Guidance

Induced Growth Analysis

This guidance describes the detailed steps for conducting an induced growth analysis for transportation projects.

TxDOT Environmental Affairs Division
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1.0 Introduction

While many factors – such as real estate prices, local amenities, etc. – influence development, the link between transportation improvements and developments cannot be ignored. Transportation projects often reduce travel time, enhancing the attractiveness of surrounding land for development through changes in accessibility. These changes in accessibility might influence development in a localized area adjacent to the transportation project (e.g. gas stations and motels near an interchange) and larger-scale effects on the location of future development within a region. An analysis of these induced growth impacts 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 sets of 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?
- Are impacts likely to result from project-related changes in development patterns? If so, what specific types of resources could be impacted?

For an EA or EIS project, use the Induced Growth Impacts Analysis Decision Tree to determine whether induced growth impacts are anticipated. If so, then a more detailed six-step induced growth written analysis is required. This guidance explains the process for that more detailed six-step induced growth written analysis if it is required for an EA or EIS. For CE projects, there is no requirement to prepare a written induced growth analysis.

2.0 Instructions for a detailed six-step induced growth written analysis

Combining the logic from the NCHRP and AASHTO methodologies, TxDOT established a process for determining the potential for induced growth and the potential impacts of that growth. If a detailed six-step written analysis is warranted, use the following methodology.

1. Define the methodology.
2. Define the area of influence (AOI) and study timeframe.
3. Identify areas subject to induced growth in the AOI.
4. Determine if growth is likely to occur in the induced growth areas.
5. Identify resources subject to induced growth impacts.
6. Identify mitigation if applicable.

Step 1 – Define the Methodology.

Numerous methods of analysis are available for the study of induced growth impacts effects. The required environmental review document content is as much about which method is selected as explaining how that method was implemented. The document needs to identify very clearly the method of analysis used; the assumptions and limitations involved in that method; and the underlying data and to explain how that analysis was applied to produce the documented results.

This guidance provides a specific framework for conducting an analysis. However, there are different methods a practitioner can use to gather and analyze the data. Different methods are appropriate for

different situations. The selection of a particular method depends on numerous factors, including best available data, project context, and controversy. Plus, more than one method can be used in combination. Figure 1 provides detailed information about the most commonly used methods. For detailed information on this and other complex methods, refer to the NCHRP Report 466 located in the Indirect and Cumulative Toolkit.

Figure 1 Induced Growth Impacts Analysis Methodologies

Method	Description	Advantage	Disadvantage
Planning Judgment	It uses experience, professional literature, data collected from knowledgeable persons, and assessment of local conditions – trends and forecasts – to make judgments about impacts. Computations are generally done in simple tables and spreadsheets. Line of logic and data upon which the logic is based must be explained.	• Inexpensive • Quick • Logical • Scalable	• Pure judgment must be avoided; use of planning judgment often and easily lapses into pure judgment. • Quality is highly variable. • It is generally qualitative, not quantitative.
Collaborative Judgment	It emphasizes group process, diverse inputs, and outreach and is useful for gathering a wide range of information on multiple actions and resources using questionnaires, interviews, panels, etc. It can be expanded to include public involvement.	• Flexible • Useful for subjective information • Transparent • More credible than an individual planner's judgment	• Quantification can be difficult or impossible. • Results can appear more subjective than other methods.
Cartographic Techniques	It includes a wide range of techniques based on various types of maps. Overlay techniques are commonly used. Resource Capability Analysis is a cartographic technique that overlays specific types of maps – opportunity and constraint maps for development – to identify areas likely to undergo land use change. All cartographic techniques can be performed using a geographic information system (GIS) platform.	• Addresses spatial pattern and proximity of effects • Can be adapted to account for temporal effects • Useful for compiling many different types of data • Tools and data often readily available • Effective visual presentation • Can allow for optimization of development or mitigation options	• It can be time consuming. • Important data might not be available. • It is limited to effects based on location. • It is difficult to address the magnitude of effects.
Elasticities	It measures the effect a change in one variable has on the amount of change in another variable. It can be used to account for induced travel effects and for post-	• It can capture induced travel. Forecasts often account for route redistributions, but not new latent trips.	• It relies on estimates; if local data are unavailable, estimates need to reflect the specific

