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The Development of a Web-Based Small Airport Economic Impact Model

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Cooperative Research Program

TEXAS A&M TRANSPORTATION INSTITUTE
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16. Abstract

Knowing the current economic impact of an airport is critical to both airport sponsors and the Texas Department of Transportation (TxDOT). While TxDOT periodically commissions a statewide economic impact study, the ability to provide updated or more precise economic impact values to airport sponsors and other stakeholders is needed. Having updated and current numbers is important because many local officials use the airport's economic impact values to justify airport investment.

Researchers built the input/output model using IMPLAN multipliers, visitor spending data from the Texas Governor's Office, Terminal Area Forecast data from the Federal Aviation Administration, and the latest available data from the recently completed statewide economic impact study of Texas airports. The web tool, called the Small Airport Economic Impact Estimator, takes the model and provides an interface for users to calculate the economic impact of the airport of their choice. The user has the option to calculate using the default data or provide new inputs based on his or her knowledge of current conditions.

The Small Airport Economic Impact Estimator Tool provides a resource for airport managers, planners, and local officials. As economic conditions change and the airport develops, the Estimator provides up-to-date economic impact numbers that can support grant applications and local funding matches, as well as attract new development. In addition, the Estimator can estimate economic impacts that may be realized if certain improvements are made that increase airport activity.

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DISCLAIMER

This research was performed in cooperation with the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA). The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of FHWA or TxDOT. This report does not constitute a standard, specification, or regulation.

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CHAPTER 1: INTRODUCTION AND PURPOSE

Texas has 264 general aviation airports and 15 non-hub commercial service airports creating a robust aviation network across the state that connects rural, suburban, and urban locations. These smaller airports not only provide services to the community and region but are often centers of employment through jobs offered at the airport itself and businesses located at the airport. On-airport activity can consist of businesses that offer aircraft sales, storage, and fuel sales; air freight operators; and concessions, such as retail stores and restaurants. Businesses in the surrounding community may also rely on the airport to conduct or support its operations. The airport can be a necessary component of their business model and may be a driving factor in why they have chosen a particular location.

Small airports can also provide tourism access and therefore bring visitors to the region to spend money and boost local economic activity. This access to travel provides benefits to users in the region by reducing their travel time, which in turn leads to greater economic benefits. Although the economic benefits of these airports are not always as obvious as those of their larger commercial service counterparts that move a greater number of passengers and provide other obvious tourism connections, the literature does show that smaller airports play a significant role in connecting small and rural areas to larger destinations, and that despite their size, they play an important economic role.

The Texas Department of Transportation's (TxDOT's) Aviation Division periodically conducts a statewide economic impact study to determine the economic benefits provided by the Texas airport system. However, for many airports, there is a further need to be able to determine their economic impact on a more frequent basis than the five- to seven-year cycle when economic impact studies are conducted.

The primary reasons for a more frequent examination of economic impacts are:

- Some airports' not being included in the statewide study (or incomplete information being used).
- Privacy concerns with respect to the financial/economic data because the airport may only have one tenant or business, making it identifiable.
- Changes in an airport's activity levels since the last statewide study was performed.
- An airport's desire to have a more detailed analysis than that allowed when looking at 300 airports at one time.

Because many local officials use these numbers to justify grant-matching funds and investment in their airports, it is important to have current data available for decision-making. In addition, the development of a more customized economic impact model can allow airport managers and other stakeholders to estimate economic benefits for planned improvements or other scenario changes. For example, an airport might be able to estimate the change in economic benefits should a particular airport improvement lead to more tenants, more based aircraft, increased activity, more visitors, and/or increased employment levels on the airport.

As part of this research, the researchers performed the following:

1. Conducted a focused review of airport economic impact modeling in terms of both methodology and data needs, including those that are Texas and industry specific including aircraft use, travel patterns, visitor spending data and local/regional economic multipliers.
2. Developed an economic impact estimator model for small airports that will include a web-based user interface for easy use.
3. Validated the model output using results from previous analyses using different economic models.

The research team reviewed economic impact methodologies and determined that a traditional input/output (I/O) model would provide the best estimates of the economic impact for a small airport. Researchers built the I/O model using Economic Impact Analysis for Planning (IMPLAN) multipliers, visitor spending data from the Texas Governor's Office, Terminal Area Forecast data from the Federal Aviation Administration (FAA), and the latest available data from the recently completed statewide economic impact study of Texas airports.

The web tool, called the Small Airport Economic Impact Estimator, takes the model and provides an interface for users to calculate the economic impact of the airport of their choice. The user has the option to calculate using the default data or provide new inputs based on his or her knowledge of current conditions. The Estimator takes these inputs and generates summary outputs for three different types of activity:

- Airport activity—employment or expenses directly related to the functioning of the airport.
- Visitor activity—the impact of visitor spending on the region.
- Tenant/business activity—employment or expenses related to any tenants or businesses that are located on the airport.

In addition, the Estimator calculates the annual impact of capital expenditures at the airport, based on an average of the past three years of capital expenses.

CHAPTER 2: BACKGROUND AND LITERATURE REVIEW

Aviation and individual airports provide business, visitor, and capital activity to the economy in the communities they serve. The importance of large commercial service airports is often easy to calculate because of their ability to collect data and perform economic analysis that shows their benefit to the community. Because of this, previous research focused on those large airports and their impact; however, in recent years, the importance of smaller to mid-sized airports has been noticed. Small airports provide crucial services to the local area and economy, such as emergency service provision or usage of onsite facilities for community purposes and events.

These airports are often located in rural areas or smaller regions, so they provide a long-distance freight connection, aid in search and rescue, or coordinate and assist during times of emergency (*1*, *2*, *3*). Some of these impacts are difficult to quantify, but the businesses and services provided by the airport can be used to calculate their impact to the economy. Without the airport there to provide the service, rural residents are likely to suffer the effects of lower economic activity in the region, as well as personally needing to travel farther for certain goods and services.

ECONOMIC IMPACT OF SMALL AIRPORTS

Airport Cooperative Research Program (ACRP) Research Report 16: Guidebook for Managing Small Airports defines a small airport as "general aviation, nonhub commercial service and airports with limited and/or volunteer staff" (*1*). The National Plan of Integrated Airport Systems (NPIAS) does not expressly define a small airport, but general aviation airports are defined as "public-use airports that do not have scheduled service or have less than 2,500 annual passenger boardings (49 USC 47102(8))" (*4*). In terms of non-hub airports, NPIAS defines these as having more than 2,500 annual passenger boardings but less than 10,000 (*5*).

Texas has 264 general aviation airports and 15 non-hub commercial service airports creating a robust aviation network across the state that connects rural, suburban, and urban locations. These smaller airports not only provide services to the community and region but are often centers of employment through employment at the airport itself and businesses located at the airport. On-airport activity can consist of fixed-base operators (FBOs) that offer aircraft sales, storage, and fuel sales; air freight operators; and concessions, such as newsstands or restaurants (*2*, *3*). Businesses in the surrounding region might also rely on the aviation connection; it can be a necessary component of their business model, and so without that airport, the business may have chosen a different location (*6*). Small airports can also provide travel access and therefore bring visitors to the region who spend money and boost economic activity. This access to travel provides benefits to users in the region by reducing their travel time, and these benefits in turn lead to increases in economic activity (*7*). Although the economic benefits of these airports are not always as clear as those of commercial service airports that move a greater number of passengers and provide a tourism connection, the literature shows that these airports have a crucial role to play in connecting small and rural areas to larger destinations.

APPROACHES TO ECONOMIC IMPACT STUDIES

As noted in *ACRP Synthesis 7* and additional literature, there are three methods to determine the economic impact of an airport or airport system: a survey of airports, an econometric analysis,

and I/O or multiplier models (*8*, *9*, *10*). Each method has its own benefits and limitations. A survey relies on subjective quantitative assessments from experts in that airport or airport system. This method is open to bias depending on who is interviewed and does not provide verifiable numbers for analysis. Econometric analysis relies heavily on wide-ranging and detailed data, and specifying the correct model can be challenging. In addition, econometric analysis introduces causality questions: did the airport or airport system provide the economic boost the model is calculating, or was the region already economically sound, allowing the airport/system to flourish? Data can also be problematic because secondary data are often not available to the extent required for meaningful results. This is not the case for I/O models as they do not use secondary data.

In terms of calculating the economic benefits derived from general aviation and non-hub airports, the literature shows that despite their size, they can play an important economic role. Problems normally arise due to lack of detailed data and lack of resources to complete a study to understand their importance. The *Guidebook for Managing Small Airports* states that the most widely used approach to determining economic impact for airport systems and airports is the I/O model (*1*). An I/O model requires less data than econometric analysis, which can be used to provide a more nuanced understanding of the economic impact of an airport but relies on quantifiable metrics, unlike subjective surveys of experts. I/O models work by estimating the impact to the region of economic activity through the inclusion of expenditure and other inputs to provide the generated economic output for the region. Care does need to be taken to avoid double counting throughout the model, and region-specific multipliers should be used to provide accurate estimates (*8*). While some have critiqued I/O methodologies due to these issues and the problems with properly accounting for the eventual leakage of that spending outside the region, it is generally accepted as the best model when considering airport systems and, especially, small airports (*3*, *9*, *11*). The lack of detailed data available for small airports makes econometric analysis unsuitable, but the I/O model provides a practical methodology based on defined inputs that provide a comprehensive picture of that airport's, or an airport system's, economic impact (*9*).

I/O models provide three measures of economic impact through the use of data inputs from airports on their activity levels:

- Employment.
- Payroll expenditures.
- Output.

Employment includes both full- and part-time jobs, with part-time jobs being calculated to create a full-time equivalent number of positions. Payroll expenditures are the expenses related to salary, wage, and benefits earned by all employees and business owners at the airport. Output refers to goods and services that are generated by the airport on an annual basis. This is expressed by a dollar amount and is estimated using annual sales, or annual operating costs, which assumes that the output is approximately equivalent to what the airport expends. These three measures cannot be summed to provide a total economic impact because elements of economic benefit related to payroll are also contained, to a certain extent, within output. Summing these numbers would lead to double counting and an overestimation of the economic

impact; therefore, these three measures stand alone in the consideration of total economic impact for an airport (*11*).

The three measures of economic impact are used to evaluate four categories of economic impact in terms of airports:

- On-airport activity.
- Capital projects/improvements.
- Commercial service visitors.
- General aviation visitors.

On-airport activity refers to airport tenants that are businesses with employees, such as airlines, FBOs, concessionaires, and flight schools. Governmental agencies that have operations on the airport are also included in this activity measure. The output for on-airport activities is often assumed to be annual gross sales, but this does not consider the impact of agencies that do not generate revenue. Therefore, non-profit-generating tenant output is calculated using annual operating expenditures.

Capital projects represent construction improvements made to the airport, in terms of runway rehabilitation or terminal improvements. Other businesses or tenants at the airport can undertake projects to improve their space as well. These projects often require construction or renovations, which employ local firms in the areas of architecture, engineering, construction, and consulting. These add to both the employment (calculated using ratios) and payroll for the airport. Output from these projects is equal to the dollars spent.

Commercial service visitors are non-local passengers using commercial airlines. When incorporating them into the model, estimations of visitor spending are calculated and used as the output. The spending is also used to determine employment and payroll impacts for the region.

General aviation visitors are similar to commercial service visitors, but instead of using commercial airlines, these passengers generally arrive on private or business flights. Their visitor spending in the area is calculated and used as the output, and activities that they generate in the economy are used to determine the impact in terms of employment and payroll (11).

The information gathered from the four categories of economic activity is then used to determine the different types of economic impact, which are:

- Direct.
- Indirect.
- Induced.

Direct impacts relate to the initial point at which the money starts to circulate in the local economy; this includes on-airport activity, visitor spending, and capital expenditures. Direct impacts are used as the inputs into the model in order to determine the indirect and induced impacts. Indirect impacts are generated by users of the airport services, such as capital equipment and improvements by businesses on the airport. Induced impacts, also known as multiplier impacts or those associated with the multiplier effect, are the result of re-spending of those

dollars throughout the local economy. An example of induced impacts would be an employee spending money on groceries or gas in the local economy, as opposed to businesses at the airport spending money, which are indirect impacts.

These indirect and induced impacts are follow-on impacts from the initial transactions made; however, these transactions do eventually "leak" outside the economy (*2*, *11*). The calculation of these multiplier impacts is conducted by entering the direct dollar impact into the I/O model and using multipliers specific to that geography to determine the effect. The multiplier calculates how many times the money is recirculated through the economy into different sectors before it leaks beyond the geographic boundary, such as the city, county, or state. Sector-specific multipliers are employed to ensure the correct estimates of economic impact from this recirculation of dollars within the economy. Multipliers differ by the measures of economic impact; therefore, different multipliers are required to determine indirect and induced employment versus payroll or output multiplier impacts. The combination of direct, indirect, and induced impacts provides the total economic impact for that airport or airport system. This is generally reported in terms of total employment, total payroll, and total output.

