

AASHTO PRACTITIONER'S HANDBOOK

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ASSESSING INDIRECT EFFECTS AND CUMULATIVE IMPACTS UNDER NEPA

This Handbook is intended to assist practitioners in assessing indirect effects and cumulative impacts in the evaluation of transportation projects under the National Environmental Policy Act (NEPA).

Issues covered in this Handbook include:

- Understanding the definitions of direct effects, indirect effects, and cumulative impacts
- Gathering the information needed for the analysis
- Deciding the appropriate scope and level of detail
- Carrying out the analysis
- Identifying mitigation opportunities
- Documenting the analysis
- Using the transportation planning process to support NEPA-level studies of indirect effects and cumulative impacts

The Center for Environmental Excellence by AASHTO produces the Practitioners Handbooks. The Handbooks provide practical advice on a range of environmental issues that arise during the planning, development, and operation of transportation projects.

Each Handbook is developed by the Center in cooperation with an advisory group that includes representatives of the Federal Highway Administration (FHWA), the Federal Transit Administration (FTA), State departments of transportation (DOTs), and other agencies as appropriate.

The Handbooks are primarily intended for use by project managers and others who are responsible for coordinating compliance with a wide range of regulatory requirements. With their needs in mind, each Handbook includes:

- A background briefing;
- Key issues to consider; and
- Practical tips for achieving compliance.

In addition, key regulations, guidance materials, and sample documents for each Handbook are posted on the Center's web site at <http://environment.transportation.org>



Center for Environmental Excellence by AASHTO



American Association of State Highway and Transportation Officials

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Overview



The requirement to assess indirect and cumulative impacts of proposed federal actions was established in the Council on Environmental Quality (CEQ) regulations implementing the National Environmental Policy Act (NEPA).

- Indirect effects are caused by the project or plan, but are separated from direct effects by time and/or distance. Indirect effects include induced growth and related environmental impacts.
- Cumulative impacts are the aggregate result of the incremental direct and indirect effects of a project or plan, the effects of past and present actions, and effects of reasonably foreseeable future actions by others on resources of concern.

This Handbook focuses primarily on the assessment of indirect effects and cumulative impacts for individual transportation projects. This Handbook also briefly describes a range of approaches for using the statewide or metropolitan transportation planning process to address indirect effects and cumulative impacts for a region or corridor.

A consistent theme throughout this Handbook is the importance of maintaining a clear distinction between an indirect effects analysis and a cumulative impacts analysis. For that reason, those analyses are addressed separately in the Practical Tips section of the Handbook.

Background Briefing

This section introduces the key terms and concepts used in the assessment of indirect effects and cumulative impacts in the NEPA process. It also briefly describes key guidance documents and reference materials, which are discussed in more detail in the Practical Tips section.

Key Terms and Concepts

Direct Effects. The CEQ regulations state that direct effects are “caused by the action and occur at the same time and place” (40 C.F.R. §1508.8). Direct effects are typically well understood and predictable. Direct effects are action-focused effects. Examples of common direct effects for transportation projects include residential and business displacements, the fill of wetlands to construct a roadway, or the removal of a historic structure.

Indirect Effects. Indirect effects are those effects that “. . . are caused by the action and are later in time and farther removed in distance, but are still reasonably foreseeable.” Indirect effects “may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.”(40 C.F.R. §1508.8). Indirect effects are action-focused effects.

There are two primary types of indirect effects: induced growth (or growth-influencing) effects and encroachment-alteration effects.

- **Induced-Growth Effects.** Induced-growth effects are changes in the location, magnitude, or pace of future development that result from changes in accessibility caused by the project. An example of an induced-growth effect is commercial development occurring around a new interchange and the environmental impacts associated with this development.
- **Encroachment-Alteration Effects.** Encroachment-alteration type indirect effects are physical, chemical or biological changes in the environment that occur as a result of the project but are removed in time or distance from the direct effects. An example of an encroachment-alteration type indirect effect is a long term decline in the viability of a population of a particular species as a result of habitat fragmentation caused by the project. These types of effects are sometimes described as direct effects. The categorization is not important as long as the NEPA document demonstrates that the effects have been considered.

Cumulative Impacts. A cumulative impact is “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.” (40 C.F.R. §1508.7).

Distinctions between Direct, Indirect and Cumulative Impacts

TYPE OF EFFECT	DIRECT	INDIRECT	CUMULATIVE
Nature of Effect	Typical/Inevitable/Predictable	Reasonably Foreseeable/ Probable	Reasonably Foreseeable/ Probable
Cause of Effect	Project	Project's Direct and Indirect Effects	Project's Direct and Indirect Effects and Effects of Other Activities
Timing of Effect	Project Construction and Implementation	At Some Future Time other than Direct Effect	In the Past, at Time of Project Construction or in the Future
Location of Effect	At the Project Location	Within Boundaries of Systems Affected by the Project	Within Boundaries of Systems Affected by the Project

Source: NCHRP Report 403, *Guidance for Estimating the Indirect Effects of Proposed Transportation Projects* (1998).

“But-For” Relationship. As a general rule, a project may be considered to cause an impact if the project is necessary for the impact to occur. This relationship is sometimes described as a “but-for” relationship: that is, the development would not have occurred but for the transportation project. A but-for condition can exist as a matter of law—e.g., if an action cannot take place without a permit. A but-for condition can also exist as a matter of fact—e.g., if a developer would choose not to build a shopping mall unless a nearby road is expanded.

Necessary vs. Sufficient. Even when a project is a necessary condition for an impact to occur, there may be—and often are—other conditions that also need to be present in order for the impact to occur. Thus, while the transportation project may be a *necessary* condition, it may not be a *sufficient* condition for the impact to occur. Other conditions that may be necessary for a development project typically include but are not limited to:

- suitable, available land for development or redevelopment.
- economic conditions that support development, e.g., markets, acceptable rate of return on investment in land purchase, design, construction, and other costs.
- zoning and other land use controls and policies suitable for the type of development suggested by market conditions.
- other infrastructure that supports development, e.g., water and sewer service.
- amenities, e.g., schools, access to recreational opportunities.

“Reasonably Foreseeable.” Indirect effects and cumulative impacts must be considered if they are reasonably foreseeable. Impacts that are merely possible, or that are considered “speculative,” are not reasonably foreseeable. In one of the leading court decisions on this topic, the U.S. Court of Appeals for the First Circuit explained the legal standard as follows:

[O]nly those effects that are “likely” (or “foreseeable” or “reasonably foreseeable”) need be discussed, ... and, as in other legal contexts, the terms “likely” and “foreseeable,” as applied to a type of environmental impact, are properly interpreted as meaning that the impact is sufficiently likely to occur that a person of ordinary prudence would take it into account in reaching a decision.¹

The CEQ provides a similar interpretation, requiring agencies to consider the “uncertain, but probable” indirect effects of their actions:

The EIS must identify all the indirect effects that are known, and make a good faith effort to explain the effects that are not known but are “reasonably foreseeable.” If there is total uncertainty about the identity of future land owners or the nature of future land uses, then of course, the agency is not required to engage in speculation or contemplation about their future plans. But, in the ordinary course of business, people do make judgments based upon reasonably foreseeable occurrences. It will often be possible to consider the likely purchasers and the development trends in that area or similar areas in recent years; or the likelihood that the land will be used for an energy project, shopping center, subdivision, farm or factory. The agency has the responsibility to make an informed judgment, and to estimate future impacts on that basis, especially if trends are ascertainable or potential purchasers have made themselves known. The agency cannot ignore these uncertain, but probable, effects of its decisions.²

Other Terminology Issues. Just as it is important to understand when similar terms have different meanings, it also is important to understand when different terms have the same meaning. There is no substantive distinction in the CEQ regulations between “effect” and “impact,” nor is there a substantive distinction between “indirect” and “secondary.” To avoid confusion, it is good practice to use these terms consistently within a NEPA document.

- **Effects vs. Impacts.** The CEQ regulations use the terms “indirect effects” (40 C.F.R. § 1508.8) and “cumulative impacts” (1508.7). To be consistent with usage in the CEQ regulations, this Handbook also uses the terms “indirect effects” and “cumulative impacts.” This terminology is a matter of convention, and does not reflect a substantive distinction between the meaning of “effects” and “impacts,” which are described as synonymous in the CEQ regulations.³ The CEQ itself has not been consistent in its use of these terms: while the regulations refer to cumulative impacts, several CEQ guidance documents refer to “cumulative effects,” including the CEQ’s handbook on this topic. In practice, it is acceptable to refer to effects or impacts, as long as the terms are used consistently.