Method	Description	Advantage	Disadvantage
	processing adjustment of travel demand model results.		condition of an improved corridor. • It is not recommended as a stand-alone method.
Four-Step Model	Almost universally used for travel-demand modeling by MPOs and other planning organizations, the four steps are trip generation, trip distribution, mode-choice, and travel assignment.	• Readily available • Widespread support and institutional legitimacy • Quantified results	• While it can provide information about traffic, it does not, in most cases, account for land use impacts, and such analysis results require supplementation from other methods. • It has difficulty accounting for induced travel. • Primary units of analysis are too large to account for neighborhood-scale, making it only applicable for corridors, regions, metropolitan areas, etc. • Utility and accuracy of results depend on data quality and assumptions. • It can be difficult to explain to the public
Comparative Case Analysis	It uses case studies of similar past projects to forecast likely outcomes.	• Relatively simple and inexpensive • Might allow for identification of indirect impacts that are otherwise difficult to identify	• The major limitation of this method is finding completely comparable situations on which to base forecasts. Therefore, this method is not recommended as a stand-alone analysis, but can be used to supplement other methods of analysis. • It is only effective for truly comparable cases similar in size, project type, location, design, demographic conditions, growth rates, etc.

Method	Description	Advantage	Disadvantage
			• Data sources must be similar for both cases. • It requires data collection for all cases to be compared. • Retrospective analysis requires separating project-related impacts from those caused by other factors. • It is not recommended as a stand-alone method.
Scenario Writing	In narrative form, it outlines one or more logical sequences of events to describe the conceivable future environment and can be used to establish the upper and lower bounds of potential outcomes.	• Relatively simple and inexpensive • Useful for outlining a range of possible effects	• It requires assumptions and consideration of numerous uncertainties. • Reliability of the results depends on the plausibility and credibility of the argument and the qualifications and/or competence of the writer. • It might be difficult to identify all appropriate variables. • Completeness, validity, accuracy, and reliability are questionable.
Trend Extrapolation	It allows for projections based on analysis of time series data and involves linear (simple) extrapolation, curve fitting, or upper limit curves.	• Simple and requires readily available software • Useful for establishing baseline projections	• Utility is limited to baseline or no-build forecasts. • It might be too simplistic. • Projections taken too far into the future or based on too few historic data points might be flawed. • It assumes no change to the conditions supporting past trends and might be unrealistic even as a baseline.

Traditionally, TxDOT relied on planning judgment, but this requires some caution and involves some risk. Although there is a tendency to rely heavily on the experience of the analyst, this is rarely a self-sufficient method, as it provides no citation to authority. This method also can lapse into the use of pure judgment, which must be avoided. The analysis must include written findings, incorporating supporting logic and facts. Interviewing local land use experts is a good way to gather facts to support the findings. The causal chain of events must be documented and supported by facts or accepted theory. While planning judgment is often the most expedient method for analysis of induced growth, other options might be preferable. For complex projects, planning judgment is generally not sufficient.

Collaborative judgment expands planning judgment into a group effort, which helps to provide transparency and impartiality. Collaborative judgment can be used for any type of impact (direct, indirect, and cumulative) and might include public involvement and panels of experts. Collaborative judgment is likely to be viewed as more legitimate than a single planner's judgment. In the absence of other resources, collaborative judgment might be the only sufficient method. Numerous techniques might be employed for collaborative judgment, ranging from informal to highly structured, such as Delphi panels. The key feature of the collaborative method is interaction among all members of the group.