Although I/O models have their limitations in certain contexts, previous economic impact analyses, within and beyond the aviation industry, have largely relied on this methodology. The Texas Aviation Economic Impact Study has used this approach over the past 15 years, providing the state and TxDOT with an estimate of individual airport economic impacts as well as the impact of the system as a whole (*11*). This study provides the airport with an estimate of its economic impact without a large investment from the airport and allows TxDOT to understand the importance of its investment in aviation across the state. Although this study provides small airports with an estimate of their economic impact, as previously stated, the airport activity can change significantly in between studies with the introduction of a new business or the completion of a capital improvement. The ability to estimate economic impact due to those changes can help an airport attract more business and raise funding for further projects or maintenance.

Multipliers depend on the region and local context; the industry mix and population alter the industries present and offer different opportunities for retail and services. The variation in these multipliers allows for accurate estimates of economic impact but requires a great deal of analysis and local knowledge. Tools are available that provide multipliers for states and counties across the United States; the majority of economic impact assessments use tools such as IMPLAN to determine the appropriate multiplier for their geography. However, the data requirements and resources needed to complete an economic impact study can prove untenable for smaller airports. The ability to access a tool that expedites the economic impact process is crucial for smaller airports that do not have the expertise or resources to conduct their own. Regional airports provide transportation connections to the area and reduce the demand on alternative modes, such as roadways. These airports need a way to show the impact that the airport has on the regional economy and to justify capital improvements to their funding sources. A web-based tool provides greater accessibility and efficiency to this process and allows airport managers to display impacts beyond their direct investment in the airport and region.

DATA REQUIREMENTS AND SOURCES

In order to accurately estimate the economic impact of an airport, data on airport activity such as employment and payroll information or flight occupancy levels are required. Airport activity data come from a variety of sources; the research team reviewed these sources to ensure accurate data are used in creating the model. FAA or the state aviation agency often collects data on activity levels at airports across the United States or their state.

In addition, airports may collect and report their own activity levels to provide an idea of their impact to the region. In terms of airport-specific data, such as employment and payroll, this is often collected through surveys by consultants or can be provided by the airport itself. Occupancy of flights in and out of the airport and estimated visitor spending can be collected in a number of ways; consultants often use surveys to gain a general idea of visitor spending and flight occupancy.

The airport size and the size of plane that the airport can support can serve as proxies for understanding the number of visitors flowing through a certain airport. The Texas state study uses a consultant survey to estimate average visitor spending, which bases its estimates on the size and capacity of the airport. The Office of the Governor in Texas also conducts travel research that estimates visitor spending by region for various different categories, including accommodation and meal service. This resource provides better estimates by providing spending by region that takes into account the different economies and amenities across Texas (*12*). The South Carolina state study relies on individual airports as well as FAA's National Offload Program to understand general aviation visitor numbers and then estimate their spending levels based on airport data (*13*). Appendix A provides an overview of the state studies that were examined in order to determine common methodologies and data sources.

WEB-BASED ECONOMIC IMPACT MODELS FOR AIRPORTS

The provision of a web-based tool to host the I/O model allows small airports access to an up-to-date estimate of their economic impact to provide justification for funding or to show the economic activity created by recent projects or new businesses at the airport. The Estimator focuses on small airports due to the need for this service and the difficulties that arise from attempting to estimate economic impacts for both small airports and those with greater passenger activity using the same estimator; larger commercial service airports require more detailed studies to determine their actual economic impact.

The development of such a web-based economic impact tool for small airports was previously undertaken by the Minnesota Department of Transportation. The calculator was first developed in 2005 using data collected from Minnesota airports and further updated in 2011. *Development of a Web-Based Economic Impact Calculator for Small and Medium-Sized Airports* explains the process of developing the calculator using data collected from airports across the state (*14*). The website allowed users to enter all of the different types of airport activity, such as airport sponsors, FBOs, commercial air service, businesses that use the airport for shipping freight or lease land, visitors, and retail operations. This information was placed into the model to determine economic impact using sector-specific county-level multipliers from IMPLAN; the result was an economic impact report for that airport based on the activity levels provided. The

update had multiple goals; the tool had seen interest from larger airports in the state, and so it was adapted to provide more reliable estimates for those airports and was used to create a report on the economic impact of the entire airport system in the state (*15*). The update also provided greater flexibility and reliability by better reflecting current economic conditions; the business and economic composition of an area changes over time, requiring new multipliers for the model.

IMPORTANCE OF ECONOMIC IMPACT STUDIES

Economic impact studies provide information that supports a number of activities conducted by airports, often most importantly providing support for funding or investment from federal, state, and local entities. One of the main sources of funding for small airports is FAA. FAA's Airport Improvement Program (AIP) provides grant funding to airports across the nation; however, matching requirements are in place (*16*). General aviation airports have to provide between a 5 and 10 percent match in order to receive AIP grant funds for their capital projects (in Texas, this is typically set at 10 percent). Since these airports are publicly owned, they need to provide justification for the project in order to secure a match. City councils and managers in charge of the budget must provide evidence to their citizens of the benefits derived from spending at their local airport. The provision of an economic impact report that displays a change in economic activity can be that evidence.

In addition to providing evidence for a local match or other investment, the ability to calculate economic activity change due to a project could assist with scenario planning for the airport. The ability to determine which project will best contribute to increased economic activity will assist in deciding between different projects and understanding what is most important to complete at the airport. Although economic impact is only one consideration for capital improvement projects, it can help airports determine the timeline to complete certain projects and which to prioritize where possible.

The Texas aviation system has undergone economic impact studies for a number of years; this helps TxDOT understand the importance of these airports to the local economy and the transportation system of Texas as a whole. The *Texas Aviation Economic Impact Study* provides impact estimates for the majority of airports in Texas—289 airports including four heliports (*11*). Although this estimate provides an airport with a good indication of its economic impact, the estimate is only completed periodically (typically, these studies are completed every five years), which leaves small airports without a way to convey changes in those intervening years. A web-based estimator can account for changes in the intervening years and provide a more reliable estimate of the current economic conditions and how the airport contributes. New businesses and newly generated activity in between the state study can alter the profile and needs of a small airport. Providing real-time economic impact estimates could be the key to gaining greater funding to meet those needs.

One core problem when conducting an economic impact assessment for small airport is the lack of detailed data available. Many of these airports do not keep regular data on their activity levels or economic output, which makes completing an economic impact assessment difficult. Due to difficulties in collecting data, the *Texas Aviation Economic Impact Study* uses estimates for airports that have less than 5,000 itinerant operations. These estimates are useful in providing a

snapshot of the impact, but the nature of estimating activity could lead to conservative economic impact estimates. Growth and changes at a small airport can necessitate updates or the collection of better data in order to justify new capital projects or support continued growth. The option to use airports' own estimates of activity or to collect the required information and add it into a model can provide some much-needed flexibility.

An economic impact analysis is a useful tool for airports of all sizes; however, small airports often suffer from a lack of resources and expertise to conduct a study in house or contract out to a consultant. These airports must rely on state studies, such as the *Texas Aviation Economic Impact Study*, to provide them with estimates of their impact to the local economy and their state (*11*). Although these studies provide useful information for these airports, conditions can change drastically in the intervening years. New businesses or new activity can be attracted to the airport, and expansion or improvement projects can be completed, all of which boost the economic output for the organization. A web-based impact estimator would provide real-time calculations that the airport can use to show its importance to the local community. Another advantage of the estimator would be showing the increase in economic activity due to a proposed capital improvement project at the airport.

Additional resource materials are included in Appendix A.

CHAPTER 3: DEVELOPMENT AND TESTING OF SMALL AIRPORT ECONOMIC IMPACT ESTIMATOR TOOL

To quantify the economic impact an airport has on a region, a common analysis technique, known as an economic impact assessment, is often used. This assessment must include a way to quantify external factors and to evaluate potential indirect factors that may be associated with the treatment. These external factors are used as inputs to an I/O model to produce direct, indirect, and induced economic impacts. An I/O model demonstrates how a change in production, labor, or income will impact the current economy through the use of regional multipliers. The analysis is based on the interdependencies between economic sectors and can assess how a shock or change will impact the economy.

Economic impact tools often use I/O models as their base and include other components to increase the validity and reliability of the models. For example, certain models use regional social accounting matrices to track the flow of goods and services in an economy. Other, more transportation-specific tools have included travel demand models with their I/O base. Economic impact assessments provide levels of impact from direct to induced: direct impacts are the results of the initial change in expenditures, indirect impacts are the effects derived from the operations of the direct industries, and induced impacts result from the spending of direct and indirect wages. Employment, wages, and output are presented for direct, indirect, and induced impacts. Changes in economic impacts can also impact the tax revenue of the local taxing authorities.

The research team has developed and validated an economic impact estimator tool to be used by small airport sponsors, their stakeholders, and government officials. Because of the scope and complexity of commercial service airports, only non-hub commercial service airports have been included in this model development. However, larger commercial service airports have not been specifically removed from this model. The model's calculations will still work and provide an estimated economic impact value should the user provide the requisite input values.

Following a review of the literature and in conjunction with TxDOT, the research team defined small airports to be all general aviation airports and those non-hub commercial service airports in the Texas Airport System Plan. This was essentially supported by previous research that indicated the plan should include general aviation airports and non-hub commercial service airports that essentially function as large general aviation airports with some schedule airline service.

The research team identified, collected, and organized airport-related economic and activity data specific to determining an airport's economic impact. This included but was not limited to the following:

- Airport sponsor related:
  - Airport operations.
  - Employment.
  - Payroll (salaries/wages/benefits) of airport employees.
  - Operating expenditures.
  - Capital expenditures.
  - Number of enplanements (if commercial service).

    - Visitor spending (commercial service and general aviation).
    - Operations mix (local/transient).
    - Aircraft occupancy.
- Tenant/business related:
    - Employment by industry/business type.
    - Operating expenditures.
    - Payroll (salaries/wages/benefits) of airport businesses.
    - Gross sales.
    - Capital expenditures.

The research team also worked to identify default numbers from the research for visitor spending categories that are specific to Texas with the ultimate capability of having the user modify for specific airport use. While previous research established nine broad categories of airport expenditures, the team identified 16 different types of businesses typically located on airports, all with different multiplier and production values accounting for more accurate or realistic results. Not all airports will have all these expenditure categories.

The research team developed the spreadsheet-based model/database that serves as the estimator tool for determining the economic impact of small airports. This model served as the basis for the web-based interface. This model includes the estimator's internal calculations for determining economic impacts based on the user inputs. The model also includes specific county-level and economic-sector multipliers to account for any intrastate, economic, and industry differences as well as those between the types of businesses operating on the airports.

The research team derived the multipliers for the model from IMPLAN software, which will also be consistent with the methodology for previous Texas Aviation Economic Impact Studies.

The research team tested the model to ensure its validity, reliability, and consistency in two ways:

- TTI compared model results with the 2018 *Texas Aviation Economic Impact Study*, which TTI assisted in managing and is very familiar with. The research team selected 10 airports and performed a deep-dive analysis into the results and accompanying differences. The research team asked the project panel to review the model results and select an additional three to five airports to compare the results with those from the 2018 study performed by CDM Smith.

- TTI compared the model results with those of its own proprietary I/O model used in performing economic impact studies of transportation infrastructure across the state. This review was not as stringent as the previous review because the model is not as complex. The model uses similar multipliers, and no previous results existed, so it is largely a function of the input data. Because the multipliers are very similar, the results are very similar. While this is a good test of the calculations, it was not a good test of the methodology.

The output of the Small Airport Economic Impact Estimator includes the following:

- Total employment.
- Total payroll.
- Total output for:
  - On-airport impacts (employment, payroll, and output).
  - Construction/capital improvement impacts (employment, payroll, and output).
  - Commercial service visitor impacts (employment, payroll, and output).
  - General aviation visitor impacts (employment, payroll, and output).

MODEL DEVELOPMENT

TTI staff developed the draft Small Airport Economic Impact Estimator Tool, which consists of a spreadsheet model using Excel. The tool uses eight worksheets to supply data to the model calculations including a data input and summary page:

1. Economic Analysis of Activities (input page).
2. IMPLAN Region Multipliers.
3. Lookup Airports.
4. Visitor Spending.
5. Airport Activity.
6. Tenant Activity.
7. Tenant Data.
8. Capital Expenses.

Each of these worksheets contains significant and important data that are integral to the model's functionality. The worksheets provide data important for economic impact calculations, default values for airports that may not have historical data available, and a user-friendly interface for airport managers and others to easily select their airport and corresponding visitor spending region and appropriate economic impact multipliers. Each of the model worksheets is discussed in more detail as follows.

Economic Analysis of Activities

The Economic Analysis of Activities worksheet serves as the user input page to provide a user-friendly approach for airport managers and other stakeholders to easily select their airport for analysis. The worksheet contains the model formulas and calculations and pulls data from the other worksheets to make the economic impact calculations.

Upon selection of the airport from the drop-down menu, the tool automatically loads the airport's county and visitor spending region. These are important to the model because it uses county-level multipliers for the economic impact analysis as opposed to statewide multipliers. In addition, visitor spending is different in different parts of the state. The visitor spending regions are county based, and selecting the county ensures that the most accurate spending patterns for the local area are used.

