)	Pennsylvania DOT (2017). Pennsylvania Department of Transportation Project-Level Air Quality Handbook, Publication No. 321. http://www.dot.state.pa.us/public/PubsForms/Publications/PUB 321.pdf	This handbook provides guidance on how to conduct the qualitative or quantitative GHG analyses required for projects that meet the definition of "regionally significant" under Federal transportation conformity regulations. If the project affects VMT or speeds and has not been assessed under a planning level GHG assessment, then a quantitative analysis is performed; otherwise, a qualitative analysis is performed. Operational, fuel-cycle, and construction GHG emissions are included in a quantitative analysis. This handbook also addresses the impacts of climate change. It suggests a discussion of climate change effects on the project or the selection of alternatives and a limited discussion of the impact on the affected environment and adaptation and resiliency. PennDOT considers extreme rainfall and flooding to be the primary climate concern. PennDOT has guidance related to EJ, but it is not tied to climate change issues.	This analysis is typically part of the Air Quality Report in an appendix in the environmental document and summarized in the main body of the environmental document.
Proudfoot et al. (2015)	Proudfoot, J., D. Ponder, D. Tindall, and D. Wysocki (2015). *NCHRP Report 804: Guidebook for Designing and Managing Rights-of-Way for Carbon Sequestration and Biomass Generation*. Transportation Research Board of the National Academies, Washington, D.C. https://doi.org/10.17226/22154	This guidebook and an accompanying feasibility toolkit describe the state of the practice of using highway rights-of-way vegetation for carbon sequestration and biomass generation for use as feedstock for biopower and biofuel production. The guidebook and toolkit are intended to assist operations and maintenance managers, vegetation managers, alternative finance officers, and environmental managers seeking to extract greater financial and environmental value from roadside vegetation.	The guidebook and toolkit are a resource for state DOTs considering whether and how to apply right-of-way carbon sequestration as a GHG mitigation measure for projects.
Rhode Island DOT (2019)	Rhode Island DOT (2019). Transportation Asset Management Plan. https://tamptemplate.org/wp-content/uploads/tamps/050_rhodeislanddot.pdf	Under consideration of Environmental Risk Management, this document includes risks to the state's transportation system from sea-level rise. It describes an ongoing project called STORMTOOLS, which developed models and maps for short- and long-term planning, illustrating what coastal flooding could look like in the future under different sea-level rise and storm scenarios. These maps allow a better understanding of the risks of coastal inundation for transportation asset management, particularly because of the expected lifespan of roads and bridges constructed today.	This report does not address project-level environmental reviews, but it does provide information and methods that could be used to document climate effects in the review process.

Short Reference	Bibliographic Reference	Brief Description	Relevance
Rhode Island Mobility Innovation Working Group (2021)	Rhode Island Mobility Innovation Working Group (2021). Clean Transportation and Mobility Innovation Report Rhode Island's Roadmap to a Clean Transportation Future. http://climatechange.ri.gov/documents/mwg-clean-trans-innovation-report.pdf	Developed by a broad group of agency, private sector, and non-governmental organization representatives to reduce GHG emissions from the transportation sector, this report looks to implement new technologies and strategies for a more equitable and environmentally responsible transportation system. In general, electrification, expanded public transportation options, and encouragement of infrastructure and community design that allow for active transportation are described. It recognizes the need to provide benefits for residents of overburdened and underserved communities. The report presents 24 specific transportation-related recommendations and 37 immediate action steps.	This document does not discuss project-level environmental reviews. However, for some of the recommendations and immediate actions steps, long-range plans, TIPs and/or transportation project environmental reviews may serve as a reporting mechanism.
Sabin Center (undated)	Sabin Center for Climate Change Law at Columbia Law School and Arnold & Porter (undated). The U.S. Climate Change Litigation Database. http://climatecasechart.com/climate-change-litigation/us-climate-change-litigation/	This database includes information on legal cases that relate to climate change.	This resource can help identify cases related to climate change that were brought under NEPA and state environmental review laws and the factors leading to litigation.