1 *Sierra Club v. Marsh*, 976 F.2d 763, 767 (1st Cir. 1992).

2 CEQ, *Forty Most Asked Questions Concerning CEQ’s National Environmental Policy Act Regulations*, 46 Fed. Reg. 18026 (March 16, 1981), Response to Question 18.

3 40 C.F.R. § 1508.8 (“Effects and impacts as used in these regulations are synonymous. Effects includes ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial.”).

- *Indirect vs. Secondary.* The term “secondary effects” is sometimes used as a substitute for “indirect effects.” While use of this term does not affect the legal adequacy of the analysis, the CEQ regulations refer only to “indirect effects” and do not use the term “secondary effects.” For consistency with the CEQ regulations, this Handbook exclusively uses the term “indirect effects.”

Key Reference Documents

There are many guidance documents and reference materials that provide advice for practitioners on how to conduct indirect effects and cumulative impacts analyses. See the Reference Materials section of this Handbook for additional information on these guidance documents.

- **CEQ.** In 1997, the CEQ issued the handbook, *Considering Cumulative Effects under the National Environmental Policy Act*. This handbook is non-binding and is not considered a guidance document, but has been widely followed. There is no comparable CEQ handbook or guidance document for indirect effects. In 2005, the CEQ issued a memorandum on consideration of “past actions” in cumulative impacts analyses.
- **FHWA.** In 2003, FHWA issued an interim guidance document, *Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process*. This interim guidance has never been finalized. It remains FHWA’s most current and comprehensive guidance on indirect effects and cumulative impacts.
- **State DOTs.** Several State DOTs have developed their own guidance documents for conducting indirect effects and/or cumulative impacts assessments, including California, Maryland, North Carolina, Oregon, Texas, Washington, and Wisconsin.
- **NCHRP Reports.** Several reports on indirect effects and cumulative impacts have been produced by the National Cooperative Highway Research Program (NCHRP). They include:
 - *NCHRP Report 403, Guidance for Estimating the Indirect Effects of Proposed Transportation Projects (1998)*. This report presents an eight-step process for analyzing indirect effects of transportation projects. It has been widely followed by State DOTs in developing their guidance for analyzing indirect effects.
 - *NCHRP Report 466, Desk Reference for Estimating the Indirect Effects of Proposed Transportation Projects (2002)*. This report updated the material presented in NCHRP Report 403 and provided additional training materials for practitioners.
 - *NCHRP 25-25, Task 22, Forecasting Indirect Land Use Effects of Transportation Projects (2007)*. This report provides an in-depth review and assessment of models, expert panels, and other methods for estimating the growth-related impacts of transportation projects.
 - *NCHRP 25-25 Task 43, Legal Sufficiency Criteria for Adequate Indirect Effects and Cumulative Impacts Analysis as Related to NEPA Documents (2008)*. This report reviews the legal principles governing indirect effects and cumulative impacts assessments, and lists specific factors to consider in reviewing them for legal sufficiency.
 - *NCHRP 25-25 Task 36, Recurring Community Impacts (2008)*. This report provides recommendations for considering “recurring community impacts” in a cumulative impacts analysis. Recurring community impacts are defined as multiple impacts affecting the same community over time by past public and private actions.
 - *NCHRP 25-25 Task 54, Evaluate Colorado’s ACEA Methodology as a Mechanism for Cumulative Impacts Assessment in Regional Transportation Plans (2009)*. This report describes an “Area-Wide Cumulative Effects Assessment” that has been used in Colorado. ACEA is a tool for addressing cumulative effects on a regional scale.

Key Issues to Consider

Initial Steps

- Who will have primary responsibility for preparing the analyses? What other organizations or entities will be involved as reviewers or contributors of information?
- What guidance is applicable, e.g., an individual State's handbook or policy for considering indirect and/or cumulative impacts?
- What level of effort is likely to be required? Have the resource demands associated with these analyses been addressed in the project's schedule and budget?

Indirect Effects

- Does the project have an explicit economic development purpose, e.g., is economic development part of the purpose and need statement? How will the extent of this economic development and related impacts be estimated?
- Does the project provide new capacity, provide new access, create a land use or transportation node, or reduce regional travel times? How will the potential land use effects of these changes be accounted for?
- What methodologies are applicable and how should the practitioner choose between qualitative and quantitative methods?
- If indirect land use effects are involved, how will these estimates (often in units such as households and employment) be translated into environmental impacts?
- What is the incremental effect on the resources in the future with the project as compared to the future condition without the project, e.g. the difference between the No Build and Build condition?
- Are there measures that can be taken that reduce or avoid project-related impacts to each resource, or enhance the resilience of each resource to this and other impacts? Who would be responsible for implementing those measures?

Cumulative Impacts

- What specific resources should be addressed as part of the cumulative impacts analysis?
- What is the current health of each resource? What past actions/trends, whether public or private, led to this condition? What are the current trends and projected future health of the resource?
- What other transportation projects have been recently completed, or are currently under construction?
- Which future transportation projects are reasonably foreseeable? What are the potential environmental impacts of these projects on each resource?
- Which future non-transportation projects and developments, whether public or private, are reasonably foreseeable? What are the potential environmental impacts of these projects?
- How will the combined effects of past actions, other present actions, reasonably foreseeable future actions and the proposed project affect the health of each resource?
- What types of minimization and mitigation measures could be considered? Who would be responsible for implementing those measures?

Documentation

- How will the indirect effects and cumulative impacts assessments be incorporated into the NEPA document?
- Will the entire analysis be included in the NEPA document itself, or will a separate technical report be prepared, with a summary in the NEPA document?
- Will indirect effects and cumulative impacts be considered together in a single section or chapter, or will these analyses be clearly demarcated in the NEPA document?
- What additional supporting documentation needs to be included in the project file?

Practical Tips

The issues of indirect effects and cumulative impacts are often considered together, but each involves a distinct set of issues and analyses. To maintain a clear distinction between the two concepts, this Practical Tips section addresses indirect effects and cumulative impacts separately. It then addresses documentation of these analyses. Finally, it describes approaches for using the pre-NEPA planning process to support NEPA studies of indirect effects and cumulative impacts.

Indirect Effects Analysis

As noted in the Background Briefing, an indirect effects analysis can include “induced-growth effects” as well as “encroachment/alteration effects.” While both types of effects are important, the issue of induced growth arises most frequently and presents the greatest conceptual and technical challenges for practitioners. Therefore, this section focuses on ways to analyze the growth-related indirect effects of a transportation project.

An analysis of growth-related indirect effects involves tracing the chain of causation connecting a transportation project to future land use changes and then to the impacts of those changes. The steps in this chain of causation can be expressed as three distinct questions:

- Does the project have the potential to increase mobility and/or accessibility? If so, in what geographic area is increased accessibility likely to occur?
- Is the increased accessibility likely to cause changes in development patterns (timing, type, location, or amount)? If so, where are those changes in development likely to occur?
- What impacts are likely to result from changes in development patterns that are caused by the project? What specific types of resources could be impacted?

As a framework for addressing these questions, this Handbook outlines a step-by-step approach that includes: information-gathering; an initial assessment to determine overall approach; developing the scope and methodology; conducting the analysis; and considering mitigation. This approach is based upon, and is intended to be consistent with, the FHWA interim guidance, State DOT guidance, and NCHRP reports referenced above.

1 | Information Gathering

The first step in preparing an analysis of indirect effects is gathering information. This process does not occur all at once. During scoping, the practitioner assembles basic information about the project and the surrounding area. If this information indicates that a more in-depth analysis is warranted, more extensive information-gathering is undertaken. The following summary briefly describes the types of information that should be gathered for an indirect effects analysis.

Project Purpose. The project purpose provides an indication of a project’s potential to induce growth or otherwise change land use. If a project has an explicit economic development purpose, there is generally a strong presumption that the project will induce growth. Therefore, an in-depth indirect effects analysis usually is needed for projects that are explicitly intended to promote economic development. It also is important to recognize that a project may induce growth even when it does *not* have an explicit economic development purpose. A project with a transportation-focused purpose (e.g., relieving congestion) could still induce growth—for example, by providing additional capacity that enables faster or more intense growth than would otherwise occur.