Also loading upon selection of the airport are any airport and tenant data that may be available from the recently conducted economic impact study. The TxDOT Aviation Division conducted a statewide airport economic impact study in 2017 and 2018 that was published in August 2018. In the course of the study, airport and tenant data were collected. The model provides these data as default estimates. Privacy protections employed during that study are maintained with no identifying information being made available. Loading default numbers is done as a courtesy to assist airports that may not be too familiar with their own data. In the event that the data are outdated or if the airport would like to run some hypothetical scenarios, the ability to update or provide additional data is made readily available. User-entered data will take precedence in the model calculations and output.

IMPLAN Region Multipliers

In constructing the model, the team used multipliers from IMPLAN to accurately calculate the economic impacts from activity happening at and on the airport. Once all of the tenants had been assigned an IMPLAN industry code, the team collected the multipliers for output, employment, and labor income to enable to calculator to work with any type of input data (employment, payroll, or operating expenses). In addition, the output per worker and labor income per worker factors were collected to again ensure the model would calculate all outputs with a single input variable.

The economic impact model uses region-specific multipliers to address the different economies across Texas. The following regions were created in IMPLAN to develop region-specific multipliers:

- Panhandle.
- Upper Gulf Coast.
- North Texas.
- East Texas.
- West Texas.
- South Texas.
- Central Texas.

For each region, a unique multiplier is used for the 20 industries that are associated with airports and their tenants. Industries include those related to air transportation and aviation schools, as well as industries associated with visitor spending, such as hotels and restaurants. Social accounting matrices multipliers (Type SAM) were used to take into account direct, indirect, and induced effects. The multipliers are used to calculate the total economic impact for the airport and for each tenant industry category.

The multipliers used in this model are different than the statewide multipliers in the 2018 study. This accounts for some variation of the model results but is expected to be more accurate.

Lookup Airports

The Lookup Airports worksheet contains data crucial to visitor spending. The worksheet contains the airport's name, county, spending region, and associated general aviation activity.

This general aviation activity includes itinerant arrivals, visitors per aircraft, and annual visitors. The airports included in the analysis are those included in the Texas Airport System Plan, which coincide with those included in the 2018 Texas Aviation Economic Impact Study.

The airports' general aviation activity was sourced from the most recent FAA data from the Terminal Area Forecast Model (January 2020). The activity includes itinerant airport operations. Using industry standards to calculate visitor spending impacts, the model uses industry-accepted visitors per aircraft data used in the 2018 study. The number of visitors per aircraft varies somewhat by the level of activity at the airport. This ranges from 2.1 visitors per aircraft to 3.7 visitors per aircraft, depending on the total number of general aviation operations (Table 1). Also associated with this criterion is visitor spending. However, the model developed for this project uses more locality-specific spending data for its calculations. This is discussed in more detail in the section on the Visitor Spending worksheet.

Table 1. Visitor Spending and Occupancy Data.

Itinerant General Aviation Operations	Visitors per Aircraft	Spending per Visitor
0–499	2.8	$10
500–4,999	2.8	$130
5,000–9,999	2.1	$150
10,000 +	2.7	$190
Commercial service	3.7	$290

Source: 2018 *Texas Aviation Economic Impact Study* (11)

While visitor spending is derived from itinerant aircraft operations, it is not a direct one-to-one relationship because not all itinerant traffic comes into town, spends the night, or otherwise spends money in the community following arrival. In fact, it is customary practice in aviation economic impact analyses to assume that only a fraction of those itinerant operations do in fact spend money in the region. For this model, researchers used the same formula for determining visitors as was used in the 2018 study. It is assumed only one-third of the itinerant aircraft operations stay in the area. Using the visitors-per-aircraft numbers, annual visitors can be determined. Itinerant aircraft operations must first be factored to account for each trip including two operations. Therefore, itinerant operations must be divided by two to get transient arrivals. Transient arrivals are then multiplied by one-third to get the number of aircraft that stay in the region to spend money.

In addition to general aviation visitor spending, visitor spending is also calculated for the non-hub commercial service airports. This includes their general aviation visitors and those that are enplaned on commercial airlines. Passenger enplanements and capital improvement expenditures for 2017–2019 are also included on this worksheet. Commercial service visitor impacts are derived using the same per-visitor spending as general aviation visitors. The number of visitors is determined by using half of the annual enplanements. This assumes that half of those getting on a plane live in that city and half are returning home having completed a trip.

Visitor Spending

Visitor spending accounts for a significant portion of the economic impact created by airports. Therefore, understanding how these impacts are calculated is important. The methodology for determining visitor spending impacts is discussed in the previous section. Each county in the state belongs to a tourism region as defined by the Texas Tourism Office. Each airport is then assigned a tourism region by virtue of the county in which it resides. Each of the tourism regions has its own spending patterns determined by a consultant study performed for the state.

Each region includes its own unique spending data in terms of length of stay and average per-person spending by trip. This is further disaggregated by types of spending, whether it be for lodging, restaurants, retail, or entertainment. Further, each region also uses its own set of multipliers for each type of spending because what you spend money on propagates through the economy in different ways.

Table 2 shows the Texas tourism regions and the multiplier regions used in this study. These vary from the 2018 study in that some statewide multipliers were used as opposed to county/region multipliers, and some industry multipliers used were different or were grouped differently than this model. Finally, the average expenditures per person per trip used in this model were determined by tourism region. The research team did not use those developed from a national dataset and used in the 2018 study.

Table 2. Texas Travel Regions and Multiplier Regions.

Texas Travel/Tourism Region	Texas Regional Multiplier
Big Bend Region	West Texas
Gulf Coast Region	Upper Gulf Coast
Hill Country Region	Central Texas
Panhandle Plains Region	Panhandle
Piney Woods Region	East Texas
Prairies and Lakes Region	North Texas
South Texas Plains Region	South Texas

Table 3 shows the visitor spending values used in the 2018 Texas Aviation Economic Impact Study. These values are determinant on the activity level of the airport that is visited. So too is the aircraft occupancy. The study's authors determined these numbers, which are based on data from airports across the country and over some period of years. Part of the significance of building a Texas model was the ability to use more specific, Texas-based impact numbers. This includes Texas-specific visitor spending numbers. Table 4 shows visitor spending numbers from Texas's tourism office.

Table 3. General Aviation Visitor Spending Values Used in 2018 Texas Aviation Economic Impact Study.

Number of Itinerant Operations	Visitors per Arrival	Dollars Spent per Visitor
0–499	2.8	$10
500–4,999	2.8	$130
5,000–9,999	2.1	$150
10,000 or more	2.7	$190
Commercial service	3.7	$290

Source: CDM Smith (11)

Table 4. Visitor Spending Values Used in Small Airport Economic Impact Estimator Tool.

Region	Average Length of Stay (Including Days)	Average Spending per Person per Day	Average Spending per Person per Trip
West Texas	2.85	$144	$410
Upper Gulf Coast	2.16	$122	$264
Central Texas	1.94	$134	$259
Panhandle	1.98	$99	$197
East Texas	1.61	$69	$111
North Texas	2.01	$128	$257
South Texas	2	$138	$276

Source: Travel Texas, Economic Development and Tourism, Office of the Governor (12)

The Small Airport Economic Impact Estimator Tool uses these Texas spending patterns to determine visitor impacts. The tool did use the aircraft occupancy values noted in Table 3 because no other values were identified. During the development of the web interface, the research team explored the possibility of having a user-defined aircraft occupancy override and an option to simply enter the number of annual visitors to the airport. In the final model, the aircraft occupancy override was not implemented but users are able to input the total number of visitors to their airport.

Visitor impacts from commercial service enplanements were calculated using the same visitor spending patterns in Table 4. The 2018 study employed higher values. This was done to maintain consistency and due to lack of other spending data specific to commercial service airports.

Airport Activity

The Airport Activity worksheet contains the survey data of airport managers for all system airports that were collected as part of the 2018 Texas Aviation Economic Impact Study. If the airport management surveys were returned, the data are contained in the worksheet and are used to populate that airport's input data by default for calculation. If the airport would like to update the information, a field is provided next to it to do so, overriding the survey data, which will ultimately be dated.

The data that are provided or entered by the user apply to that airport's operations only and not any of its tenants. This includes airport employment, total airport payroll, and the airport's operating expenses. While all of these data are not required to generate an economic impact

number, the more data that are available, the better quality the results. The model uses operating expenses if available, followed by employment and payroll expense.

Tenant Activity

The Tenant Activity worksheet consists of employment, payroll, and operating expense data for on-airport tenants (businesses) at each airport. The worksheet is further broken down into 16 different types of businesses, each with their own industrial classification so appropriate multipliers can be use. These data are used to provide default activity numbers by airport by business type on the model input page. Should the model user want to provide updated numbers, this can be done in the box provided next to the default numbers to override the inputs.

The worksheet also includes any capital expenditures made by the on-airport businesses and by the type of business (by industrial classification). These data are also pre-loaded and can be changed to reflect updated numbers.

Tenant Data

The Tenant Data worksheet is essentially the disaggregated data provided in the Tenant Activity worksheet. This worksheet is used to derive the Tenant Activity data and provide default activity numbers for the model by airport while protecting any identifiable data. The data in this worksheet are important in calculating the summary data and in better understanding the data that are used in determining economic impacts. Some airports have several businesses across many industries, while some airports only have one business.

Capital Expenses

The Capital Expenses worksheet includes all capital improvement program (CIP) expenditures and Routine Airport Maintenance Program (RAMP) expenditures for all system airports for the last three years. In calculating CIP expenditures, it has long been industry practice to use only an average of the last three years when determining the economic impact for a given year. In keeping with this practice, this model uses an average of the last three years when calculating the economic impact associated with airport construction.

The worksheet includes those numbers for all system airports as provided by the TxDOT Aviation Division. These numbers are provided on the model input page when the airport is selected from the drop-down menu. Should this number change, the user can enter an alternative number in the override box next to it. In keeping with customary practice, this number should be an average of the last three years. However, if the user is trying to ascertain the economic impact of a particular project, the entire CIP or project expenditure can be entered to see that impact.

MODEL TESTING AND VALIDATION

Testing and validating the model are essentially demonstrating that the model produces results that are accurate and meaningful. Researchers expect the model to measure what it is intended to measure and in accordance with standard industry practices associated with airport economic impact analyses.

The research team developed the model according to standard industry practices for determining economic impacts. The model calculations specific to general aviation airports were added based on the methodology applied across the industry in addition to those used in the 2018 Texas Aviation Economic Impact Study.

The model was developed to pre-load default values for airport activity, visitor activity, and tenant activity from the data collection efforts of the 2018 study. In those cases where more recent data were available, they were used. Specifically, this was done for general aviation visitor activity and capital expenditure data. The TxDOT Aviation Division provided the most recent CIP data through 2019 including RAMP data. In addition, the research team identified and incorporated Texas-specific travel expenditure data, which vary somewhat from the spending data used in the 2018 study. In some cases, like in the Permian Basin and West Texas region, travel spending patterns can be 25 percent higher than those used previously.

When the spreadsheet model structure was completed, the research team set out to test and validate the model. This was essentially done at the same time with the purpose of determining if the model calculations could replicate the results from the 2018 study. Researchers selected 10 airports to begin the testing and validation process. The 10 airports were selected randomly according to FAA ASSET category. In addition, the research team continued the random selection process to include a geographic range (tourism region) of airports as well. Table 5 lists the 10 airports selected for further review of model results and validation.

Table 5. Airports Selected for Further Analysis.

Airport	FAA ASSET Category	Geographic Region
Center Municipal	Local	East Texas
South Texas International at Edinburg	Local	South Texas
Marian Airpark	Basic	Panhandle
Pleasanton Municipal	Basic	South Texas
Arlington Municipal	Regional	North Texas
Midland Airpark	Regional	West Texas
Sugar Land Regional	National	Upper Gulf Coast
Fort Worth Alliance	National	North Texas
Easterwood Field	Non-hub	Central Texas
San Angelo Regional	Non-hub	West Texas

The research team continued to make adjustments to the model as it sought to determine economic impacts for the selected airports and compare them to the 2018 study. This process of reviewing the model calculations and validating the model provided an opportunity to examine both the model methodology and input data, and those of the 2018 study, in detail. This allowed the research team to better understand what affected the model results and how the model was performing against previous results using the same or similar data inputs.

The results of this process are shown in the following individual tables because each airport was analyzed separately for airport activity, visitor activity, and tenant activity. These tables provide the raw model results, and the percent difference is not indicative of model accuracy or reliability. Each of the tables are discussed separately to provide an explanation of the results.

These results include different input values, and each type of activity has its own set of input data and methodology that is dependent on the data that are available for each airport or provided by each airport. Also, the two models are not exactly the same, which is by design because the developed model was intended to use Texas-specific data. Making an apples-to-apples comparison is difficult but can be done to demonstrate that the developed model produces results consistent with those in the 2018 study.