Siegel (2019)	Siegel, M. and A. Loznak. (2019). Survey of Greenhouse Gas Considerations in Federal Environmental Impact Statements and Environmental Assessments for Fossil Fuel-Related Projects, 2017-2018. Sabin Center for Climate Change Law. http://columbiaclimatelaw.com/files/2019/10/NEPA-Survey-Report-10.15-Final-Loznak-and-Siegel.pdf	The paper provides a recent summary of climate change consideration under NEPA on fossil fuel projects. It discusses how 16 NEPA projects included in the study addressed climate change with respect to the following elements: scope of action (connected actions and tiering); direct and indirect emissions; alternatives (considering emissions and adaptation); mitigation of GHG emissions; effect of climate change on the proposed action; and adaptation measures.	This analysis of recent NEPA reviews within the energy sector provides a basis for comparison with recent NEPA reviews within the transportation sector. It also provides a relevant list of elements to be considered when reviewing climate change considerations under NEPA and a sound framework that could be incorporated into the current transportation study.

Short Reference	Bibliographic Reference	Brief Description	Relevance
Tennessee DOT (2011)	Tennessee DOT (2011). Tennessee Environmental Procedures Manual, Guidelines for Preparing Environmental Documentation for Federally Funded and State Funded Transportation Projects. https://www.tn.gov/content/dam/tn/tdot/environmental/Environmental Procedures Manual 2-10-16.pdf	A qualitative discussion of the GHG emissions associated with the project is to be included in the air quality analysis for EIS projects. Template language has been prepared, stressing the small contribution of GHGs from a project compared to the transportation sector's overall GHG emissions.	This discussion is typically part of the Air Quality Report in an appendix in the environmental document and summarized in the main body of the environmental document.
Tennessee DOT (2015)	Tennessee DOT (2015). Assessing the Vulnerability of Tennessee Transportation Assets to Extreme Weather. https://www.fhwa.dot.gov/environment/sustainability/resilience/pilots/2013-2015_pilots/tennessee/final_report/tdot.pdf	As a result of this study, TDOT planned to enhance a number of its policies and procedures. Those most relevant to project environmental review include modifying road design policies and parameters; considering changes in the way TDOT designs, constructs, and repairs bridges; considering the impacts of extreme weather as part of the environmental review process; and identifying new data collection activities to better characterize and monitor the condition of vulnerable assets.	It is expected that climate change effects, impacts of extreme weather, and their relation to the design and scope of the project will be included in the environmental document.
Texas DOT (2018)	Texas DOT (2018). Technical Report: Statewide On-Road Greenhouse Gas Analysis and Climate Change Assessment. https://ftp.txdot.gov/pub/txdot/get-involved/sat/loop-1604-from-sh16-i-35/091020-greenhouse-gas-report.pdf	This report addresses both GHG emissions and mitigation, as well as the impacts of climate change on the Texas transportation system. With regard to GHG emissions and mitigation, it presents a statewide on-road and fuel-cycle emissions analysis and TxDOT actions and funding to support emissions reduction. With regard to impacts of climate change, the report describes impacts from extreme weather events, extreme heat and drought, precipitation, flooding, and sea-level rise, as well as TxDOT strategies to address these. The report concludes with a discussion of uncertainty associated with traffic models and projections and with climate models and predictions.	Currently, TxDOT addresses climate change considerations for NEPA project-level decisions by referencing this programmatic statewide assessment. See TxDOT (2021).
Texas DOT (2020)	Texas DOT (2020). Final Environmental Impact Statement: North Houston Highway Improvement Project, Houston District. https://www.txdot.gov/content/dam/project-sites/nhhip/docs/nhhip-feis-vol-me-i-2020.pdf	This is the final EIS for the proposed North Houston Highway Improvement Project that would include a set of roadway improvements north of downtown Houston in Harris County, Texas.	The project includes a number of climate change mitigation measures, such as those that were informed by public engagement. The FEIS describes these measures and the process for soliciting public input.

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Texas DOT (2021)	Texas DOT (2021). Environmental Handbook Preparing an Environmental Assessment. https://www.txdot.gov/content/dam/docs/environmental/toolkit/620-05-gui.pdf	Chapter 5 of this handbook includes text related to climate change and greenhouse gas emissions for FHWA projects for which an EA is being performed. The text consists of generic qualitative statements related to climate science, on-road greenhouse gas emissions, TxDOT policies and activities related to climate change and greenhouse gas emissions, and mitigation measures.	The text must be included in the Greenhouse Gas and Emissions chapter of the EA for projects whose public hearing is on or after August 1, 2021.