Potential for Increased Mobility and/or Accessibility. The potential for travel time savings (shorter, faster trips) and/or increased accessibility is a key determinant of a project’s potential to induce growth. If a project simply involves the repair or replacement of an existing structure, without any increase in capacity or adding a new access point, it generally will have little or no ability to induce growth. On the other hand, if a project substantially reduces travel times or creates a new access point on a transportation facility, the project may have the potential to induce growth. Traffic modeling provides a quantitative basis for assessing potential travel time savings. Early in a study, when forecasts are not yet available or are highly preliminary, it may be possible to assess travel time savings qualitatively based on the nature of the improvement being proposed.

Growth Trends and Projections. The basis for assessing induced growth is an understanding of the baseline growth trends that exist in the absence of the project. Growth trends can be described in many ways, including data on population and employment,

housing construction, commercial and industrial development, conversion of undeveloped land, and other factors. While the specific data used will vary from project to project, it is always important to describe existing growth trends in some manner, as a frame of reference for assessing a project's potential to induce *different* or *greater* growth than would have otherwise occurred.

Land Use Plans. Land use plans and other related plans, such as economic development plans, provide a basis for distinguishing between planned and unplanned growth. The fact that growth has been planned doesn't necessarily mean it was not induced by a project; a project can be the necessary condition for planned growth, such as when a new interchange is constructed to serve a master-planned development. Nonetheless, the distinction between planned and unplanned growth is often an important consideration in project decision-making, because planned growth is generally considered preferable to unplanned growth.

Constraints on Growth Potential. Even in situations where a transportation project increases mobility and accessibility, other factors may limit the potential for induced growth. Constraints on growth include factors such as lack of demand, lack of available land, lack of water and sewer infrastructure, land use controls, regulatory constraints, and public opposition to development. These types of factors also play an important role in assessing a project's potential to cause induced growth, and are particularly important in assessing the degree to which increased accessibility and mobility will translate into increased growth.

Presence of Protected/Sensitive Resources. If a project has the potential to induce growth, it is necessary to consider whether the induced growth is likely to impact protected, impaired, threatened, or otherwise sensitive resources—for example, wetlands, forests, farmland, or wildlife habitat. As a basis for making this determination, an indirect effects analysis typically includes an inventory of the noteworthy natural and human resources in the area where induced growth could occur.

2 | Initial Assessment of Indirect Effects

As noted above, an indirect effects analysis typically begins with an initial assessment of a project's potential to cause indirect effects. The initial assessment focuses on determining whether a project is likely to cause indirect effects and the overall magnitude of those effects. This assessment generally is qualitative and is based on existing data sources. It provides a basis for deciding whether a more detailed analysis is needed.

An indirect effects analysis takes into account both encroachment-alteration effects and induced-growth effects. For most transportation projects, the indirect effects of greatest concern involve the project's potential to induce growth—or, more specifically, its potential to cause changes in the amount, timing, location, or type of development—as well as the potential for that induced growth to cause impacts on the environment.

In general, a project is more likely to require an in-depth analysis of indirect effects if the project provides new transportation capacity that increases accessibility by reducing travel times or if the project provides a new access point from a facility; serves a geographic area in which the conditions for growth are present; and/or includes sensitive environmental resources, such as wetlands or natural habitat, that could be impacted by development.

Conversely, a project is less likely to require an in-depth analysis of indirect effects if it involves no new capacity or access points; it serves an area that is already highly developed, or that otherwise has little developable land; and/or there are few sensitive resources in the areas potentially affected by any induced growth.

The initial assessment can be conducted as part of the scoping process and often will include some opportunity for input by regulatory agencies. Especially for complex projects, it is beneficial to engage other agencies in the initial assessment, generally as part of the scoping process for the NEPA study. If a decision is made that further analysis is not needed, it is prudent to inform the agencies of this decision promptly, so that any concerns or objections can be addressed early in the process. In addition, it is a good practice to make sure the project record includes thorough documentation showing the information provided to other agencies, the comments received, and any responses provided.

3 | Developing the Scope and Methodology for the Indirect Effects Analysis

Before beginning an indirect effects analysis, it is necessary to make several important decisions regarding the scope and methodology for the analysis. These decisions may be governed by State-specific or agency-specific guidance, manuals, or policies.

They also may be influenced by the specific circumstances of each project, including the overall size and complexity of the project as well as the potential severity of the indirect effects. These decisions are subject to change as the analysis progresses, but they need to be made at least preliminarily at the outset.

Define the Study Area. The indirect effects study area should be broad enough to encompass the entire area in which the project has the potential to cause indirect effects, but not so large as to unnecessarily increase the data gathering requirements and complexity of the assessment. Typical types of boundaries used to define the indirect effect assessment study areas include commute-sheds, growth boundaries, neighborhood boundaries, watersheds and habitat areas. The indirect effects study area is often larger (in some cases, much larger) than the study area that is used for developing alternatives. When an indirect effects study area is large, it may be useful to identify “zones” within the study area as a means of organizing the analysis and presenting the conclusions.

Determine the Time Horizon. The time frame for the indirect effects assessment should be long enough to include reasonably foreseeable events. NCHRP Report 466 states that most indirect effects assessments set a time horizon equal to the typical transportation planning horizon of approximately 20 years. The time horizon of long range and comprehensive land use plans and development regulations may also be a factor in determining the study time horizon. One benefit of this approach is that it allows the indirect effects analysis to use the same population and employment forecasts that are used in the transportation planning process.

Select the Methodology. There is no single standard method for analyzing indirect effects. Rather, there is a large “toolkit” of qualitative and quantitative analysis methods that are considered acceptable for analyzing the indirect effects of transportation projects. The selection of a method or methods for application is done on a case-by-case basis considering factors specific to individual plans/projects. Factors to consider in selecting an analysis method for an indirect effects assessment include:

- Magnitude of potential induced-growth effects
- Strengths and limitations of each available tool in the context of this specific project
- Relationship to other analyses in NEPA process (e.g., compatibility with modeling or other analyses that are being done for other purposes, such as traffic forecasting)
- Agency and public expectations (e.g., preferences for a specific method that has been used in previous studies)
- Cost and schedule constraints

Consider Requirements of Other Laws. An indirect effects analysis prepared for purposes of NEPA compliance may also have implications for analyses and decisions required under other laws. For example, indirect effects on aquatic resources are considered as part of Section 404 permitting under the Clean Water Act. Indirect effects on threatened and endangered species are considered as part of Section 7 consultation under the Endangered Species Act. Indirect effects may also need to be considered as part of Section 106 consultation under the National Historic Preservation Act. It is prudent for practitioners to consider these other requirements when developing the scope and methodology for an indirect effects analysis.

Consult with Resource Agencies. It is advisable to consult with resource agencies, during scoping or at other times in the NEPA process, regarding the scope and methodology for the indirect effects analysis. For projects that involve an environmental impact statement (EIS), the lead agencies are required under 23 U.S.C. § 139 to consult with participating agencies regarding the methodology and level of detail for analyzing alternatives. This consultation may include consideration of the scope and methodology for indirect effects analysis.

4 | Conducting the Indirect Effects Analysis

While there are many different methods that can be used to analyze indirect effects, the analysis always involves the same core objective: to understand the causal relationship between a transportation project, the growth that may be caused by that project, and the impacts that may result from that growth. These causal relationships provide the underlying framework for the approach outlined below.

Note: The steps described below do not need to occur in this order, nor are they required to be sequential. This section simply describes one possible approach to carrying out the work that is typically required for an indirect effects analysis.

Step 1. Assess the Potential for Increased Accessibility. For transportation projects, the starting point for assessing indirect effects is the project's potential to increase accessibility. These types of changes generally are assessed using standard travel demand modeling tools—the same models that are used for other purposes in the NEPA study. For purposes of the indirect effects analysis, certain types of data are likely to be especially important, such as:

- What geographic areas will experience increased accessibility, in the form of faster travel times or more direct access to a transportation facility?
- How much will travel times improve? What specific areas experience the greatest improvements in travel times?
- Are there any noteworthy differences among the build alternatives in terms of the travel time savings or new access points that they would provide? For example, do the alternatives vary in terms of the specific geographic areas that would experienced faster travel times?
- Are there important uncertainties in the estimates of travel time savings? For example, are the travel time savings provided by this project contingent on other transportation system improvements that have not yet been constructed? Uncertainty can be important in determining whether induced growth is foreseeable.
- To what extent is the travel model capable of taking into account induced travel? Is induced travel a factor that could meaningfully affect travel time savings?