The level of variability among the two models depends on the activity type being calculated and assumptions made regarding the input data. Each of these are discussed in more detail.

Airport Activity

Table 6 shows the results for airport activity for the selected airports. The difference between the two models is a result of the data used to generate the impacts. In some cases, only employment data were available. The developed model prioritizes the data to be used based on availability. For airport and tenant impacts, if operating expenses are available, they are used, followed by employment numbers and payroll expenses. Only one can be used, and the others serve as proxies. However, there is some variability in the results depending on which one is used. In some cases, it is difficult to know which one was used in the 2018 study. Nevertheless, the results showing large difference are within the range of results determined by the developed model. For example, at Arlington Municipal, the developed model determines impacts based on operating expenses if they are available, followed by employment and then payroll.

Table 6. Airport Activity (Total On-Airport) Model Results versus 2018 Study Results.

Asset Category	Airport	TTI Model	2018 CDM Smith Report	Percent Difference
Local	Center Municipal	$135,858	$156,000	−15%
Local	South Texas International at Edinburg	$3,920,016	$4,804,000	−23%
Basic	Marian Airpark	$358,991	$132,000	63%
Basic	Pleasanton Municipal Airport	$205,788	$364,000	−77%
Regional	Arlington Municipal	$102,094,295	$216,192,000	−112%
Regional	Midland Airpark	$19,450,995	$12,551,000	35%
National	Sugar Land Regional	$54,598,296	$71,886,000	−32%
National	Fort Worth Alliance	$661,826,286	$464,504,000	30%
Non-hub	Easterwood Field	$33,436,441	$35,082,000	−5%
Non-hub	San Angelo Regional	$29,486,500	$58,614,000	−99%

Source: TTI and CDM Smith

What is unknown is what data were used to generate the 2018 study results for Arlington. The impacts are nearly double. However, an examination of the results of the developed model shows the impacts calculated using employment are substantially higher. In fact, the impacts are more than $170 million higher, putting it within range of the 2018 study results. The model is performing the calculations correctly, but the data that are used may significantly change the results. Some variability is also a result of location-specific multipliers that are being used as well as the difference between regional and statewide output numbers for each industry/job. This alone can account for up to approximately 20 percent of the difference.

Visitor Spending

Table 7 shows the results for general aviation visitor spending among the selected airports. The differences are largely due to differences in visitors used to calculate the impact and the multipliers used as noted previously. The number of occupants per aircraft is also a factor. The research team found that the same occupancy factors were not always used in accordance with the methodology. When the visitor numbers from the 2018 study are entered into the developed model, the results are similar. In some cases, the data had changed significantly over the intervening years. These changes in input data and inconsistent/unknown aircraft occupancy numbers contributed to the large percent difference shown in the table. The research team is comfortable in the methodology and calculations being made in the model with respect to general aviation visitor spending. Much of the variability seen between the two models can be rectified by user-defined inputs in the completed model.

Table 7. General Aviation Visitor Activity Model Results versus 2018 Study Results.

Asset Category	Airport	TTI Model	2018 CDM Smith Report	Percent Difference
Local	Center Municipal	$375,491	$308,000	18%
Local	South Texas International at Edinburg	$138,355	$109,000	21%
Basic	Marian Airpark	$148,779	$125,000	16%
Basic	Pleasanton Municipal Airport	$461,183	$385,000	17%
Regional	Arlington Municipal	$7,751,028	$10,458,000	−26%
Regional	Midland Airpark	$3,930,532	$843,000	79%
National	Sugar Land Regional	$8,597,624	$10,589,000	−23%
National	Fort Worth Alliance	$10,117,364	$14,385,000	−42%
Non-hub	Easterwood Field	$6,192,425	$10,011,000	−62%
Non-hub	San Angelo Regional	$7,057,690	$13,044,000	−85%

Source: TTI and CDM Smith

Capital Expenses

The impacts on capital expenditures are perhaps the most straightforward of calculations. The differences shown in Table 8 are a result of different input numbers and the associated multipliers used in determining the indirect impacts. The 2018 study uses a three-year average of CIP data from 2015 to 2017. The developed model includes a three-year average of CIP data from 2017 to 2019. When the 2018 study data are entered into the developed model, the impact results are similar and within variability accounted for by the multiplier differences. The large differences shown in the model are a result of using data over a different time period. The research team is comfortable in the methodology and calculations being made in the model with respect to capital improvement expenditures.

Table 8. Capital Expense Model Results versus 2018 Study Results.

Asset Category	Airport	TTI Model	2018 CDM Smith Report	Percent Difference
Local	Center Municipal	$623,479	$216,000	65%
Local	South Texas International at Edinburg	$1,578,036	$5,128,000	−225%
Basic	Marian Airpark	$7,372	—	100%
Basic	Pleasanton Municipal Airport	$98,628	$62,000	37%
Regional	Arlington Municipal	$1,157,331	$9,704,000	−738%
Regional	Midland Airpark	$109,416	$1,202,000	−999%
National	Sugar Land Regional	$182,700	$10,518,000	−5,657%
National	Fort Worth Alliance	$18,459,229	$40,117,000	−53%
Non-hub	Easterwood Field	$3,883,907	$14,286,000	−268%
Non-hub	San Angelo Regional	$2,463,909	$14,548,000	−490%

Source: TTI and CDM Smith

SUMMARY OF MODEL TESTING AND VALIDATION

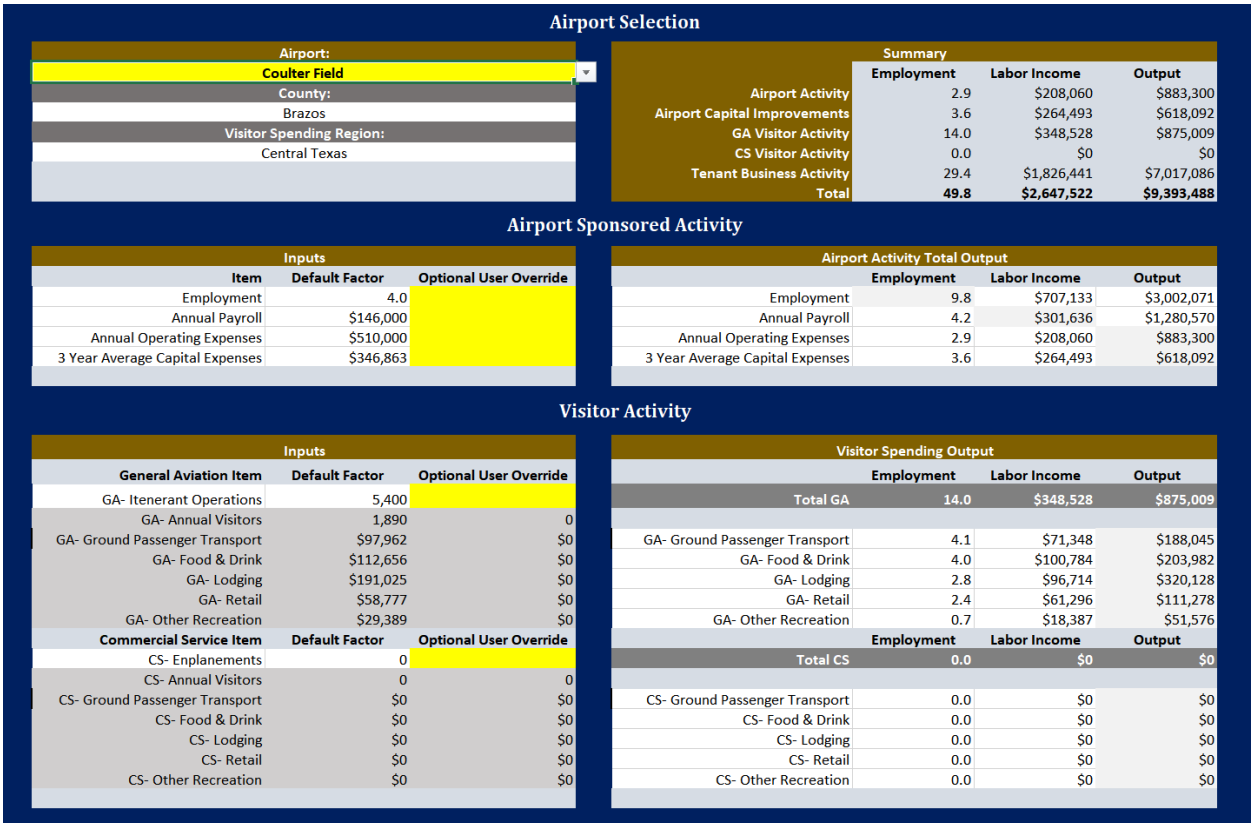
Depending on the activity type, the developed model is able to replicate the 2018 *Texas Aviation Economic Impact Study* results quite well. Where the model is not dependent on employment as the primary source of impact, the results are better matched. This includes visitor data and capital expenditure data where model inputs are not provided in the number of employees but in the number of visitors or dollar amount spent. Then it simply becomes a matter of user input assumptions including aircraft occupancy and spending amount per visitor per trip or dollar amount spent on capital improvements.

Airport operational and tenant impacts can be ascertained using data from operating expenses, employment numbers, or payroll numbers. Economic impact models typically have a hierarchy that is used to calculate these impacts. The model developed in this research follows standard practice by using operational expenses first, followed by employment numbers and then payroll expenses. Only one of the three measures is used in determining economic impacts. Depending on the data available for each airport, a different measure may be used to determine those impacts. This creates a situation where the results may have some variability between the two models. Since the research team does not know for sure which measure was used to determine the impacts for some activities in the 2018 study, it is difficult to make a true comparison. However, when examining the airports individually and in depth, the results returned by the model for each of the three measures puts the results in the same range as those estimated for the 2018 study.

Airport visitor and capital expenditure data are much more straightforward. In cases where the inputs were identified and known for the 2018 study, they were replicated by the developed model within 10 percent when adjusted for differences in spending pattern and multipliers. Visitor impacts for passenger enplanements at the non-hub commercial service airports continue to be a point of discussion because the spending data used in the developed model were kept the same as the general aviation visitors, while the 2018 study used a much higher number (two to five times larger depending on the airport). The research team attempted unsuccessfully to

identify more appropriate spending values for commercial service airport enplanements. One mechanism to address any issues associated with this would be to provide an option for a user-defined input so airports can customize their own spending patterns for the region they serve. Differences in spending patterns shown in Table 3 and Table 4 are enough to cause differences of almost 45 percent. Additionally, differences in some multipliers can cause another 10 to 20 percent. Based on the analysis of the results, the research team is confident the model is performing as expected. The variability is reasonably explained, and when the identical inputs are available and entered, the results are similar. The inputs and assumptions are then left to the user to define based on the data that are available to them and the specific characteristics of their airport and the region they serve.

Figure 1 through Figure 3 show the model input pages for airport activity, visitor activity, and tenant activity. The tenant business activity has 16 different industry types available to represent the different types of business activity that take place on airports.



Airport Selection

Airport:	
Coulter Field	
County:	
Brazos	
Visitor Spending Region:	
Central Texas	

Summary	Employment	Labor Income	Output
Airport Activity	2.9	$208,060	$883,300
Airport Capital Improvements	3.6	$264,493	$618,092
GA Visitor Activity	14.0	$348,528	$875,009
CS Visitor Activity	0.0	$0	$0
Tenant Business Activity	29.4	$1,826,441	$7,017,086
Total	49.8	$2,647,522	$9,393,488

Airport Sponsored Activity

Inputs		
Item	Default Factor	Optional User Override
Employment	4.0	
Annual Payroll	$146,000	
Annual Operating Expenses	$510,000	
3 Year Average Capital Expenses	$346,863	