Twaddell and Zgoda (2020)	Twaddell, H., and B. Zgoda (2020). *TCRP Research Report 214: Equity Analysis in Regional Transportation Planning Processes*. Transportation Research Board, Washington, DC. https://doi.org/10.17226/25860	This report documents a five-step equity analysis framework for regional transportation plans and programs. The report distinguishes between *required populations or groups* (protected under Title VI and Executive Orders (EOs), *underserved persons or communities* (any group considered for inclusion in equity analysis), and the *transportation disadvantaged* (those dependent on others for access).	While focused on programs rather than projects, this report has a number of elements that may be useful for environmental review, such as an overview of federal requirements related to equity in planning, various definitions of equity and protected populations, and procedural best practices; it may also support equity consideration through planning and environmental linkages.
Ulibarri, Perez Figueroa, and Grant (2022)	Ulibarri, N., Perez Figueroa, O., and A. Grant (2022). Barriers and Opportunities to Incorporating EJ in the National Environmental Policy Act. *Environmental Impact Assessment Review*, Vol. 97. https://doi.org/10.1016/j.eiar.2022.106880	This paper explores how EJ—specifically procedural, distributive, and recognition justice—is currently addressed in the preparation of EISs and identifies barriers and opportunities for better inclusion. The authors find that many NEPA practitioners see NEPA as a valuable tool for achieving procedural and distributive justice. However, a number of institutional and organizational barriers exist, most prominently a structure that hinders opportunities for meaningful public engagement, ambiguity in how distributive justice is defined and implemented, and a lack of substantive requirements for potential distributional inequities to be addressed.	This paper provides insights that can help transportation planners and public involvement staff better structure opportunities for public engagement on climate change effects to ensure meaningful input from EJ communities.
U.S. DOS and EOP (2021)	The United States Department of State and the United States Executive Office of the President (2021). The long-term strategy of the United States: pathways to net-zero greenhouse gas emissions by 2050. https://www.whitehouse.gov/wp-content/uploads/2021/10/US-Long-Term-Strategy.pdf	This document lays out how the United States can reach its ultimate goal of net-zero emissions no later than 2050 and keep a 1.5°C limit on global temperature rise within reach and prevent unacceptable climate change impacts and risks.	This document provides justification for seeking ambitious GHG reductions. It references goals for zero-emission vehicles and sustainable fuels that are likely to affect future emissions from transportation sources considered as part of environmental reviews.

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U.S. DOT (2021a)	U.S. Department of Transportation (2021). Climate Action Plan: Revitalizing Efforts to Bolster Adaptation and Increase Resilience. https://www.sustainability.gov/pdfs/dot-2021-cap.pdf	This plan builds on the previous Climate Action Plans prepared in 2012 and 2014. It discusses how the U.S. DOT has integrated climate change impacts, adaptation, and resilience into domestic and international planning, operations, policies, and programs. It outlines opportunities and obligations to accelerate reductions in GHG emissions from the transportation sector and make transportation infrastructure more climate change resilient now and in the future by ensuring that federally supported transportation infrastructure and DOT programs, policies, and operations both consider climate change impacts *and* incorporate adaptation and resilience solutions whenever possible.	This plan contains guidance from the U.S. DOT on how it will seek to incorporate climate change considerations and mitigate GHG emissions into its various agency activities, including planning and project reviews.
U.S. DOT (2021b)	U.S. Department of Transportation (2021). U.S. Department of Transportation Actions to Address EJ in Minority Populations and Low-Income Populations. Document number DOT 5610.2C. https://www.transportation.gov/sites/dot.gov/files/2021-08/Final-for-OST-C-210312-003-signed.pdf	This order updates and clarifies the original (1997) DOT EJ Order and cancels and supersedes the 2020 DOT order on EJ (Order 5610.2B). The 2021 Order calls for identifying and evaluating effects; measures to avoid, minimize, and/or mitigate disproportionately high and adverse effects and providing offsetting benefits; considering alternatives; and public engagement.	Federal transportation agency order on considering EJ. Applies to DOT projects, programs, policies, and activities that affect human health or the environment, such as permits, licenses, and financial assistance provided by DOT.