Step 2. Assess the Potential for Induced Growth. If the project provides increased accessibility, it is necessary to proceed to the next step—assessing the potential for that increased accessibility to induce growth. Growth inducement does not necessarily mean *more growth* in total within a State or metropolitan area. Induced growth can be manifested in many ways, including changes in the type, location, and pace of growth. For example, if a new highway interchange is constructed at the periphery of a developing area, the interchange may attract development that would have otherwise occurred elsewhere in the region. This shift in development patterns is commonly described as “induced” growth. In assessing the potential for induced growth, the following types of issues are typically considered:

- Is growth already occurring in the study area? Is it likely that the current growth trends would continue regardless of whether the project is implemented?
- What is the magnitude of the increase in accessibility? Would the travel time reductions be large enough to influence travel patterns? For example, would the project bring currently rural areas within a reasonable commuting time of a major metropolitan area?
- For areas that would experience improved accessibility, what other factors are present that might enable or inhibit growth? For example, is there sufficient developed land? Are there land use restrictions? Are there environmental permitting requirements? Is there market demand for development? Does other necessary infrastructure exist (e.g., water/sewer)? Is there support for development among local government officials and the public?
- If current laws or policies limit growth, is it likely that those restrictions would be modified if the project were constructed? In other words, does the area have a track record of rigorously adhering to land use plans, despite development pressures, or are plans routinely modified to conform to development pressures?
- Are there noteworthy differences *within* the study areas in terms of the potential for induced growth? For example, is it possible to identify specific locations (e.g., around interchanges) where development is especially likely? Is it possible to identify other areas where development is especially unlikely? If so, it may be useful to divide the study area into zones and express distinct findings for each zone.
- Is it feasible to quantify the amount of additional growth that is expected to occur, either in the study area as a whole or in specific zones within the study area? Some analysis methods—for example, some land use models and expert land use panels—can be used to generate quantitative projections, including projections of change in land cover or impervious surfaces. The fact that they yield quantitative results does not necessarily make them more accurate or more informative than qualitative methods, but they can be useful tools for assessing induced growth. When using quantitative methods, it is important to document the assumptions and analyses underlying the quantitative results presented in the NEPA document—e.g., assumptions about population and employment growth rates.
- Are there important areas of uncertainty that affect the assessment of induced growth? For example, does the potential for induced growth depend primarily on political factors that cannot be readily assessed by a model? If so, these uncertainties should be acknowledged and documented in this analysis.

Step 3. Assess the Potential for Impacts on Sensitive Resources. The final step in the chain of causation involves the connection between induced growth and environmental impacts. This stage of the analysis typically involves the greatest uncertainty, because it requires an assessment of the *location* of induced growth, which is especially difficult to predict. Land use models and expert land use panels can be used to generate predictions about the location of induced growth, which can in turn provide a basis for identifying specific types of resources that could be impacted—but as noted above, these tools are not necessarily more accurate or informative than more qualitative tools. Some specific issues to consider in this stage include:

- What sensitive resources are present in the study area? What is the condition of those resources?
- Is it possible to determine the general locations where induced growth is likely to occur? What types of sensitive resources, if any, are located in those areas?
- If induced growth is expected in areas where sensitive resources are present, are there reasons to believe that impacts to those resources will be avoided? For example, are regulatory or land use restrictions in place that can be relied upon to protect those resources?
- Overall, what specific resources (if any) are most likely to be impacted by induced development as a result of this project?
- Will the project have incremental effects, in combination with other projects that are affecting the same resource?
- To the extent that impacts are identified, what measures are available to minimize and mitigate those impacts? Who would be responsible for implementing those measures?

It is not always possible to trace the chain of causation from a single project to a specific impact on a specific resource. As noted earlier, the CEQ has made clear that an indirect effects analysis should consider effects that are “likely” or “probable,” not “speculative” or “remote.” Consistent with this direction, agencies should not engage in speculation about the types of resources that could be impacted by development that is caused by a project.

Step 4. Assess Potential Minimization and Mitigation Measures. For purposes of NEPA compliance, it is important to identify and consider reasonable minimization and mitigation techniques for indirect effects. Considering these measures does not mean that they must be adopted. Minimization and mitigation strategies that may be discussed in an indirect effects analysis include:

- access management
- zoning and comprehensive planning
- transfer of development rights
- growth management regulations
- resource management and preservation regulations
- land acquisitions and conservation easements, and
- incentives for infill development.

Some of the potential minimization and mitigation measures for indirect effects will be outside the control of transportation agencies. When discussing these measures for indirect effects, it is valuable to identify the entities that would have authority to impose or implement those measures. The discussion should also note which minimization and mitigation measures are already being implemented or are planned to be implemented. For example, Wisconsin DOT’s *Guidance for Conducting an Indirect Effects Analysis* recommends using a table or matrix that outlines the various minimization and mitigation activities, indicates which agency or stakeholder has the authority to implement them, and describes the likelihood of implementation for each measure.

Cumulative Impacts Analysis

An assessment of cumulative impacts focuses on the combined effects of the proposed action and other actions on specific resources. A cumulative impacts analysis typically focuses on a sub-set of the resources considered in the analysis of direct and indirect effects. For each resource considered, the cumulative impacts analysis should provide information on the current health of the resource and historical trends; summarize the direct and indirect impacts of the proposed action; describe the reasonably foreseeable effects of other actions; and consider mitigation. This section outlines one possible approach for performing this type of analysis.

1 | Information Gathering

As with an indirect effects analysis, the information-gathering for a cumulative impacts analysis is iterative. The initial steps in the analysis are based primarily on existing data sources, which may be supplemented by further investigations as the analysis progresses. This section identifies the types of information that typically are gathered for a cumulative impacts analysis.

Resource Types. The starting point for any analysis of cumulative impacts is a basic understanding of the types of environmental resources that are present in the general vicinity of the proposed project. Existing mapping can provide a snapshot of the types of resources that could become the focus of a cumulative impacts analysis.

Resource Conditions and Trends. A cumulative impacts analysis requires consideration of the effects of past and present actions, whether public or private. This requirement is typically met by considering the historical trends and current conditions of a resource. Therefore, the analysis does not simply require mapping of current conditions. It will also require historical data, showing how the condition of a resource has changed over time. If projections of future conditions are available, they also can play a role in describing resource conditions and trends. As the study progresses, more detailed mapping is developed and can be incorporated into the cumulative effects analysis.

Other Future Actions. The range of “other actions” that may need to be considered is very broad. Transportation actions can be readily identified from transportation plans. Non-transportation actions are often more difficult to identify. Land use plans provide one possible source of information, but a full understanding of other actions may require active investigation, including interviews with local land use planners, economic development officials, permitting agencies, property owners, and other stakeholder groups.

Impacts of Proposed Action. The direct and indirect effects of the proposed action are a building block of any cumulative impacts analysis. This information is presented elsewhere in the NEPA document (outside the cumulative impacts analysis), and is then summarized in the cumulative impacts analysis. One of the challenges facing practitioners is the timing of these analyses: because the cumulative impacts analysis must incorporate information from the direct and indirect analyses, the cumulative impacts analysis is subject to delay if the other analyses are delayed. Typically, the cumulative impacts analysis begins before full information is available about the impacts of the proposed action, and is updated as detailed information is developed.

Resource Management, Land Use, and Economic Development Plans. Plans developed by Federal, State, local, and other agencies can inform a cumulative impacts analysis in several ways. Resource management plans (e.g., watershed plans or species recovery plans) can provide a valuable source of information about current threats to environmental resources and about strategies that are already in place to help improve the conditions of those resources. Land use plans may provide an indication of where development (“other actions”) may occur in the future, while also providing an indication of how development pressures could be constrained through land use controls. Economic development plans provide information about where growth is desired, and the extent of government support for that growth. Preparers of cumulative impacts analyses typically consider all of these plans, to the extent they are available and relevant.