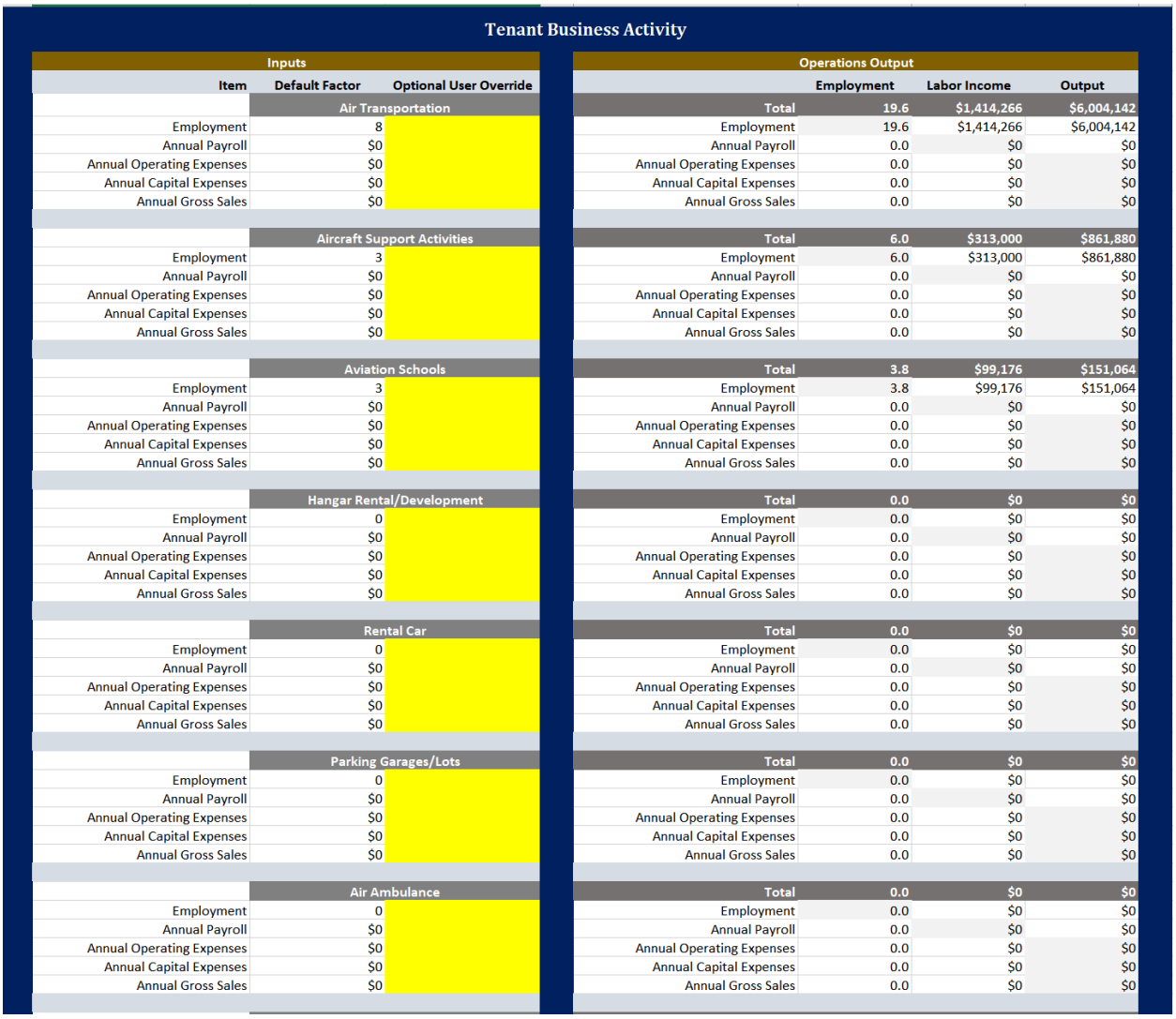
Airport Activity Total Output	Employment	Labor Income	Output
Employment	9.8	$707,133	$3,002,071
Annual Payroll	4.2	$301,636	$1,280,570
Annual Operating Expenses	2.9	$208,060	$883,300
3 Year Average Capital Expenses	3.6	$264,493	$618,092

Visitor Activity

Inputs		
General Aviation Item	Default Factor	Optional User Override
GA- Itenerant Operations	5,400	
GA- Annual Visitors	1,890	0
GA- Ground Passenger Transport	$97,962	$0
GA- Food & Drink	$112,656	$0
GA- Lodging	$191,025	$0
GA- Retail	$58,777	$0
GA- Other Recreation	$29,389	$0
Commercial Service Item	Default Factor	Optional User Override
CS- Enplanements	0	
CS- Annual Visitors	0	0
CS- Ground Passenger Transport	$0	$0
CS- Food & Drink	$0	$0
CS- Lodging	$0	$0
CS- Retail	$0	$0
CS- Other Recreation	$0	$0

Visitor Spending Output	Employment	Labor Income	Output
Total GA	14.0	$348,528	$875,009
GA- Ground Passenger Transport	4.1	$71,348	$188,045
GA- Food & Drink	4.0	$100,784	$203,982
GA- Lodging	2.8	$96,714	$320,128
GA- Retail	2.4	$61,296	$111,278
GA- Other Recreation	0.7	$18,387	$51,576
	Employment	Labor Income	Output
Total CS	0.0	$0	$0
CS- Ground Passenger Transport	0.0	$0	$0
CS- Food & Drink	0.0	$0	$0
CS- Lodging	0.0	$0	$0
CS- Retail	0.0	$0	$0
CS- Other Recreation	0.0	$0	$0

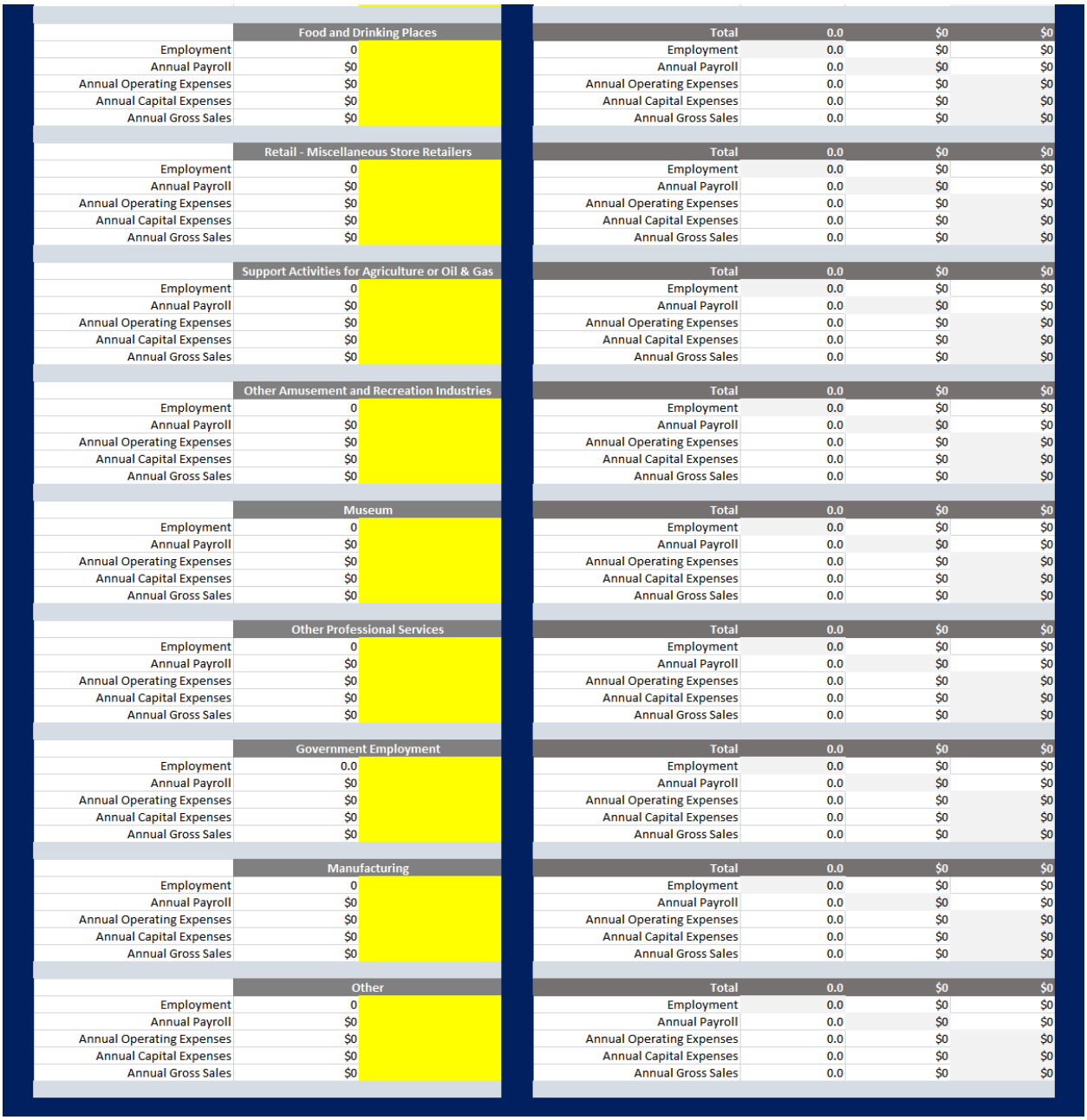
Figure 1. Screenshot of Small Airport Economic Impact Estimator Tool Input and Output Page—Airport and Visitor Activity.



Tenant Business Activity

Inputs			Operations Output			
Item	Default Factor	Optional User Override		Employment	Labor Income	Output
	Air Transportation		Total	19.6	$1,414,266	$6,004,142
Employment	8		Employment	19.6	$1,414,266	$6,004,142
Annual Payroll	$0		Annual Payroll	0.0	$0	$0
Annual Operating Expenses	$0		Annual Operating Expenses	0.0	$0	$0
Annual Capital Expenses	$0		Annual Capital Expenses	0.0	$0	$0
Annual Gross Sales	$0		Annual Gross Sales	0.0	$0	$0
	Aircraft Support Activities		Total	6.0	$313,000	$861,880
Employment	3		Employment	6.0	$313,000	$861,880
Annual Payroll	$0		Annual Payroll	0.0	$0	$0
Annual Operating Expenses	$0		Annual Operating Expenses	0.0	$0	$0
Annual Capital Expenses	$0		Annual Capital Expenses	0.0	$0	$0
Annual Gross Sales	$0		Annual Gross Sales	0.0	$0	$0
	Aviation Schools		Total	3.8	$99,176	$151,064
Employment	3		Employment	3.8	$99,176	$151,064
Annual Payroll	$0		Annual Payroll	0.0	$0	$0
Annual Operating Expenses	$0		Annual Operating Expenses	0.0	$0	$0
Annual Capital Expenses	$0		Annual Capital Expenses	0.0	$0	$0
Annual Gross Sales	$0		Annual Gross Sales	0.0	$0	$0
	Hangar Rental/Development		Total	0.0	$0	$0
Employment	0		Employment	0.0	$0	$0
Annual Payroll	$0		Annual Payroll	0.0	$0	$0
Annual Operating Expenses	$0		Annual Operating Expenses	0.0	$0	$0
Annual Capital Expenses	$0		Annual Capital Expenses	0.0	$0	$0
Annual Gross Sales	$0		Annual Gross Sales	0.0	$0	$0
	Rental Car		Total	0.0	$0	$0
Employment	0		Employment	0.0	$0	$0
Annual Payroll	$0		Annual Payroll	0.0	$0	$0
Annual Operating Expenses	$0		Annual Operating Expenses	0.0	$0	$0
Annual Capital Expenses	$0		Annual Capital Expenses	0.0	$0	$0
Annual Gross Sales	$0		Annual Gross Sales	0.0	$0	$0
	Parking Garages/Lots		Total	0.0	$0	$0
Employment	0		Employment	0.0	$0	$0
Annual Payroll	$0		Annual Payroll	0.0	$0	$0
Annual Operating Expenses	$0		Annual Operating Expenses	0.0	$0	$0
Annual Capital Expenses	$0		Annual Capital Expenses	0.0	$0	$0
Annual Gross Sales	$0		Annual Gross Sales	0.0	$0	$0
	Air Ambulance		Total	0.0	$0	$0
Employment	0		Employment	0.0	$0	$0
Annual Payroll	$0		Annual Payroll	0.0	$0	$0
Annual Operating Expenses	$0		Annual Operating Expenses	0.0	$0	$0
Annual Capital Expenses	$0		Annual Capital Expenses	0.0	$0	$0
Annual Gross Sales	$0		Annual Gross Sales	0.0	$0	$0

Figure 2. Screenshot of Small Airport Economic Impact Estimator Tool Input and Output Page—Tenant Business Activity Part I.