U.S. EPA (2022)	U.S. Environmental Protection Agency. Climate Change Website. https://www.epa.gov/climate-change	The EPA climate change website includes links to information about climate science, GHG emissions, and climate change indicators, information on what EPA and others are doing to address climate change, and information on considering climate change effects in different sectors, including transportation. Notably, the website provides a link to the EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks, which can be used to provide context of emission trends nationwide, as well as trends within specific sectors and subsectors, including transportation. The website also includes a link to the EPA's Adaptation Resource Center (ARC-X), an interactive resource for local governments with information about climate risks, adaptation strategies, case studies, tools, and EPA funding opportunities. The website also links to EPA's 2021 Climate Adaptation Action Plan, which broadly outlines EPA's planned priority actions and performance measures.	The website provides a collection of climate change resources, information, and tools that could be used to inform NEPA analyses and documentation.

Short Reference	Bibliographic Reference	Brief Description	Relevance
U.S. EPA (undated)	U.S. Environmental Protection Agency. How Citizens can Comment and Participate in the National Environmental Policy Act Process. https://www.epa.gov/nepa/how-citizens-can-comment-and-participate-national-environmental-policy-act-process	This website provides information on opportunities for public engagement as part of the NEPA process.	This resource can help planners develop effective strategies for engaging the public in environmental analysis for NEPA, including consideration of GHG emissions and climate change effects.
U.S. EPA (2013)	U.S. EPA (2013). Model Guidelines for Public Participation: An Update to the 1996 NEJAC Model Plan for Public Participation. https://www.epa.gov/environmentaljustice/model-guidelines-public-participation	This document provides guidelines for public participation with a focus on outreach to EJ communities. It updates a 1996 document of the National EJ Advisory Council (NEJAC).	This resource can help planners develop effective strategies for engaging EJ communities in environmental analysis, including consideration of GHG emissions and climate change effects.
U.S. EPA (2016)	U.S. EPA (2016). Using MOVES for Estimating State and Local Inventories of Onroad Greenhouse Gas Emissions and Energy Consumption. EPA-420-B-16-059. https://www.epa.gov/state-and-local-transportation/estimating-greenhouse-gas-emissions	This technical guidance describes how to use EPA's MOVES models to estimate greenhouse gas emissions and/or energy consumption from on-road vehicles in a state or metropolitan area.	Provides information for practitioners using MOVES to estimate GHG emissions, including provision of input data, model application, and processing of outputs.
U.S. EPA (2020)	U.S. EPA (2020). Greenhouse Gas and Energy Consumption Rates for Onroad Vehicles in MOVES3. EPA-420-R-20-015. https://www.epa.gov/moves/moves-onroad-technical-reports	This report describes the energy and greenhouse gas rates in MOVES3 and documents the data sources and analyses used to develop the energy and greenhouse gas emission rates.	Provides insights into the methods and assumptions behind MOVES3 relevant to GHG emissions, such as the Federal emission standards that are reflected, carbon content of fuels, and emission rates per start.
U.S. EPA (2021a)	U.S. EPA (2021). Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts. EPA 430-R-21-003. https://www.epa.gov/system/files/documents/2021-09/climate-vulnerability_september-2021_508.pdf	This report contributes to a better understanding of the degree to which four socially vulnerable populations—defined based on income, educational attainment, race and ethnicity, and age (Table ES.1)—may be more exposed to the highest impacts of climate change in six categories: air quality and health; extreme temperature and health; extreme temperature and labor; coastal flooding and traffic; coastal flooding and property; and inland flooding and property.	This report provides information that may be relevant to transportation agencies considering how climate change effects related to a proposed project or program could impact vulnerable communities.

Short Reference	Bibliographic Reference	Brief Description	Relevance
U.S. EPA (2021b)	U.S. EPA (2021). Emission Factors for Greenhouse Gas Inventories. https://www.epa.gov/climateleadership/ghg-emission-factors-hub	This document provides a variety of emission factors for different types of transportation fuels and vehicles, including CO_2, CH_4, and N_2O.	This is a useful reference for factors of GHG content per unit of fuel (gallon or unit of energy) and also for non-CO_2 grams per mile emission factors.