2 | Initial Assessment of Cumulative Impacts

Cumulative impacts analyses vary widely in terms of their scope, level of detail, effort, and cost. Some projects warrant a brief discussion that is largely qualitative in nature and relies largely on existing data sources. Other projects warrant a much more in-depth analysis, which includes extensive investigations, analysis, and documentation. At the outset of a NEPA study, it is useful to make an initial assessment of the overall level of effort that is appropriate for the project’s cumulative impacts analysis.

In making this initial assessment, the following factors may be relevant:

- *Type of NEPA Documentation.* A more extensive analysis of cumulative impacts is likely to be required if an environmental impact statement (EIS) is being prepared.
- *Impacts of the Proposed Action.* The severity of the effects of the proposed action will also inform the approach to the cumulative impacts analysis. Even among projects requiring an EIS, there are broad differences among projects in terms of the severity of impacts. Projects involving a high level of direct and indirect impact to sensitive resources are likely to require a more detailed cumulative impacts analysis.

- **Sensitivity of Resources.** The approach to the cumulative impacts analysis also is based on the sensitivity or vulnerability of resources that could be affected by the project. For example, if a project is located in the vicinity of important habitat for an endangered species, and the population of that species is declining, that factor may justify a more extensive assessment of cumulative impacts on that species, even if the project itself is expected to have modest effects on that species. (Note: If the project will have *no* direct or indirect effects on that resource, then a cumulative impacts analysis generally is not performed for that resource.)
- **Other Actions and their Impacts.** The number of other actions, and the extent of their impacts, can also influence the approach to a cumulative impacts analysis. A more detailed cumulative impacts analysis may be warranted for a project that is located in a rapidly developing area, where the development—e.g., residential development in a formerly rural area—is eroding the quality of natural habitats.

This initial assessment should be informed by input from environmental resource and regulatory agencies as well as input from local officials, stakeholder groups, and the public. This assessment is typically conducted as part of the scoping process for an EIS, and is conducted in the early stages of development of an EA, even if there is no scoping process as such.

This initial assessment is closely linked to, and in practice may be indistinguishable from, the decision-making on scope and methodology for the cumulative impacts analysis. These two issues are discussed separately in this handbook, but in practice they are closely related and may occur simultaneously.

3 | Determining Scope and Methodology for the Cumulative Impacts Analysis

The CEQ has emphasized that a cumulative impacts analysis should “count what counts” and should not produce superficial analyses that cover many topics with little relevance to the effect of the proposed action.⁴ Scoping is the process for deciding what to count—that is, what to analyze—in the cumulative impacts analysis for a project. As part of the scoping process, the agency preparing this analysis must decide, at least preliminarily, the key resource issues to consider; the scope of the study area; the timeframe for the analysis; and the methodology for analyzing and estimating cumulative impacts.

Identify Resources for Analysis. The starting point for a cumulative impacts analysis is to identify a set of resources that will become the focus of the analysis. These resources are typically a subset of the range of environmental resources considered in the assessment of direct and indirect effects—in many cases, just two or three topics are chosen for analysis. Some factors to consider in choosing these issues include:

- What types of environmental resources are present in the vicinity of the project?
- Which resources are most prevalent, sensitive, and/or threatened by other actions?
- Which resources are likely to be most substantially affected by the project (taking into account both direct and indirect effects of the project)?

In weighing these factors, the agency preparing the analysis should consult with environmental resource and regulatory agencies. The views expressed by other agencies and the public should be considered, along with the above criteria, in deciding the issues to address in the cumulative impacts analysis. The rationale for selecting the resources for analysis should be thoroughly documented.

Define the Study Area(s). The study area for a cumulative impacts analysis will be determined based on the environmental resources that are selected for analysis. There may be a single cumulative impacts study area that is used for all of the resources, or a separate study area for each resource. For example, if an agency decides to focus its cumulative impacts analysis on farmland, endangered species habitat, and water quality, the agency might choose to define three separate study areas, based on the geographic distribution of those three resources. The general principle is that the study area (or study areas) should be broad enough to encompass all of the potential cumulative impacts. While an agency has broad discretion in applying this principle, it is important to make sure the NEPA document (1) clearly defines the boundaries selected, (2) explains the reasons why those boundaries were selected, and (3) responds to any substantive comments that raise objections to those boundaries.

4 CEQ, *Considering Cumulative Effects*, p. v.

Determine the Time Horizon. The time horizon, like the study area, may be defined differently for each resource. The time horizon can be defined with regard to future and past effects.

- *Future Effects.* The typical time horizon for considering direct and indirect effects in an EIS is approximately 20 to 25 years. A cumulative impacts analysis may have a similar time horizon, but in some cases a longer time period may be appropriate. For example, when considering effects on an endangered species, the time horizon for the cumulative effects analysis could be based on the time horizon for the recovery plan, which may extend over several decades. Similarly, a cumulative effects analysis that considers greenhouse gas emissions may extend over several decades.
- *Past Effects.* It is not necessary to set a specific time period for considering past actions, as long as the effects of past actions are discussed. If a specific time horizon is set for past events, a period of at least 10 years is appropriate.⁵

Select the Methodology for Analysis. Most States have adopted guidance that provides an overall framework for indirect effects and cumulative impacts analyses. Many of these guidance documents list a series of steps that should be followed. Within the framework of that guidance, there are still important choices to make about the specific methods to use in carrying out these analyses for an individual project. One important issue is balance between qualitative and quantitative methods for describing resource trends and potential effects. For some projects, cumulative impacts are described primarily in qualitative terms—for example, by describing the types of resources that may come under additional stress as a result of the combined impacts of the proposed action and other reasonably foreseeable actions. For other projects, cumulative impacts are described in quantitative terms—for example, by providing an estimate of the number of acres of a particular type of habitat that could be destroyed as a result of the proposed action and other actions. Before beginning a cumulative impacts analysis, it is prudent to make at least a preliminary decision about the use of qualitative and quantitative methods. If there are disagreements among agencies about the approach, it is preferable to identify and address those disagreements as early as possible.

Consider Requirements of Other Laws. The Endangered Species Act (ESA) require consideration of cumulative impacts as part of the Section 7 consultation process, but the ESA Section 7 regulations define this term differently. Under the ESA, cumulative impacts include “those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation.” (50 C.F.R. § 402.02).⁶ This definition differs from the NEPA definition in two key ways: (1) only “future State or private activities” are considered, and (2) the impacts must be “reasonably certain” to occur, not just reasonably foreseeable. The distinction between NEPA and ESA definitions should be taken into account when preparing cumulative impacts analyses that are intended to serve both laws.

Consult with Resource Agencies. It is advisable to consult with resource agencies, during scoping or at other times in the NEPA process, regarding the scope and methodology for the cumulative impacts analysis. For projects that involve an EIS, the lead agencies are required under 23 U.S.C. § 139 to consult with participating agencies regarding the methodology and level of detail for analyzing alternatives. This consultation may include consideration of the scope and methodology for cumulative impacts analysis.

5 See NCHRP 25-25 Task 43, *Legal Sufficiency Criteria for Adequate Indirect Effects and Cumulative Impacts Analysis as Related to NEPA Documents* (Aug. 29, 2008), pp. 58-59.

6 The Section 7 regulations do not define the term “reasonably certain to occur,” but this term is defined in guidance as follows: “Indicators of actions ‘reasonably certain to occur’ may include, but are not limited to: approval of the action by State, tribal or local agencies or governments (e.g., permits, grants); indications by State, tribal or local agencies or governments that granting authority for the action is imminent; project sponsors’ assurance the action will proceed; obligation of venture capital; or initiation of contracts. The more State, tribal or local administrative discretion remaining to be exercised before a proposed non-Federal action can proceed, the less there is a reasonable certainty the project will be authorized.” U.S. Fish and Wildlife Service and National Marine Fisheries Service, *Consultation Handbook: Procedures for Conducting Consultation and Conference Activities under Section 7 of the Endangered Species Act* (March 1998), p. 4-32.