	Food and Drinking Places		Total	0.0	$0	$0
Employment	0		Employment	0.0	$0	$0
Annual Payroll	$0		Annual Payroll	0.0	$0	$0
Annual Operating Expenses	$0		Annual Operating Expenses	0.0	$0	$0
Annual Capital Expenses	$0		Annual Capital Expenses	0.0	$0	$0
Annual Gross Sales	$0		Annual Gross Sales	0.0	$0	$0
	Retail - Miscellaneous Store Retailers		Total	0.0	$0	$0
Employment	0		Employment	0.0	$0	$0
Annual Payroll	$0		Annual Payroll	0.0	$0	$0
Annual Operating Expenses	$0		Annual Operating Expenses	0.0	$0	$0
Annual Capital Expenses	$0		Annual Capital Expenses	0.0	$0	$0
Annual Gross Sales	$0		Annual Gross Sales	0.0	$0	$0
	Support Activities for Agriculture or Oil & Gas		Total	0.0	$0	$0
Employment	0		Employment	0.0	$0	$0
Annual Payroll	$0		Annual Payroll	0.0	$0	$0
Annual Operating Expenses	$0		Annual Operating Expenses	0.0	$0	$0
Annual Capital Expenses	$0		Annual Capital Expenses	0.0	$0	$0
Annual Gross Sales	$0		Annual Gross Sales	0.0	$0	$0
	Other Amusement and Recreation Industries		Total	0.0	$0	$0
Employment	0		Employment	0.0	$0	$0
Annual Payroll	$0		Annual Payroll	0.0	$0	$0
Annual Operating Expenses	$0		Annual Operating Expenses	0.0	$0	$0
Annual Capital Expenses	$0		Annual Capital Expenses	0.0	$0	$0
Annual Gross Sales	$0		Annual Gross Sales	0.0	$0	$0
	Museum		Total	0.0	$0	$0
Employment	0		Employment	0.0	$0	$0
Annual Payroll	$0		Annual Payroll	0.0	$0	$0
Annual Operating Expenses	$0		Annual Operating Expenses	0.0	$0	$0
Annual Capital Expenses	$0		Annual Capital Expenses	0.0	$0	$0
Annual Gross Sales	$0		Annual Gross Sales	0.0	$0	$0
	Other Professional Services		Total	0.0	$0	$0
Employment	0		Employment	0.0	$0	$0
Annual Payroll	$0		Annual Payroll	0.0	$0	$0
Annual Operating Expenses	$0		Annual Operating Expenses	0.0	$0	$0
Annual Capital Expenses	$0		Annual Capital Expenses	0.0	$0	$0
Annual Gross Sales	$0		Annual Gross Sales	0.0	$0	$0
	Government Employment		Total	0.0	$0	$0
Employment	0.0		Employment	0.0	$0	$0
Annual Payroll	$0		Annual Payroll	0.0	$0	$0
Annual Operating Expenses	$0		Annual Operating Expenses	0.0	$0	$0
Annual Capital Expenses	$0		Annual Capital Expenses	0.0	$0	$0
Annual Gross Sales	$0		Annual Gross Sales	0.0	$0	$0
	Manufacturing		Total	0.0	$0	$0
Employment	0		Employment	0.0	$0	$0
Annual Payroll	$0		Annual Payroll	0.0	$0	$0
Annual Operating Expenses	$0		Annual Operating Expenses	0.0	$0	$0
Annual Capital Expenses	$0		Annual Capital Expenses	0.0	$0	$0
Annual Gross Sales	$0		Annual Gross Sales	0.0	$0	$0
	Other		Total	0.0	$0	$0
Employment	0		Employment	0.0	$0	$0
Annual Payroll	$0		Annual Payroll	0.0	$0	$0
Annual Operating Expenses	$0		Annual Operating Expenses	0.0	$0	$0
Annual Capital Expenses	$0		Annual Capital Expenses	0.0	$0	$0
Annual Gross Sales	$0		Annual Gross Sales	0.0	$0	$0

Figure 3. Screenshot of Small Airport Economic Impact Estimator Tool Input and Output Page—Tenant Business Activity Part II.

REVIEW OF TXDOT-SELECTED AIRPORTS

Following the initial model review, the research team asked TxDOT to select three to five additional airports for further review and comparison against the results from the 2018 *Texas Aviation Economic Impact Study* performed by CDM Smith and the results from TTI's propriety in-house I/O model. This was done while the web application was being developed. The TxDOT project team selected airports in the following cities:

- Hondo.
- Sugar Land.
- Littlefield.
- San Marcos.
- Gilmer.

Comparison of Inputs

The research team matched the inputs used by the 2018 study as well as possible and as well as could be known. This included the number of jobs, the amount of capital investment (CIP), and the number of visitors coming to the airport. Ultimately, the research team was not 100 percent confident of the inputs used to generate the 2018 study results, and this included the occasions where both operating expenses and employment were provided but only one was used. The research team made a good-faith effort to replicate the inputs based on the available data. Because the TTI in-house I/O model does not account for visitor spending, a full comparison between all three models could not be made. Table 9 through Table 13 show the results of the analysis and comparison between the 2018 CDM Smith model and results, and those of the newly developed model for each of the selected airports.

Table 9. CDM Smith Study versus TTI Model Comparison—South Texas Regional Airport at Hondo.

Total Output		Total Employment	
CDM	**TTI**	**CDM**	**TTI**
$11,582,000	$13,535,784	162	117.5
%DIFF	−17%	%DIFF	27%

Table 10. CDM Smith Study versus TTI Model Comparison—Sugar Land Regional Airport.

Total Output		Total Employment	
CDM	**TTI**	**CDM**	**TTI**
$92,993,000	$78,367,242	692	642
%DIFF	16%	%DIFF	7%

Table 11. CDM Smith Study versus TTI Model Comparison—Littlefield Taylor Brown Municipal Airport.

Total Output		Total Employment	
CDM	**TTI**	**CDM**	**TTI**
$2,004,000	$2,290,361	18	18.4
%DIFF	−14%	%DIFF	−2%

Table 12. CDM Smith Study versus TTI Model Comparison—San Marcos Regional Airport.

Total Output		Total Employment	
CDM	**TTI**	**CDM**	**TTI**
$82,109,000	$112,508,391	664	557.3
%DIFF	−37%	%DIFF	16%

Table 13. CDM Smith Study versus TTI Model Comparison—Fox Stephens Field–Gilmer Municipal Airport.

Total Output		Total Employment	
CDM	**TTI**	**CDM**	**TTI**
$1,457,000	$1,889,265	19	13.8
%DIFF	−30%	%DIFF	27%

Comparing the two models shows obvious differences in results. The results are different due to the differences in the inputs for the two models because they both use the same I/O modeling algorithm. These differences include:

- The multipliers that were used.
- Visitor spending pattern data.
- Job categories and associated salaries.
- How the jobs are classified.
- Inflation (2018 versus 2020).

The results vary based on how many jobs are on the airport and how they are classified. This includes variations in how actual businesses are classified because they impact the jobs and average salaries associated with those jobs and businesses. This further highlights why users of this model should have the best data available when running an analysis for their airports. The type of job, management or maintenance, the type of business, and FBO operator or repair station, along with where they are located geographically, can impact the results. In addition, the user must be aware of differences in results associated with the data source. Are the data actual airport data from the city or county, or are they survey data or a best estimate? The importance of having accurate and complete data cannot be overstated.

Results of Comparison

The results of the two models vary in some distinct ways. This section highlights these differences in an effort to better understand how the newly developed model results are different than the CDM Smith model results, and to better understand how the TTI model can be used to provide an airport with more customized and accurate results. These differences are:

- On-airport payrolls are higher in the TTI model.
- Visitor payrolls are higher in the CDM Smith model.
- Construction payroll is higher in the TTI model.
- The employment on-airport multiplier is higher in the CDM Smith model.
- The employment visitor multiplier is higher in the TTI model.

- The employment construction multiplier is higher in the CDM Smith model.
- Visitor spending per visitor is higher in the TTI model.

Because of this, airports relying on employment data as inputs will see larger variations because salary and wage rates, location, and how they are classified will greatly influence the total output results. Using employment data drives higher impacts (inherent in the model). In addition, visitor spending varies in the CDM Smith model by activity level compared to geographic region in the TTI model. For example, in the visitor spending regions in the TTI model, visitor spending in West Texas is approximately four times greater than that in East Texas. Littlefield visitor spending is four times greater per visitor than in Gilmer. This is due to the current increased cost of doing business in the Permian Basin oilfield.

Other examples of variations in results caused by variations in data inputs include the following:

- At Sugar Land, if employment data are used, jobs would increase by 75, and total output would increase by $29 million, exceeding CDM Smith results.
- Reclassifying one job at Littlefield causes a drop of over $100,000 in payroll impacts. This change in job/business classification of air transportation versus support for agriculture/oil would represent 25 percent of total payroll at the airport.
- Depending on how 157 jobs in San Marcos are classified, total output could increase to $118 million or drop to $45 million. CDM Smith study results came in at $82 million.

These examples are provided to, once again, stress the importance of complete and accurate data when using this model because even small, unsuspecting changes in how the data are used can cause large variations in results. Understanding the data inputs and documenting them to correspond with the results are the expected practice.

For the two models, overall, on-airport impacts were dependent on the input metric used and in what business/job category the jobs were placed. Visitor impacts were almost always higher in the TTI model, while construction impacts were always lower in the TTI model. Total impacts were generally lower in the TTI model and dependent on what was used to generate the on-airport impacts because that is where most of the overall impacts take place—on the airport with tenant businesses.

The TTI in-house proprietary I/O model was not included in the comparison because it generally does not compute impacts on the same level as the other two models. TTI's in-house economic I/O model is built off multipliers based on data from the Texas Workforce Commission and the Texas Comptroller's Office. The model converts changes in production, employment, or labor income across (33 or 157) industry sectors. It essentially has two different options. It does not determine visitor spending impacts and uses statewide economic multipliers.

With respect to model results, the following summarizes how the TTI proprietary I/O model compares to the CDM Smith and TTI models:

- Total output is higher than the CDM Smith study results and the TTI model results with the exception of San Marcos Regional Airport. This is a function of the 157 FBO jobs at the airport and how each of the models classifies them.

- Total employment results were in between the TTI model and CDM Smith model results.
- Construction impacts were higher than in both the TTI and CDM Smith models, with total output two times higher and employment two-and-a-half times higher. Payrolls were the lowest of the three but closest to the CDM Smith model.
- The model does not calculate visitor impacts.

SUMMARY OF MODEL COMPARISONS

The developed model performed well given the known variations/differences and will only be as good as the data that are input. The use of a generic approach in terms of types of jobs and visitor spending can introduce a lot of variability into the results.

The developed model uses the most current IMPLAN multipliers and salary data, and the research team is confident in the model's internal calculations. The model uses the most up-to-date multipliers/data and assumptions with respect to visitor spending/output prioritization. As previously stated, the key is using accurate, airport-specific inputs, which this model allows.

CHAPTER 4: DESIGN AND TESTING OF SMALL AIRPORT ECONOMIC IMPACT ESTIMATOR TOOL WEBSITE

Upon completion and validation of the Small Airport Economic Impact Estimator spreadsheet model, the research team's software applications developers began developing the web-based interface to create a user-friendly and intuitive model. This chapter presents the model's layout and design as a user would view it and also provides some additional technical information related to its development.

The Small Airport Economic Impact Estimator is an Excel spreadsheet-based model that stores all of the model's data and calculations on several different worksheets. Figure 1 shows the model's calculator page. The research team developed a web-based user interface to create a more user-friendly model that also includes enhanced functionality by adding a map and pie charts for the model's output.

In addition, a user's guide and print function have been included on the top navigation bar should users need information on how to use the model, identify what something may mean, or print a report for a public meeting or future use. The model does not save any information. Users will need to save a PDF of any inputs they provide.

TECHNICAL INFORMATION

The research team created an administrator guide for the Small Airport Economic Impact Estimator Tool, which is intended to provide information on the development and management of the website in order to ensure a smooth transition from TTI to TxDOT following the one-year hosting of the website through October 21, 2021. TTI will host the website and coordinate with TxDOT during this transition period.

The administrator guide is a separate publication (product) developed from this research. What follows in this section is also largely contained in that publication.

This is a new site that will require hosting. As is currently understood, Github Pages and Azure are among the accepted hosting providers agreed upon by TTI and TxDOT. This web application was developed on Github Pages.

The web address for this application is https://txeconomicapproach.org/.

The domain name for this application is tentative pending TxDOT approval. While this domain does not yet have final TxDOT approval, the domain, or any final TxDOT-approved domain, can redirect to the same Github Pages location with a few minor configuration changes in the Github Pages settings panel. This will make it easy to have a location on TxDOT's website link to the location should that be desired. Because this website does not have a database or user accounts, some of the elements in the administrator guide may not apply.

This web-based economic impact model for small airports is built with the latest web framework of ReactJS. ReactJS is an open-source library often used in developing web interfaces that have only a single page. The original spreadsheet model, which this calculator is based on, was

developed by the Infrastructure Investment Analysis Program at TTI. All hard-coded data used in this web tool, including default numbers for each airport, multipliers for each specific region, and basic information for airports, are imported from either the spreadsheet or the datafile provided through the TxDOT Open Data Portal. Once the user has selected an airport from the airport list and entered the customized input, the web calculator will reproduce the calculation procedures in the spreadsheet model and show the results immediately on the webpage. The user can also retrieve a well-organized PDF report by clicking the "Print" button at the top of the page. This is the only way to keep a record of inputs and outputs supplied to/from the model.

Other modules/packages developed for ReactJS were used to develop the website and are listed in Table 14.

Table 14. Modules/Packages Used to Develop the Main Components of the Website.

Name	Version	Description
React	16.13.1	The library used for building user interfaces
Leaflet	1.6.0	The JavaScript library to build the map component
React leaflet	2.7.0	React components for Leaflet maps
Highcharts	8.1.2	The charting library to build the pie chart component
Highcharts React	3.0.0	The official minimal Highcharts wrapper for React
Accounting	0.4.1	The number, money, and currency formatting library
Geobuf	3.0.2	The binary encoder/decoder used specifically to import geographic data

Compatibility Matrix

The website has been tested and is compatible with the latest version of Chrome, Firefox, Safari, and Edge with a resolution of 1920×1080. Table 15 shows the compatibility matrix for this web application.

Table 15. Small Airport Economic Impact Estimator Tool Compatibility Matrix.