Whatever method is selected, it is important to consider any assumptions throughout the analysis. It is also necessary to evaluate and disclose the level of uncertainty involved in the analysis and to communicate it to the decision-maker and the public. The method used affects both the level of uncertainty and the way it is documented. If expert panels or stakeholder involvement are used in forecasting induced growth impacts effects, it is very important to document any differing opinions. **When analyzing results, it is always preferable to quantify impacts when practicable. However, in some situations, qualitative methods can be sufficient for analysis of indirect impacts. For complex or controversial projects, more sophisticated methods might be necessary.**

Step 2 – Define the area of influence (AOI) and study timeframe.

Several techniques are available to determine the appropriate study area for induced growth impacts, or the AOI. These techniques include adopting political and/or geographic boundaries, using the project commute shed, using the location of next major parallel roadway, and incorporating input gathered from stakeholder interviews or public involvement. Also, consider travel-time savings and travel volume while determining the AOI. Combined, these techniques can define the appropriate AOI for the full ranges of potential induced growth effects impacts.

Generally, larger project improvements with greater savings in travel time – such as improved mobility and access – have a larger AOI. Large-scale projects of regional importance might have much larger study areas. Produced as part of Task 22 of NCHRP Project 25-25, the NCHRP Forecasting Report provides specific guidance on the magnitude of time savings and its relevance to induced growth impacts, as well as an explanation on elasticities, which can be used to define the appropriate AOI more accurately. If a project is short in length but opens previously inaccessible parcels, a smaller AOI might be appropriate. A good example is connecting a discontinuous frontage road.

If indirect impacts are considered early in the scoping process, it is possible to develop the overall study area for the project with consideration of the potential induced growth impacts. If this is the case, the AOI might be the same as the project study area. If induced growth impacts were not considered when establishing the study area boundaries, it might be necessary to select an expanded AOI. There is no concrete formula for establishing a study area appropriate in every instance. The Environmental Affairs Division (ENV) is available to assist in determining an appropriate AOI. Although doing so requires additional data collection, it is preferable to have an oversized rather than undersized AOI. **Whatever the**

size and shape of the AOI selected, the environmental review document must clearly explain the logic behind that selection.

Selection of an appropriate AOI also requires consideration of the timeframe. Most analyses use the transportation plan horizon year as the appropriate timeframe for an induced growth impacts analysis. **Timeframe considerations for an induced growth impact analysis only have a future component, unlike cumulative impacts analyses.** While an induced growth impacts analysis does not require a past temporal boundary, the analyst should consider past trends when determining if growth might occur.

Step 3 – Identify areas subject to induced growth in the AOI.

Once the AOI is determined, the practitioner uses information gathered from aerial photography, available GIS data layers, information from local officials or planners, or information from other sources to determine which areas within the AOI would be most likely to experience induced growth. This cartographic technique can be achieved most effectively using GIS. However, it is possible to complete this exercise with other computer applications or on paper. Include a map depicting the AOI in the environmental review document.

When looking at the AOI, the practitioner first identifies undevelopable parcels, areas they are confident will not experience development and/or redevelopment as a result of the project. This could include areas such as parks, wildlife refuges, floodplains, or areas that are currently developed.

When eliminating currently developed parcels, the practitioner considers the age of the development and the potential of that parcel to be redeveloped. Redevelopment is likely to be most important in developed areas that are currently undergoing change, are designated by the local government as areas where redevelopment is desirable (i.e. Tax Increment Financing (TIF) districts), or have high vacancy rates and/or properties for sale. Transportation projects can also affect the rate at which planned development is implemented.

After the undevelopable parcels have been eliminated, the practitioner can examine the remaining areas to determine which parcels will be subject to induced growth. This step incorporates several factors including information from planning documents and information from the local agency on availability of utilities, accessibility to the parcel, etc.

For example, a parcel is not likely to experience induced growth if all of the following are true:

- The project proposes to build a new roadway making several undeveloped parcels newly accessible;
- The area does not currently have water or sewer lines running near the newly accessible parcels; and
- The planning document and/or official have no plans to construct utilities to that area.

However, a parcel would be subject to induced growth if all of the following are true:

- It is adjacent to the limited access highway;
- The parcel currently has utility lines available to it; and
- The project proposes to construct an access road that would allow traffic to reach the parcel.