4 | Conducting the Cumulative Impacts Analysis

A cumulative impacts analysis includes a series of analyses, focused on each of the resources selected for detailed consideration. For each of these issues, the analysis will include the same basic steps: (1) describe resource conditions and trends; (2) summarize the direct and indirect impacts of the proposed action on that resource; (3) describe other actions and their effects on the resource; (4) estimate the combined effects of the proposed action and other actions on the resource; and (5) consider minimization and mitigation for those effects. This analysis should be documented in the EA or EIS, with appropriate supporting information in the project file.

Note: The steps described below do not need to occur in this order, nor are they required to be sequential. This section simply describes one possible approach to carrying out the work that is typically required for a cumulative impacts analysis.

Step 1: Describe Resource Conditions and Trends. For each resource selected for analysis, the cumulative impacts analysis should include a discussion of both the current condition of the resource and relevant trends.

- **Current Conditions.** The discussion of current conditions is a snapshot of the health of the resource. It may include quantitative data as well as qualitative assessment. For example, if an assessment is addressing water resources, the description of current conditions might give the number of acres of various categories of wetlands, a description of the important functions of those wetlands, and a description of the overall quality of those wetlands; it might also include similar types of information regarding streams, lakes, or other water bodies. The intent of this description is to help the reader understand the overall health of the resource.
- **Trends.** The discussion of trends provides a picture of the changes in the resource over time. This picture can include historical trends as well as forecasts of future changes. A discussion of historical trends generally does not need to address individual actions that affected the resource; rather, it provides an overview of developments that have resulted in the current condition of the resource. For example, if water bodies are impaired, the discussion might explain the role of certain land uses (agriculture, mining, residential development, etc.) in causing the impaired conditions. Similarly, the future projections would provide a baseline for understanding the direction of the resource—i.e., is its condition improving or declining, and is there any reason to believe that the resource is approaching a “tipping point” that could lead to irreversible declines?

For the EA or EIS itself, this type of information can be presented in summary form, with supporting details provided in an appendix or technical report. The goal of the discussion is simply to provide context for understanding the potential impacts of the proposed action and other reasonably foreseeable future actions.

Step 2: Summarize Effects of the Proposed Action on Key Resources. The direct and indirect impacts of the proposed action are a component of cumulative impacts. Therefore, a cumulative impacts analysis must include a summary of the proposed action’s direct and indirect effects on each of the key resources considered in that analysis. It is important to keep in mind that the cumulative impacts analysis should *not* include a summary of *all* the direct and indirect effects of the proposed action. The cumulative impacts analysis should just summarize the direct and indirect effects of the proposed action on each resource. This discussion should be supported by cross-references to more detailed discussion elsewhere in the EA or EIS.

Step 3: Describe Other Actions and Their Effects on Key Resources. The discussion of other actions in a cumulative impacts analysis typically includes both a list of “other actions” and an assessment of the impacts of those actions on the resources selected for analysis.

- **List of Other Actions.** The cumulative impacts analysis must identify other reasonably foreseeable future actions, including federal and non-federal actions. Typically, the analysis includes a list (often in table format) of other actions that are identified specifically, such as planned highway or transit projects. Actions that are more difficult to identify individually, such as residential or commercial development, or natural resource development activity, are typically described as a group. While a variety of approaches can be used, it is important to demonstrate that the analysis has encompassed the full range of other actions, not just other transportation projects or other actions that require federal approval.

- *Assessment of Impacts of Other Actions.* The cumulative impacts analysis must consider the impacts of the other actions on the resources that have been selected for analysis. In many cases, it is not possible to describe those impacts in detail—e.g., because those other actions are only in the early planning stages, or do not require NEPA review at all. It is not necessary to describe the other actions in the same level of detail as the proposed action. However, where there is a basis for doing so, the cumulative impacts analysis should express potential impacts in quantitative terms—for example, by estimating the total amount of wildlife habitat that could be converted to residential development based on existing trends. Concrete factual information is preferable to broad generalities.

As this discussion shows, it is not sufficient merely to list the reasonably foreseeable future actions. The assessment also needs to discuss the potential impacts of these actions on the environmental and community resources, or explain why there is not enough information available to do so. At a minimum, the analysis should summarize the environmental impacts identified by other NEPA documents for proposed projects in the area.

Step 4: Estimate Combined Effects on Key Resources. Finally, the cumulative impact assessment must draw conclusions about the aggregate impact on each resource as a result of all the reasonably foreseeable actions by others, plus the incremental impacts (direct and indirect) of the proposed project. These conclusions should take into account the current health of each resource—the result of past and present actions—and any current trends. Trends could include development activity that could have adverse impacts on the resource, as well as restoration programs that could lead to overall improvements in the health of a resource. Where appropriate data is available, the discussion of cumulative impacts should incorporate quantitative information regarding the impacts anticipated for each resource. Conclusions about cumulative impacts should be based on facts generated by the cumulative impact assessment process, not on speculation.

Step 5: Consider Minimization and Mitigation. As explained above, cumulative impacts include (1) the impacts of the proposed action and (2) the impacts of other actions. The discussion of minimization and mitigation in the cumulative impacts analysis should reflect the distinction between the proposed action and other actions:

- *Proposed Action.* Minimization and mitigation for the impacts of the proposed action is typically addressed outside the cumulative impacts section—as part of the discussion of the proposed action’s direct and indirect effects—and can be cross-referenced in the cumulative impacts section. This discussion may include measures beyond the control of the lead agencies, such as land use planning decisions that could be implemented by local governments.
- *Other Actions.* Minimization and mitigation for impacts of other actions typically consists of a discussion of potential measures, which could be adopted by the sponsors of those other actions. For example, if the “other actions” include agricultural practices that affect water quality in impaired streams, the cumulative impacts analysis could discuss potential measures that could be adopted to reduce agricultural run-off into streams. The discussion should identify the entity that would carry out such measures, as well as the likelihood of those measures actually being implemented.

The discussion of mitigation can be presented separately for each key resource, or as a single set of measures that would mitigate impacts on multiple resources. For example, if the cumulative impacts analysis focuses on water quality and wildlife habitat, it is possible that the same mitigation measure (e.g., purchasing land to protect it from development) could benefit both types of resources. For such a project, it would make sense to present a single discussion of mitigation that applies to both sets of resources. A case-by-case decision is needed about where to discuss mitigation in a cumulative impacts analysis.

Documentation

Separating Indirect Effects and Cumulative Impacts Analyses. A wide range of approaches can be used for documenting indirect effects and cumulative impacts analyses, as long as care is taken to maintain a clear distinction between these concepts and to include all required elements of each analysis. The simplest way to avoid confusion and ensure completeness is to present these analyses in *separate chapters or in separate sections in the same chapter*.

Keys to Adequate Documentation. A recent NHCRP report, *Legal Sufficiency Criteria for Adequate Indirect Effects and Cumulative Impacts Analysis as Related to NEPA Documents* (2008), identifies three aspects of legally sufficient documentation of indirect effects:

- *Explain the Methodology.* Just as important as selecting a reasonable methodology is the importance of clearly explaining why that methodology was selected. The advantages and disadvantages/drawbacks of the methodology should be acknowledged, not ignored.
- *Provide Factual Support.* The evaluation of trends and conclusions about environmental consequences should be based on up-to-date factual information. Graphs, tables, and other graphic elements should be incorporated, where appropriate, to aid readability.
- *Use Clear Reasoning.* The conclusions of the assessment should be supported by logical analysis and plausible reasoning, and not contain internal inconsistencies or contradictions that put the results into question. It also is important to document the uncertainties involved in the analysis, explain the importance of those uncertainties, and explain how they have been addressed.

Legal Sufficiency Criteria. For a more detailed list of factors to consider in assessing the legal sufficiency of indirect effects and cumulative impacts analyses, refer to Appendix 1A (indirect effects) and Appendix 1B (cumulative impacts). These lists also are based on the recommendations in the NCHRP report, *Legal Sufficiency Criteria for Adequate Indirect Effects and Cumulative Impacts Analysis as Related to NEPA Documents* (2008).