U.S. EPA (2022)	U.S. EPA (2022). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2020. 430-R-22-003. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks	This report provides a comprehensive inventory of GHG emissions sources and sinks in the U.S., as well as information on methods used to develop the inventory. It is updated annually.	This document is useful for information on national-scale transportation emissions and for placing transportation emissions in perspective with other emissions at a national level.
U.S. EPA (2023)	U.S. EPA (2023). MOVES4: Overview of Planned Updates. July 20, 2023 Public Webinar. https://www.epa.gov/system/files/documents/2023-08/moves4-plan-update-overview-webinar-2023-07-20.pdf	These webinar slides provide information on the updates to MOVES4 as compared to the MOVES3 model.	A number of updates are relevant to GHG emissions, including the incorporation of the most recently adopted federal light-duty and heavy-duty GHG standards and improved capabilities to model electric vehicles.
University of New Hampshire (2020)	University of New Hampshire (2020). New Hampshire Coastal Flood Risk Summary, Part II: Guidance for Using Scientific Projections. https://scholars.unh.edu/cgi/viewcontent.cgi?article=1210&context=ersc	This guidance document follows up on a previous study that looked at climate science relevant to New Hampshire and includes updated projections of relative sea-level rise, coastal storms, groundwater rise, precipitation, and freshwater flooding. It includes principles for enhancing coastal flood resilience and a step-by-step approach and worksheet for selecting and incorporating updated coastal flood risk projections into private, local, state, and federal projects, including planning, regulatory, or site-specific efforts, including transportation projects. It features guidance on prioritizing equity and justice for socially vulnerable populations throughout the process.	The guidance does not directly address transportation project-level environmental review, but it does provide methods for considering resilience in project development that could be implemented and referenced as part of the environmental review process.

Short Reference	Bibliographic Reference	Brief Description	Relevance
USDA (2009)	U.S. Department of Agriculture, Forest Service (2009). Climate Change Considerations in Project Level NEPA Analysis. https://www.fs.usda.gov/emc/nepa/climate_change/includes/cc_nepa_guidance.pdf	This guidance discusses considerations in addressing climate change under NEPA (both effects of proposed projects and effects of climate change on proposed projects). It discusses scientific resources and tools available and recommends quantifying emissions to the extent that it informs the decision-making process. Further, it discusses the challenge of linking project-level emissions to global climate effects. It states that coming to a significance conclusion is not possible and not necessary because there is no established significance threshold.	This document provided initial Forest Service guidance on how to consider climate change in NEPA. It serves as a relevant example of how one Federal agency approached consideration of climate change, quantification of emissions, and significance.
USDA (2016)	Brandt, L., and C. Schultz (2016). Climate Change Considerations in National Environmental Policy Act Analysis. U.S. Department of Agriculture, Forest Service, Climate Change Resource Center. www.fs.usda.gov/ccrc/topics/nepa	This guidance revises the initial USDA (2009) guidance. For each of the three stages of NEPA (proposal development, environmental analysis, and implementation and monitoring), the guidance discusses how or when to consider effects related to climate change, along with examples from completed NEPA analyses and resources. The guidance mentions future updates to long-term plans and consistency with planning goals. It provides examples of when a quantified assessment of emissions may be appropriate and when such assessment may be more appropriate at a regional or programmatic level. The document includes links to specific NEPA documents where climate change was addressed, including effects from the project, on the project, and cumulative effects of climate change and the project on environmental resources. The significance of climate change effects at the project level is discussed, along with acknowledging the absence of a significance threshold.	The document provides a structured discussion of climate change considerations under NEPA, with links to tools, information, and examples. It discusses the type of information that is relevant to consider during different stages of the NEPA process. The document also discusses significance. Unlike the 2009 guidance, the document does not indicate that a significance conclusion is not possible and not necessary.