Step 4 – Determine if growth is likely to occur in the induced growth areas.

After identifying the parcels that would be subject to induced growth, the practitioner analyzes how likely it is that growth will occur. Factors that determine the likelihood of induced growth include information gathered using the collaborative judgement method, from planning documents; from zoning, population, and employment trend data; and from local planners or other knowledgeable officials. It is critical to

document very clearly the sources of data, their use in the analysis, and the certainties and uncertainties of the information used and to draw a clear line of logic in the analysis to the conclusion.

In the environmental review document, the practitioner first indicates if any of the available parcels are currently slated for development. This can be determined using the local agency's current planning document, information from planner interviews or questionnaires, or by searching the local agency's website for filed plans and/or building permits. When explaining about these developments, state if they are dependent on the proposed project.

Next, the practitioner analyzes any available data to determine if induced growth will occur on the remaining parcels by using the trend extrapolation method to examine trend data. If the trend in population for a city or town shows that population has been steadily increasing over the past 20 years and is projected to continue to do so, then induced growth may be more likely to occur. If the employment trend for a town shows employment opportunities have been steady but are beginning and are projected to continue declining because of the loss of a major industrial facility, induced growth is not likely. In general, the most clear and concise method of conveying trend data is using charts or graphs. If possible, the practitioner should use charts or graphs to illustrate employment and population trends in the AOI.

In addition to trend extrapolation, comparative case analysis and scenario writing can also be useful methods for examining potential outcomes in this this step. A detailed list of various methodologies is shown in Figure 1.

Unlike most other indirect impacts, land use impacts are described in value-neutral terms. Changes in land use are not described as positive or negative, as they might be either, depending upon the context, area goals, and perceptions. The same land-use change is likely to be viewed differently by different groups.

Step 5 – Identify resources subject to induced growth impacts.

If it is determined that induced growth might occur, the practitioner identifies the resources that could be impacted by the possible growth. If there is no detailed information on the development that may occur, the practitioner uses the details of a worst-case scenario. The analysis must include an inventory of all the resources present on the areas identified as likely to experience induced growth. However, substantial impacts require a more detailed analysis. Whether an impact is substantial is a function of the context, the likelihood of the impact, and the reversibility of the impact.

Using GIS or other available resources, the practitioner determines what is present on the induced growth parcels. As discussed previously, quantitative analysis is always preferable, so the practitioner provides the acreage of impacts categorized by vegetation class, habitat type, or current land use. After taking inventory of the resources present, the practitioner examines which resources might be substantially impacted.

An impact can be substantial due to its context. As with direct impacts, a potential induced growth impact can be considered small in and of itself, but also substantial due to the setting or condition of the resource. Consider the following example of a potentially substantial impact to vegetation. If there was a parcel with creek adjacent to a 2.3 acres stand of woody vegetation completely surrounded by retail and residential development and the proposed project would likely induce growth on that parcel, the impact could be substantial as the stand is likely the only refuge for wildlife traveling along or living in the adjacent creek. However, if the same size stand was surrounded by rangeland and other stands of the same vegetation, the potential induced growth impact would not be substantial.

An impact can be substantial due to its likelihood of occurring. As an example, consider a sensitive resource on a parcel identified as an induced growth area. If the parcel were in a rapidly developing suburban area experiencing a sharp upward population growth trend, the impact would be substantial.

However, if the parcel were in an area experiencing a steady population trend and no new building permits or development plats have been recently filed for any adjacent areas, the impact might not be substantial.

An impact can be substantial due to the resource's ability to recover from the impact. For example, impacts to wetland might be less likely to be substantial, as impacts to wetlands require mitigation by replacement. Whereas, impacts to environmental justice populations might be more likely to be substantial, since there are no specific mitigation requirements for such impacts. Therefore, the community might be less able to recover.

If an impact is found to be substantial, the practitioner does additional analysis to determine the magnitude of the potential impact. Then, the practitioner considers whether this substantial impact might assist the decision maker in determining which project alternative would be preferred.