Assessing the Results for Reasonableness

Given the uncertainties associated with any indirect effects or cumulative impacts analysis, it is wise to check the results for reasonableness. This check can be accomplished in one or more ways, including the following:

- Use multiple analysis methods, e.g., a mix of qualitative and quantitative techniques. If the methods point to a similar result, then there should be a fairly high degree of confidence in the results. If they are conflicting, then the underlying assumptions of the individual methods should be checked for consistency and appropriateness.
- Conduct sensitivity analyses to evaluate the impact of changing key assumptions. For example, consider different assumptions about growth rates, to determine how those assumptions affect conclusions about the future conditions of a resource.
- Seek input from specialists and stakeholders. Local officials, developers, community groups, and regulatory agencies can be asked to provide their assessment of what is reasonable given the variety of factors that can influence development and resource conditions.
- Look for counter-intuitive results. Results that seem counter-intuitive or internally inconsistent often indicate a need for further investigation. The inconsistency may indicate an underlying error in the analysis, or it may simply indicate a need to provide a better explanation of complex factors that help to differentiate two seemingly similar situations.
- Compare future projections to past experience. Historical trends do not necessarily provide an accurate prediction of future events, but they can provide a useful basis for assessing the reasonableness of forecasts. For example, if an analysis assumes that land use controls will be rigidly enforced in the future, but land use controls have been routinely loosened or changed in the past, it is prudent to explain why the future projection diverges from the past practice.

Use of the Transportation Planning Process to Study Indirect Effects and Cumulative Impacts on a Regional Scale

Assessments of indirect effects and cumulative impacts can be conducted as part of the transportation planning process and then—under certain conditions—adopted in the NEPA process for an individual project. This approach is specifically allowed, but not required, under the FHWA and FTA's transportation planning regulations (23 C.F.R. Part 450). Appendix A to those regulations provides four criteria for deciding whether planning-level studies of indirect effects and cumulative impacts can be adopted in the NEPA process:

To be used in the analysis of indirect and cumulative impacts, such information should:

- Be sufficiently detailed that differences in consequences of alternatives can be readily identified;
- Be based on current data (e.g., data from the most recent Census) or be updated by additional information;
- Be based on reasonable assumptions that are clearly stated; and/or
- Rely on analytical methods and modeling techniques that are reliable, defensible, and reasonably current.⁷

While the FHWA/FTA regulations allow a planning-level analysis to be adopted in the NEPA process, they do not provide specific direction as to the scale of analysis. Four possible approaches are described below. These are just representative examples of the ways that planning-level studies can support NEPA analysis of indirect effects and cumulative impacts.

Developing Growth-Related Vision and Goals. The transportation planning process provides broad flexibility to engage in a public dialogue about desired future conditions. For example, a metropolitan planning process can be used to engage stakeholders in consideration of alternative development scenarios, which reflect different combinations of land use changes and transportation improvements. If a shared regional vision is developed in the planning process, it can provide a frame of reference for considering growth-related impacts in the NEPA process.

Developing Information. The transportation planning process can produce information that will later be used in NEPA-level studies of indirect effects and cumulative impacts. This information can expedite project-level reviews by minimizing the amount of additional data that needs to be collected. For example, the planning process can be used to develop any of the following:

- population and employment projections
- assumptions about auto-ownership and household incomes
- a list of projects to include in the no-build scenario
- explanations of travel and development trends
- zoning and land use assumptions
- assumptions about service by other modes
- air quality and emissions forecasts
- criteria for determining acceptable levels of transportation service

Regional-Scale Assessment. An assessment of indirect effects and cumulative impacts on a regional scale would consider the effects of multiple transportation projects within a watershed, a metropolitan area, or other geographic region. This type of analysis, by its very nature, is not project-specific. The lack of project-level detail can limit the ability to adopt a regional analysis in the NEPA process. This limitation applies to indirect effects and cumulative impacts analyses.

7 23 C.F.R. Part 450, Appendix A.

- *Regional Assessment of Indirect Effects.* An assessment of indirect effects on a regional level would consider the combined effects of multiple projects on growth patterns; it likely would not include the type of project-specific indirect-effects assessment that is typically required for NEPA purposes. Therefore, while the regional analysis would provide an overall framework and starting point for the NEPA study, some additional analysis would likely be needed to assess the growth-related effects of an individual project.
- *Regional Assessment of Cumulative Impacts.* An assessment of cumulative impacts on a regional level could, in principle, encompass all of the resources and 'other actions' that would be covered in a project-level NEPA analysis. As a practical matter, however, it is likely that a regional analysis would address cumulative impacts in more general terms than would be required in a NEPA study. In addition, because it is not project-specific, the regional analysis could not address the potential for a specific proposed action to interact with the effects of other actions. Therefore, some additional analysis would likely be needed at the project level to satisfy NEPA.

Corridor-Level Assessments. An assessment of indirect effects and cumulative impacts also could be conducted for a set of transportation improvements in a specific corridor or subarea. This type of analysis is much closer to the scale of a project-level NEPA analysis, and therefore has greater potential to result in a product that can be adopted in a NEPA study without the need for substantial additional work. Moreover, the FHWA/FTA planning regulations specifically authorize adoption of planning-level studies of indirect effects and cumulative impacts when carried out as part of a corridor or sub-area planning study. See 23 C.F.R. § 450.212(b)(1) and 450.318(b)(1).⁸ Therefore, if an agency seeks to develop a planning-level study that can be adopted in the NEPA process, it is preferable to carry out the planning-level analysis at the corridor or sub-area scale rather than the regional scale.

Organizational, Legal, and Technical Issues. The broader geographic scale of a corridor-level or regional analysis presents both organizational and technical challenges for practitioners. It is important to recognize these issues at the outset, before the decision is made to undertake an indirect effects or cumulative impacts analysis on a regional or statewide scale. Always ask:

- *Who leads the study?* For a project-level analysis, the agencies with the lead role in preparing the analysis are typically the project sponsor and the lead federal agency responsible for approving the project (e.g., State DOT and FHWA). For a planning-level analysis, a metropolitan planning organization or rural planning organization may take on a lead or co-lead role. Other State or regional planning bodies also may have a lead role in carrying out a larger-scale analysis. The involvement of multiple agencies can enrich the analysis, but it also can present challenges—for example, different agencies may have different legal requirements, different project priorities, and different policy perspectives.
- *What purpose is the study intended to serve?* A project-level analysis of indirect effects or cumulative impacts typically is undertaken to comply with NEPA. It may also serve the requirements of other State or Federal laws, but NEPA is usually the main focus. When the analysis is undertaken on a regional or corridor scale, it typically is done as part of the statewide or metropolitan planning process, and may also need to meet requirements of various State or local planning laws. An analysis performed at this scale usually is not part of the NEPA process for a specific project, but there is often a desire to use the analysis as the basis for NEPA compliance in subsequent project-level studies.
- *What technical tools will be used, and what data is needed?* A regional or corridor analysis may require a different set of technical tools and data sources, as compared to a project-level analysis. For example, a regional analysis may require geographic information systems (GIS) mapping from a much broader geographic area; it also may involve the use of land use models, habitat models, or other modeling tools. The analysis also may require more data, or different kinds of data, than would be needed in a project-level analysis.

As this list indicates, the analysis of an indirect effects or cumulative impacts on a broad geographic scale is not simply a matter of conducting a project-level analysis on a somewhat bigger scale. The larger geographic scale of the analysis requires a re-thinking of the goals, the methodology, and the roles of each agency in the process.

For practitioners who are considering this type of analysis, one helpful resource is a report that analyzed Colorado's experience with conducting cumulative impacts assessments on a regional level for metropolitan transportation plans, through an Areawide

⁸ For additional information on adopting corridor or sub-area studies in the NEPA process, refer to the Center's Practitioner's Handbook 10, *Using the Transportation Planning Process to Support the NEPA Process*, available on the Center's web site at <http://environment.transportation.org>.

Cumulative Effects Assessment (ACEA) method.⁹ The report notes that ultimately, the ACEA method was not adopted by the Colorado Department of Transportation:

The ACEA study attempted to determine whether a regional accounting of resources is feasible considering the availability of data and other resources and, if so, whether a regional accounting would be useful to NEPA practitioners, planners and decision makers. The study concluded that geographic information system (GIS) data is generally adequate for most resources to support an area-wide cumulative effects assessment (Mueller et al 2008). However, the methodology and tools used for the CDOT study stopped short of providing the information a decision maker needs to understand the significance of cumulative impacts from a proposed transportation network on the potential for any given resource to maintain long-term productivity or sustain itself. Ultimately, CDOT determined the ACEA study did not provide them a practical and implementable approach for conducting a meaningful analysis for cumulative effects on a regional basis.