Browser	Chrome	Firefox	Safari	Edge
Operating system	Win10	Win10	MacOS	Win10
Version	85.0.4183.83	80.0.1	10.12 Sierra	85.0.564.44
Resolution	1920×1080	1920×1080	1920×1080	1920×1080
Compatible	Yes	Yes	Yes	Yes

Release Information

The initial release is version 1.0. How new updates are deployed to the website after it launches, including the version number and what was changed, will be coordinated with TxDOT.

Administration Panel

The web application itself does not have an administration panel, but if TxDOT has a Github Pages account, TTI can provide access to the Github Pages dashboard for the site with appropriate privileges.

Monitor Performance

Not applicable.

Set Up User and Group Accounts

Not applicable.

Define User Types and Privileges

Not applicable.

Set User Permissions and Passwords

Not applicable.

Define Roles and Security Groups

Not applicable.

Access Developer Tools

With Github Pages, the source code and developer documentation can be found in the associated Github repository. TTI can give access to the repository to those on the TxDOT team that need access.

Troubleshoot and Support

As the main developers of the site, the TTI development team should address support issues. TxDOT should address issues involving the data behind the model.

Create Security Procedures

Configurations made in Github Pages can set who has access to the Github repository, who has the privilege to deploy, and who can give access to others.

Schedule Database Maintenance, Move Databases, and Create Database Backup and Restores

The data live in the repository alongside the source code and HTML. The closest equivalent to a schedule would be during times when TTI pushes a fix to the website in response to a support issue.

However, database maintenance, in a more traditional sense, with a database server and a database administrator performing server maintenance would not apply to this site.

Establish Backup Procedures, Schedules, Scheduled and Unscheduled Backups, and Backup Logs

Developers can make backups by cloning a copy of the source code repository onto their workstation.

Provide Any Advanced Configuration Options

There are no configuration options for users to make. For developers, TTI includes documentation in the repository showing how to configure the workstation to develop and deploy changes to the production site, provided that the user has privileges.

IMPLAN AND INPUT/OUTPUT MODELING

I/O models are generally accepted as the best model when considering airport systems and, especially, small airports. I/O models work by estimating the impact to the region of economic activity through the inclusion of expenditures and other inputs to provide the generated economic output for the region.

Measures of Economic Impact

I/O models provide three measures of economic impact through the use of data inputs from airports on their activity levels:

- Employment.
- Payroll expenditures.
- Output.

Employment includes both full- and part-time jobs, with part-time jobs being calculated to create a full-time equivalent number of positions. *Payroll expenditures* are the expenses related to salaries, wages, and benefits earned by all employees and business owners at the airport. *Output* refers to goods and services that are generated by the airport on an annual basis. This is expressed by a dollar amount and is estimated using annual sales, or annual operating costs, which assumes that the output is approximately equivalent to what the airport or its tenants expend.

Order of Operations in the Calculator

I/O models can calculate without full information and still provide estimates of economic impact; despite this, these models do prefer certain inputs to determine the most accurate representation of the impact to the economy. The preferred input for an I/O model is the annual operating expenses or output number; the calculator uses annual operating expenses for airport activity and tenant activity if they are available. If the annual operating expenses are not available, the model will then apply the employment input, or the total number of jobs for the airport or tenant. Finally, if only payroll data are known, the model will calculate based on that information.

LAYOUT AND DESIGN

Upon accessing the website, users are presented with an information or splash window, which shows basic information about the model and contact information for the developers and managers of the website and model. More detailed user information is available on the website itself by clicking on the "User's Guide" button at the top of the page. A glossary is also included at the end of the User's Guide. It is also included in Appendix C.

Accessing the Calculator

The Small Airport Economic Impact Estimator is available at txeconomicapproach.org. When first accessing the website and calculator, an information screen will pop up that includes contact information and access to this guide (Figure 4). Click the X in the top right corner or anywhere off the pop-up to continue on to the calculator.

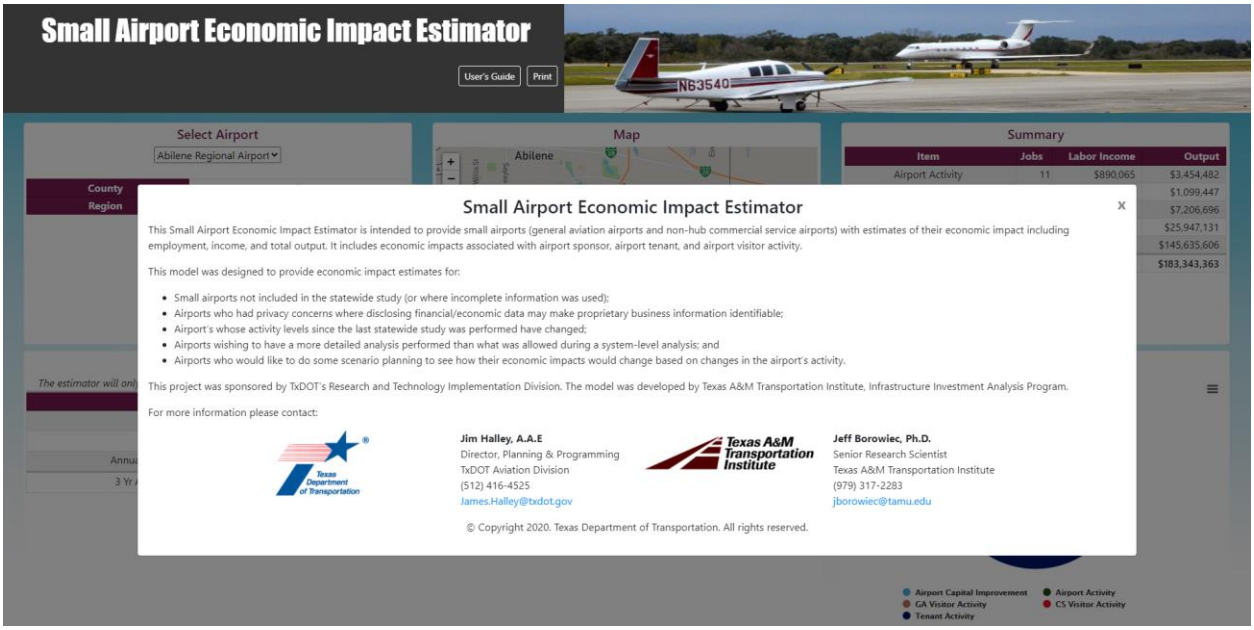


Figure 4. Small Airport Economic Impact Estimator Web Page and Information Pop-Up Page.

Once the information screen is closed, the main page will display (Figure 5). The user's guide is also available at the top of the screen.

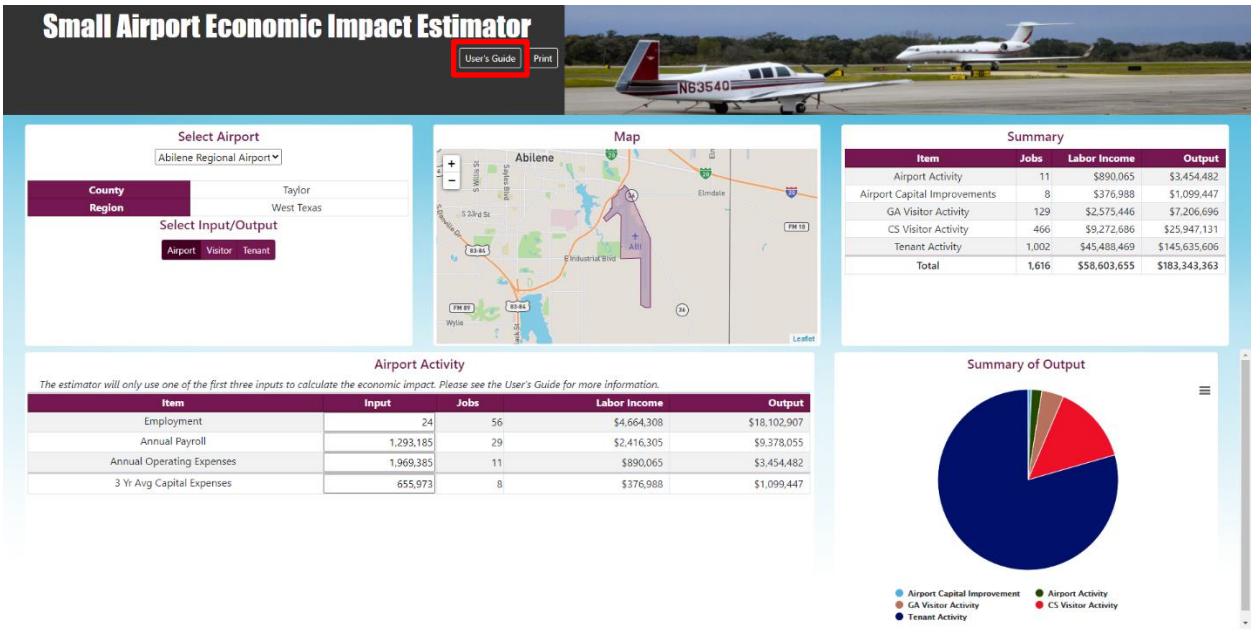


Figure 5. Main Webpage with User's Guide Location.

Selecting Your Airport

In the top left-hand corner is the airport selection panel. Select your airport from the drop-down menu, and the county and region will automatically populate below. If you are having trouble locating the airport, see Appendix B:
Airport Reference Table to determine the exact name of your airport in the Estimator tool.

The table is sorted alphabetically by associated city. The county and regions are used to determine the correct multipliers and spending patterns for your airport. The airport selection determines the county and region in which your airport is located. The region is used to provide appropriate multipliers for activity at your airport in terms of employment, capital improvements, and tenant activity. Visitor spending is also calculated based on region using data from the Governor's Office on travel spending in Texas.

Alongside the airport selection panel is a map (Figure 6). The map will zoom to the airport selected. Users have the option to control the map in order to view surrounding airports.

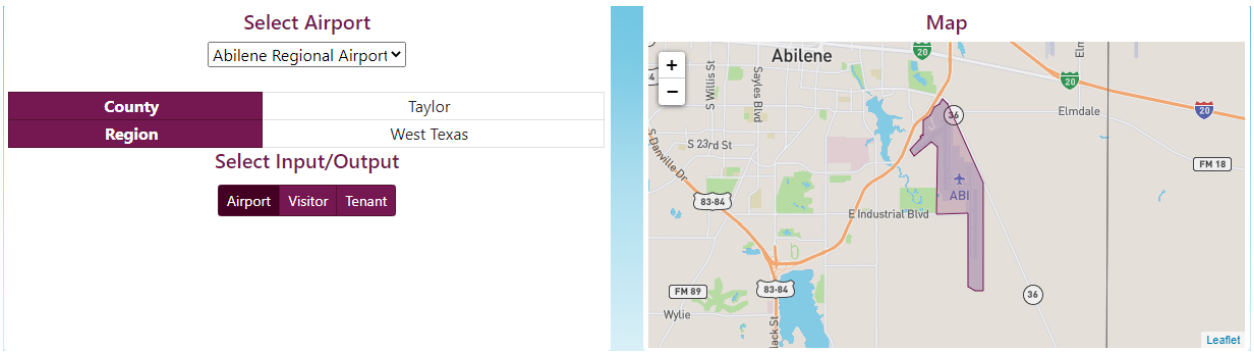
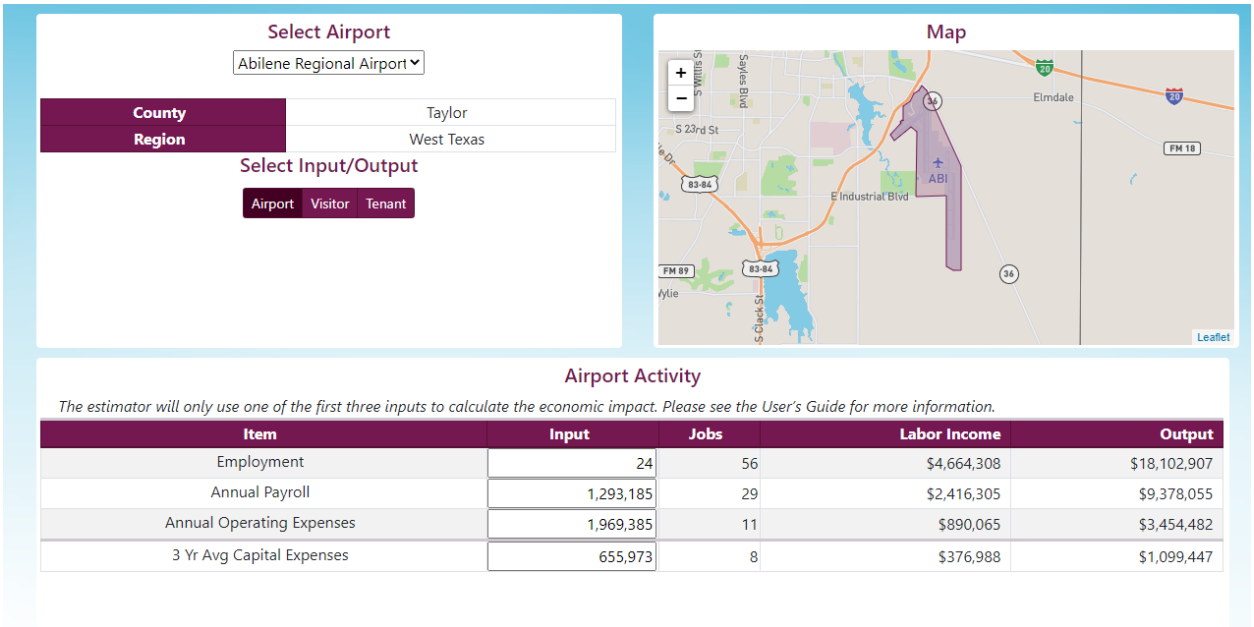


Figure 6. Airport Selection Menu and Map.