Step 6 – Identify Mitigation

In general, mitigation is considered for indirect impacts that:

- Conflict with study area goals;
- Could worsen the condition of a sensitive or vulnerable resource;
- Could delay or interfere with planned improvement of a resource; and/or
- Are inconsistent with an applicable law.

The practitioner develops mitigation options similarly to the method used for direct impacts and evaluates those options for practicality the same way. Potential mitigation options for induced growth impacts can fall outside the jurisdiction or control of the sponsoring agency. Courts have determined that environmental review documents need to identify potential mitigation strategies, even if they are not under the control of the sponsoring agency. Additionally, the document must identify who might adopt those mitigation strategies and advise those entities with mitigation authority on what was considered appropriate mitigation.

Robertson v. Methow Valley Citizens Council, 490 U.S. 332 (1989) states: "where the adverse effects … are primarily attributable to predicted off-site development that will be subject to regulation by other governmental bodies, the EIS serves the function of offering those bodies adequate notice of the expected consequences and the opportunity to plan and implement corrective measures in a timely manner." The document must include a statement explaining the effectiveness of possible mitigation measures, but does not need to include a fully developed mitigation plan.

In most cases, TxDOT does not mitigate for impacts caused by others. There are occasional exceptions, when endangered species are impacted. An induced growth impact to listed species can lead to consultation with the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act (ESA). For some induced growth impacts to endangered species, USFWS requests conservation measures. Although this situation is rare, there are cases where TxDOT must implement conservation measures to mitigate induced growth impacts.

Some induced impacts are considered within the control of the sponsoring agency. These impacts include those related to, but not limited to:

- How the project is located and its access provisions;
- How the project is constructed;
- How the project is operated; and
- How the project right-of-way will be used and maintained.

For these impacts, the document must explain avoidance measures, minimization measures, and appropriate compensatory mitigation.

3.0 Questions that should be answered in each step of the detailed six-step induced growth written analysis

The following questions are listed for each step of the TxDOT six-step induced growth impacts analysis process and are used by practitioners to analyze and document induced growth impacts comprehensively. Thoroughly answering these questions ensures a sufficiently reasoned and documented analysis.

Step 1 Define the methodology.

Was the methodology chosen based on the best available data, project complexity, and/or controversy?

Was the reasoning for choosing the methodology explained?

Is the methodology explained? If collaborative judgment was used, are all the consulted parties listed?

Step 2 Define the AOI and study timeframe.

Does the scale of the AOI reflect the scale of the proposed project?

Is the rationale for choosing the AOI explained?

Is the rationale for the AOI logical?

Has a study timeframe been established?

Is the rationale for choosing the study timeframe explained?

Is the rationale for choosing the study timeframe logical?

Step 3 Identify areas subject to induced growth in the AOI.

Were undevelopable parcels eliminated from calculation and analysis?

Does the document explain why those parcels were considered undevelopable?

Is the rationale for identifying induced growth areas explained?

Is the rationale for identifying induced growth areas logical?

Step 4 Determine if growth is likely to occur in the induced growth areas.

Were planned developments identified?

Does the document identify trends that would influence growth?

Does the analysis draw a conclusion as to whether induced growth might occur?

Are the conclusions supported by logical analysis and plausible reasoning?

Step 5 Identify resources subject to induced growth impacts.

Does the analysis quantify the acreage subject to induced growth?

Does the analysis state what is currently present on the induced growth areas?

Does the analysis differentiate between substantial and unsubstantial impacts?

Are the conclusions on substantial and unsubstantial impacts logical and plausible?

Step 6 Identify Mitigation.

Does the document identify induced growth impacts that would require mitigation?

Does the document identify mitigation measures that would protect resources from induced growth impacts caused by others?

Appendix A: Revision History

The following table shows the revision history for this guidance document.

Revision History	
Effective Date Month, Year	**Reason for and Description of Change**
December 2023	Version 1 was released.