Short Reference	Bibliographic Reference	Brief Description	Relevance
USGCRP (2016)	U.S. Global Change Research Program (2016). The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. http://dx.doi.org/10.7930/J0R49NQX	This report describes climate-related health burdens and provides a summary review of published literature on the topic. Climate-related health impacts are grouped into the following categories: temperature-related, air quality impacts, impacts of extreme events, vector-borne diseases, water-related illnesses, food safety, nutrition and distribution, and mental health and well-being. The report discusses vulnerability to climate change-related health risks, acknowledging that the vulnerability is a function of sensitivity, exposure, and capacity to respond or cope. The report further describes vulnerable populations of concern. The report notes that characterizations of vulnerability should consider how populations of concern experience disproportionate, multiple, and complex risks to their health and well-being in response to climate change. Specific to transportation, the report discusses climate-related disruption to transportation systems, emergency access, evacuation routes, access by people with disabilities, and transport of food.	The report provides an overview of climate change impact of health, summarizes relevant published studies, categorizes the impacts, and discusses vulnerability to the effects of climate change, and notes that vulnerability should consider disproportionate impacts on populations of concern, including EJ communities.
USGCRP (2018)	U.S. Global Change Research Program (2018). Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II. Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.). https://nca2018.globalchange.gov/	The report documents vulnerabilities, risks, and impacts associated with climate change across the United States and provides examples of response actions. It also identifies ten regions within the U.S. and discusses the current and future risks from climate change and ways to minimize and manage risks within each region. The report also includes a section specific to the transportation sector. This section discusses the impacts of specific climate hazards on the transportation system, the interdependence of the transportation and other sectors, the effects of disruption in the transportation network during extreme weather events, as well as resilience planning, vulnerability assessments, and the challenges of implementing resilience measures within the transportation sector.	The report provides an overview of climate hazards and indicators across the U.S. and at a regional level, discusses climate vulnerability and resilience within the transportation sector, and includes data and links to additional data and tools that could inform the consideration of climate change effects in NEPA studies and transportation planning.
USGCRP (2022)	U.S. Global Change Research Program (2022). U.S. Climate Resilience Toolkit. https://toolkit.climate.gov/	This website provides resources to learn about potential climate hazards and protect vulnerable assets. The toolkit provides a five-step process, including 1) understanding exposure, 2) assessing vulnerability and risk, 3) investigating options, 4) prioritizing and planning, and 5) taking action.	These resources may be relevant to transportation planners evaluating project-level climate change impacts.

Short Reference	Bibliographic Reference	Brief Description	Relevance
UW (2022)	University of Washington (2022). Climate Impacts in Brief. https://cig.uw.edu/learn/climate-impacts-in-brief/	This website summarizes the combined effects of climate change and climate variability in the Pacific Northwest on a wide range of impacts on the region's communities, economy, and natural systems.	This is an example of state-specific information on climate change effects that can inform environmental review.
Virginia DOT (2019)	Virginia Department of Transportation (2019). Incorporating Potential Climate Change Impacts in Bridge and Culvert Design. https://vtrc.virginia.gov/media/vtrc/vtrc-pdf/vtrc-pdf/20-R13.pdf	This document describes Virginia DOT's approach to sea-level rise and rainfall intensity. When Virginia DOT assets are designed using rainfall data, the values should be increased to account for the greater rainfall predicted due to climate change. When Virginia DOT assets are designed using discharge data not derived from rainfall, the values should be increased to account for the greater discharges due to climate change.	This report provides information and methods that could be used to document climate effects and responses in the review process.
Virginia DOT (2021)	Virginia Department of Transportation (2021). Chapter 33 VDOT Bridge Manual – Considerations of Climate Change and Coastal Storms. https://www.vdot.virginia.gov/media/vdotvirginiagov/doing-business/technical-guidance-and-support/technical-guidance-documents/structure-and-bridge/manuals-of-structure-and-bridge-acc/part2/Chapter33.pdf	The manual identifies the impacts of sea-level rise, temperature change, salinity, and precipitation intensity as climate change factors that affect bridges and describes how they impact bridges. It has design procedures and requirements for dealing with the expected impacts.	This report provides information and methods that could be used to document climate effects and responses in the review process.