Nevertheless, DOTs have a continued interest in alternative approaches to the development of a range of tools that can help staff incorporate environmental factors in the LRTP....¹⁰

While the report did not endorse the specific methods used in the ACEA study, it contains lessons learned and other detailed information regarding the analysis of cumulative effects on a broad geographic scale. This report is an important resource for practitioners who are considering undertaking a planning-level analysis of cumulative impacts.

9 NCHRP 25-25, Task 54, *Evaluate Colorado's ACEA Methodology as a Mechanism for Cumulative Impacts Assessment in Regional Transportation Plans* (2009) ("NCHRP ACEA Report").

10 NCHRP ACEA Report, p. 3.

Appendix 1A

Legal Sufficiency Standards for Indirect Effects Analysis

This table is adapted from the NCHRP report, *Legal Sufficiency Criteria for Adequate Indirect Effects and Cumulative Impacts Analysis as Related to NEPA Documents*.¹¹ Please note that this list is not necessarily exhaustive. Project-specific issues may also affect legal sufficiency.

#	ISSUE	REVIEW QUESTIONS
1	Definitions	Does it explain key definitions, including the definition of “indirect effects”?
2	Study Area and Timeframe	Does it identify the study area boundaries and timeframe, and explain the process by which they were selected?
3	Resource Areas	Does it identify specific elements of the natural and human environment that are the focus of the analysis, and explain how they were selected?
4	Causal Relationships	Does it describe cause-and-effect relationships—specifically, the chain of causation connecting the transportation project to future land use changes and to the impacts of those changes?
5	Methodologies	Does it utilize reasonable methodologies for estimating indirect effects and, where appropriate, reference literature showing that the methodology used is generally accepted?
6	Conclusions	Does it identify incremental land use effects of the Build alternatives, as compared to the No Build alternative, and explain the basis for those conclusions?
7	Consistency	Is the analysis internally consistent? Is it consistent with other sections of the NEPA document?
8	Public Involvement and Agency Coordination	Was the analysis developed with appropriate public involvement and agency coordination?
9	Mitigation	Does it identify possible mitigation measures for indirect effects and explain who has authority to impose or implement those mitigation measures?

¹¹ NCHRP 25-25 Task 43, *Legal Sufficiency Criteria for Adequate Indirect Effects and Cumulative Impacts Analysis as Related to NEPA Documents* (2008), pp. 50-57.

Appendix 1B

Legal Sufficiency Standards for Cumulative Effects Analysis

This table is adapted from the NCHRP report, *Legal Sufficiency Criteria for Adequate Indirect Effects and Cumulative Impacts Analysis as Related to NEPA Documents*.¹² Please note that this list is not necessarily exhaustive. Project-specific issues may also affect legal sufficiency.

#	ISSUE	REVIEW QUESTIONS
1	Definitions	Does it explain key definitions with reference to the CEQ regulations, including the definition of “cumulative impacts”?
2	Resources for Analysis	Does it identify specific elements of the natural and human environment that are the focus of the analysis and explain how these resources were selected for analysis?
3	Study Area Boundaries and Timeframe	Does it identify explicit study area boundaries and a time frame for the analysis, and explain the process by which these boundaries were selected?
4	Resource Conditions and Trends	Does it describe the current health of each resource, how it got to its current state, and major trends affecting the health of the resource?
5	‘Other Actions’ and their Impacts	Does it identify other reasonably foreseeable actions that will impact the resources of concern, and describe the impacts of those other actions? Specifically, does it include: <ul style="list-style-type: none"> ○ Future transportation projects? ○ Other developments, such as residential subdivisions, office parks, and commercial centers? ○ Population and employment growth forecasts?
6	Incremental Effects of Build Alternatives	Does it summarize the direct and indirect impacts of the proposed action on the resources of concern, so that the reader can understand the total increment of the project in the context of the impacts of all other actions?
7	Conclusions	Does it draw conclusions about the aggregate or total impact on each resource as a result of all the “other actions,” combined with the direct and indirect impacts of the proposed action?
8	Public Involvement and Agency Coordination	Have the public and other agencies been given an opportunity for involvement at various stages of the development of the analysis, and have their comments been addressed?
9	Minimization and Mitigation	Does it discuss minimization and mitigation measures, such as land use and resource protection policies? These should be discussed for information purposes, even if they are not in the control of the lead agencies.

¹² NCHRP 25-25 Task 43, *Legal Sufficiency Criteria for Adequate Indirect Effects and Cumulative Impacts Analysis as Related to NEPA Documents* (2008), pp. 57-61.

Appendix 2: Technical Methods for Indirect Effects Analysis

This table is adapted from the *Forecasting Indirect Land Use Effects of Transportation Projects*.¹³ The report provides a comprehensive description and assessment of the available tools for estimating growth-related indirect effects. The following table summarizes the six principal methods as described in that report. The report notes that these tools are not mutually exclusive and are often used in combination.

METHOD	WHAT IT INVOLVES
Planning Judgment	Professionals make judgments about the likely effects of transportation projects on land use, taking into account the available data and their own understanding of transportation-land use relationships.
Collaborative Judgment	Outside experts and/or stakeholders are engaged in a collaborative discussion, typically through a structured process that also includes professional planners. The collaborative process is used to develop an estimate of the likely effects of a transportation project on land use. Examples include “expert land use panels” and the “Delphi process.”
Elasticity Analysis	Travel demand model outputs are “post-processed” to estimate the likely amount of induced travel that would result from a capacity expansion. These techniques rely on data from previous projects as a basis for estimating the amount of induced travel caused by the proposed project. This tool does not directly estimate land use change.
Allocation Models	Total population and employment in a region is “allocated” to sub-areas (e.g., traffic analysis zones) within the region. This type of model is based, in part, on assumptions about the transportation system. It can be used to test different scenarios. For example, by running the model both with and without a new transportation facility, the model can be used to explore the effect of that project on the distribution of population and employment. (Note: This type of model assumes the regional totals are “given” and predicts how those totals will be distributed.) Examples include FHWA’s SMITE model.
Four-Step Travel Demand Models	This is the standard method for developing traffic forecasts in NEPA studies. It consists of four separate forecasts, with each feeding into the next: (1) a trip generation model, (2) a trip distribution model, (3) a model choice model, and (4) a travel assignment model. The model itself does not predict land use changes or the traffic patterns that result from those changes. Post-processors can be added as a means of estimating those effects.
Integrated Transportation and Land Use Models	This type of model attempts to account for the interactions between transportation investments and land use changes. It is a “dynamic” model in the sense that it allows for transportation investments to influence land use and vice versa. This type of model has been more widely used in planning-level studies than in NEPA-studies.

13 NCHRP 25-25, Task 22, *Forecasting Indirect Land Use Effects of Transportation Projects* (2007).

References

Statutes, regulations, and guidance documents cited in this Handbook, along with additional materials and sample documents, are available on the Center for Environmental Excellence by AASHTO web site: <http://environment.transportation.org>.

ADDITIONAL RESOURCES

PRACTITIONER'S HANDBOOKS AVAILABLE FROM THE CENTER FOR ENVIRONMENTAL EXCELLENCE BY AASHTO:

- 01 Maintaining a Project File and Preparing an Administrative Record for a NEPA Study
- 02 Responding to Comments on an Environmental Impact Statement
- 03 Managing the NEPA Process for Toll Lanes and Toll Roads
- 04 Tracking Compliance with Environmental Commitments/Use of Environmental Monitors
- 05 Utilizing Community Advisory Committees for NEPA Studies
- 06 Consulting Under Section 106 of the National Historic Preservation Act
- 07 Defining the Purpose and Need and Determining the Range of Alternatives for Transportation Projects
- 08 Developing and Implementing an Environmental Management System in a State Department of Transportation
- 09 Using the SAFETEA-LU Environmental Review Process (23 U.S.C. § 139)
- 10 Using the Transportation Planning Process to Support the NEPA Process
- 11 Complying with Section 4(f) of the U.S. DOT Act
- 13 Developing and Implementing a Stormwater Management Program in a Transportation Agency
- 14 Applying the Section 404(b)(1) Guidelines in Transportation Project Decision-Making

For additional Practitioner's Handbooks, please visit the Center for Environmental Excellence by AASHTO web site at: <http://environment.transportation.org>

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