Virginia DOT (2022a)	Virginia DOT (2022). Virginia Statewide Greenhouse Gas Planning Level Analysis. Prepared by Cambridge Systematics, Inc. https://www.vdot.virginia.gov/media/vdotvirginiagov/projects/hampton-roads/i-64-opportunity-connector-federal-grant/asset_upload_file392_192957.pdf	This document describes a statewide GHG inventory of 2015 emissions from surface transportation sources in Virginia; a forecast of 2040 emissions with no changes to the transportation system ("2040 no-build"); and a forecast of 2040 emissions if state and regional transportation plans and investment programs are implemented ("2040 build").	This document provides information documenting and comparing methods for statewide GHG analysis that other states may find useful when developing procedures to develop programmatic GHG assessments.

Short Reference	Bibliographic Reference	Brief Description	Relevance
Virginia DOT (2022b)	Virginia DOT (2022). Virginia Statewide Greenhouse Gas Planning Level Analysis. Memorandum prepared by Cambridge Systematics, Inc.	This memorandum summarizes the methodologies and findings of a pilot analysis that compares GHG emissions under a base year and future year no-build and various multimodal build alternatives analyses for a section of a major highway corridor. The memorandum presents and evaluates alternative methods for estimating various sources of emissions.	This document provides information documenting and comparing methods that other states may find useful when developing procedures to address GHG emissions in environmental documents.
Virginia DOT (2023)	Virginia Department of Transportation (2023). VDOT Project-Level Air Quality Resource Document. https://www.vdot.virginia.gov/media/vdotvirginiagov/doing-business/technical-guidance-and-support/technical-guidance-documents/environmental/VDOT-Project-Level-Air-Quality-Resource-Document-v.3.0.2_acc012524_PM.pdf	This document provides direction on conducting project-level air quality analysis for environmental documentation of transportation projects in Virginia.	VDOT updated this resource document in 2023 to include an appendix on methods for GHG emissions and climate change effects.
Wentz (2016)	Wentz, J. et al (2016). Survey of Climate Change Considerations in Federal Environmental Impact Statements, 2012-2014. Sabin Center for Climate Change Law. http://columbiaclimatelaw.com/files/2016/06/Wentz-et-al.-2016-02-Climate-Change-Considerations-in-Federal-EIS-2012-14.pdf	The paper provides an overview of climate change considerations in NEPA EIS documents for a broad range of projects, including 40 transportation projects. As a supplement to the paper, a summary Excel table provides the project list and tabulates how many projects considered various aspects of climate change evaluation. The climate aspects considered included direct emissions, construction impacts, induced trips, purchased electricity, other emissions, the impact of climate change on the proposed action and/or its affected environment, and the impact of climate change on water resources, energy efficiency, and water efficiency.	This analysis illustrates the range of approaches to addressing climate change in NEPA documents when climate change was initially starting to be substantively considered. It also provides a comparison of how climate was being addressed on transportation projects vs. projects in other sectors.

Short Reference	Bibliographic Reference	Brief Description	Relevance
Washington State DOT and Oregon DOT (2011)	Washington State DOT and Oregon DOT (2011). Columbia River Crossing Final Environmental Impact Statement and Final Section 4(f) Evaluation. https://www.wsdot.wa.gov/accountability/SSB5806/docs/6_Project_Development/Environmental_Process_And_Permitting/FEIS_PDFs/CRC_FEIS_Appendix_Cover.pdf	This document is the EIS for a major multimodal project study.	This EIS provides an example of how GHG and climate change effects have been evaluated within NEPA.
Washington State DOT (2011)	Washington State DOT (2011). Climate Impacts Vulnerability Assessment (CIVA). https://wsdot.wa.gov/sites/default/files/2021-10/Climate-Impact-AssessmentforFHWA-12-2011.pdf	This study provides a qualitative assessment of risks to the state's transportation system that identified areas of high potential climate impact, areas that could experience temporary operational impacts at one or more locations, and areas that could experience reduced capacity.	This is an example of how a statewide vulnerability assessment can provide information to inform project development and environmental review.
Washington State DOT (2017)	Washington State DOT (2017). Guidance for Considering Impacts of Climate Change in WSDOT Plans. https://wsdot.wa.gov/sites/default/files/2021-10/Guidance-Doc-Considering-Climate-Change-In-WSDOT-Plans.pdf	This document provides guidance for addressing the impacts of climate change in various planning documents. It uses the Department's Climate Impacts Vulnerability Assessment to identify and rate climate threats to the state's transportation infrastructure. The guidance applies to the following agency plans: Statewide Policy Plans (such as the Washington Transportation Plan); Asset Management Plans; State-interest Modal Plans (Freight Mobility, Public Transportation, Aviation, Rail, Active Transportation); State-owned Modal Plans (Highway System; Ferry System); Corridor Sketch Initiative; and Other Highway Corridor or Network Plans. It supplies steps to take for all plans and additional steps for some specific types of plans.	This guidance complements the agency's guidance for project-level assessments (see Washington State 2018).

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Washington State DOT (2018)	Washington DOT (2018). WSDOT Guidance - Project-Level Greenhouse Gas Evaluations under NEPA and SEPA. https://wsdot.wa.gov/sites/default/files/2021-10/ENV-ANE-GHGGuidance.pdf	This document and Washington State DOT (2020) describe WSDOT's approach to project-level analysis for GHG emissions. Typically, EIS and EA projects require a quantitative analysis, while CEs require no analysis or a brief qualitative discussion. Quantitative analysis may include a quantitative planning level GHG analysis, which is referenced in the project environmental document. When a project-specific quantitative analysis is performed, it must include operational (including tailpipe and upstream or fuel-cycle), construction, and maintenance emissions. Template language is provided.	This analysis is typically part of the Air Quality Report in an Appendix in the environmental document and summarized in the main body of the environmental document. The quantitative GHG analysis results are to be presented in the Cumulative Effects section of the environmental document.
Washington State DOT (2020)	Washington State DOT (2020). https://wsdot.wa.gov/sites/default/files/2021-10/ENV-ANE-AQGuidance.pdf	This document provides more specific guidance on technical approaches to modeling project-level GHG emissions. The document states that a quantitative operational analysis should be conducted using MOVES if MOVES is also being run to meet other requirements; otherwise, a qualitative operational GHG analysis should be conducted. The document provides guidance on input data sources and run setups for MOVES, as well as an outline of what to cover in the report.	This document provides more detailed technical guidance for quantitative GHG analysis consistent with the general guidance presented in Washington State (2018).
Washington State DOT (2022)	Washington State DOT (2022). Guidance for NEPA and SEPA Project-Level Climate Change Evaluations. https://wsdot.wa.gov/engineering-standards/environmental-guidance	This document provides guidance for addressing the impacts of climate change on projects in environmental documents. The guidance consists of examining the 2011 Climate Impacts Vulnerability Assessment for the project area or determining if regional or site-specific information is available, incorporating the information into the analysis and mitigation options for the project, documenting the findings in the environmental document including whether the project will exacerbate the effects of climate change on vulnerable communities and environmental resources, and documenting design changes to make the project resilient or resistant to climate threats and address the vulnerability of EJ populations, transit-dependent, or residents with special transportation needs.	This analysis is to be included in the Cumulative Effects section of the environmental document with the degree of detail based on the environmental classification of the project. Template language is available and examples from previous WSDOT projects that addressed climate impacts in environmental documents are provided.

Short Reference	Bibliographic Reference	Brief Description	Relevance
Woolsey (2012)	Woolsey, P. (2012). Consideration of Climate Change in Federal EISs, 2009-2011. Sabin Center for Climate Change Law. https://climate.law.columbia.edu/sites/default/files/content/docs/Woolsey-2012-07-Consideration-of-Climate-Change-in-Federal-EISs-2009-2011_0.pdf	The paper is based on a review of 227 EIS documents that addressed climate change between 2009 and 2011. The paper was completed following the issuance of CEQ's 2010 Draft Guidance on considering GHGs. It provides an overview of aspects of climate change considered, with sector-specific discussions, including transportation. The paper describes the widely varying procedures for addressing climate change in EIS documents that were used on projects in the absence of binding federal guidance.	This paper provides an overview of how climate change was addressed in NEPA documents shortly prior and shortly following the issuance of CEQ's 2010 Draft Guidance on considering GHGs.