Once you have chosen your airport in the airport selection panel, the calculator will automatically populate using data from TxDOT's 2018 *Texas Aviation Economic Impact Study* survey and report. Figure 7 shows an example.



Item	Input	Jobs	Labor Income	Output
Employment	24	56	$4,664,308	$18,102,907
Annual Payroll	1,293,185	29	$2,416,305	$9,378,055
Annual Operating Expenses	1,969,385	11	$890,065	$3,454,482
3 Yr Avg Capital Expenses	655,973	8	$376,988	$1,099,447

Figure 7. Auto-population of Selected Airport Data.

Airport-Sponsored Activity Tab

The "Airport" activity tab is the first tab under "Select Input/Output." This tab shows activity that is directly related to airport activity, such as the operation of terminal(s), runway(s), and other facilities. This does not include tenant activity on the airport. Tenant activity can be inputted through the "Tenant" tab, which is discussed later in the guide. The purpose/type of data input into the model can be selected using the tabs under "Select Input/Output" as shown and highlighted in Figure 8.

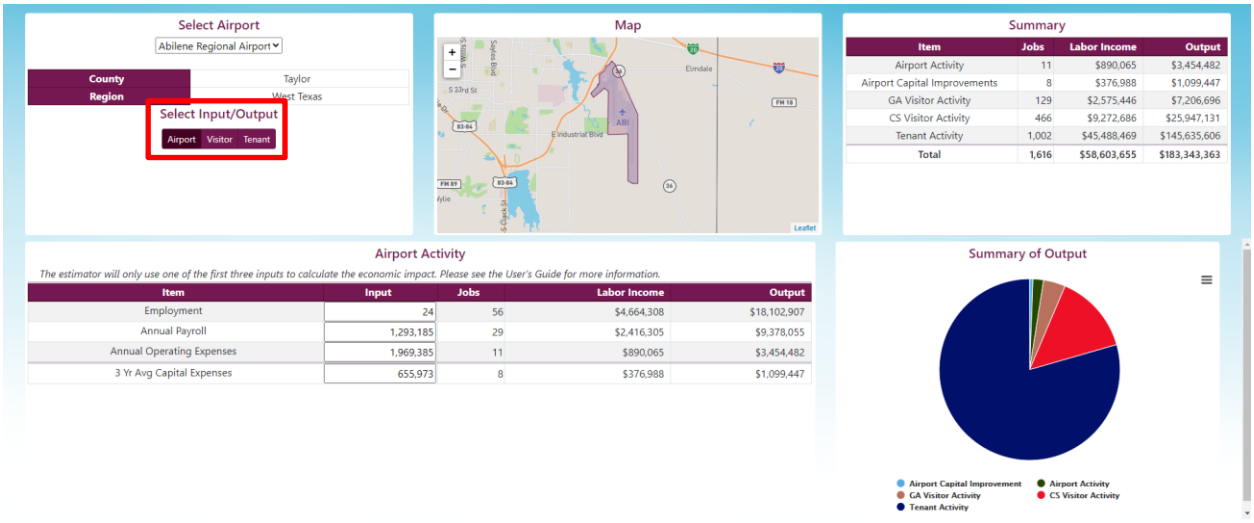


Figure 8. Data Input/Output Tabs.

The calculator includes the employment number, payroll amount, and annual operating expenses from the survey. In addition, the three-year average capital expenditures are included. The capital expenditures are calculated using capital expenses reported for the previous economic impact study along with funding provided by TxDOT for capital improvements. Capital improvement costs include AIP funds from FAA that are distributed through TxDOT, RAMP, and self-reported investments from airport tenants. RAMP funding is largely used for maintenance but can be used for smaller capital improvement projects.

The red box in Figure 9 shows the inputs that the user can update. The calculator starts with the default numbers from the previous economic impact study in the "Input" column, but if activity has changed or more up-to-date data are available, the user can input this here.

Figure 9. Airport Activity Data Input Location.

When editing the inputs, the user should remember the order of operations; the calculator will use the annual operating expenses if a number is in that cell. In order to edit, remove all numbers from employment, payroll, and operating expenses before entering the updated data. Once these numbers are edited, the summary table and output graphic will change to display the new results. The calculator allows the inputs to be edited for all three activity types—airport, visitor, and tenant activity—using the "Input" column. The "Input" column is highlighted in Figure 9.

Figure 10 shows that the user has increased employment from 24 to 30 and changed the other two possible inputs (annual payroll and annual operating expenses) to 0 to ensure the Estimator calculates based on the updated employment number.

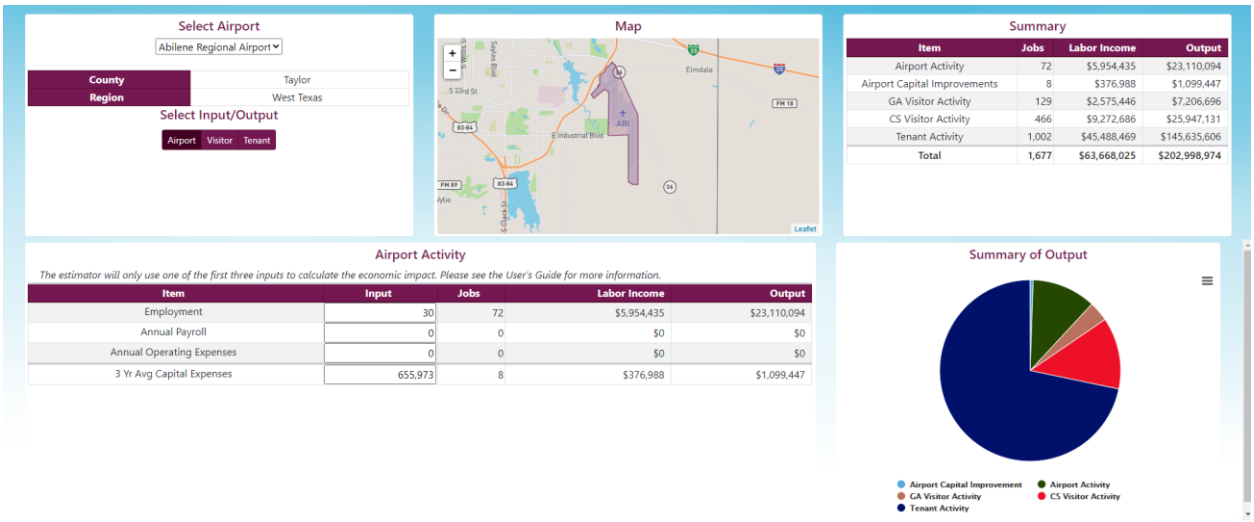


Figure 10. Airport Activity Input Changes and Summary Output.

Visitor Activity Tab

After reviewing and/or changing the airport inputs, the user then selects the "Visitor" input tab, and the "Visitor Activity" screen will populate, as shown in Figure 11.

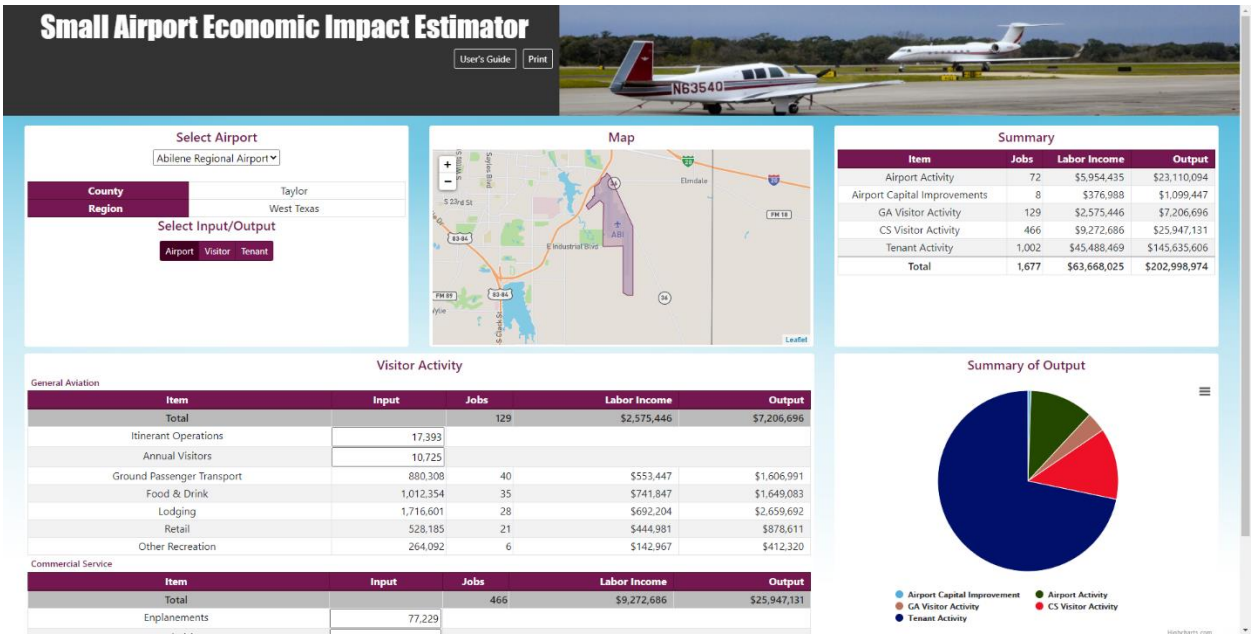


Figure 11. Visitor Activity Data Input Location.

Depending on your airport type, the table will populate with either general aviation, commercial service, or both. The Estimator uses itinerant operations, from FAA's Terminal Area Forecast, to determine the number of visitors at general aviation airports and enplanements for airports with

commercial service. Thirty-three percent of itinerant operations are considered true transient arrivals. This is then multiplied by the number of visitors per arrival as determined by CDM Smith, which completed the latest economic impact study. These numbers are based on data from CDM Smith's survey of visiting pilots and passengers at Texas airports. The breakdown of visitors per arrival is as follows:

- 0 to 499 itinerant operations: 2.8 visitors per arrival.
- 500 to 4,999 itinerant operations: 2.8 visitors per arrival.
- 5,000 to 9,999 itinerant operations: 2.1 visitors per arrival.
- 10,000 or more itinerant operations: 2.7 visitors per arrival.

In terms of visitors for commercial service airports, the calculation is half of the reported enplanements, representing a return trip. Figure 12 shows the full "Visitor Activity" table.

Visitor Activity

General Aviation

Item	Input	Jobs	Labor Income	Output
Total		129	$2,575,446	$7,206,696
Itinerant Operations	17,393			
Annual Visitors	10,725			
Ground Passenger Transport	880,308	40	$553,447	$1,606,991
Food & Drink	1,012,354	35	$741,847	$1,649,083
Lodging	1,716,601	28	$692,204	$2,659,692
Retail	528,185	21	$444,981	$878,611
Other Recreation	264,092	6	$142,967	$412,320

Commercial Service

Item	Input	Jobs	Labor Income	Output
Total		466	$9,272,686	$25,947,131
Enplanements	77,229			
Annual Visitors	38,615			
Ground Passenger Transport	3,169,478	145	$1,992,641	$5,785,841
Food & Drink	3,644,900	125	$2,670,960	$5,937,389
Lodging	6,180,482	100	$2,492,224	$9,576,009
Retail	1,901,687	75	$1,602,120	$3,163,367
Other Recreation	950,843	21	$514,741	$1,484,525

Figure 12. Visitor Activity Data Input Location—Full Screen.

If better data are available, in terms of either itinerant operation/enplanements or annual visitors, the user can edit these to reflect that change. The Estimator uses regional multipliers to determine the visitor impacts; the data involved in these calculations come from the Governor's Office (https://gov.texas.gov/travel-texas/page/travel-research).

Visitor Spending Output

The visitor spending output calculates the typical spent per person for a stay in that region. The standard trip length is two days, and the Estimator includes expenses for accommodations, transportation other than air travel, food and drink, retail, and recreation activities, all of which contributes to the regional economy around the airport.

Tenant/Business Activity Tab

Tenant activity refers to on-airport activity that is not managed or run by the airport itself. A set of 16 industry or business sectors were used in creating the Estimator. Each business sector is connected to the appropriate multiplier for its industry. In order to derive the most accurate results, the correct industry sector must be chosen. The calculator displays the industry and business sectors after the "Tenant" tab is selected. Figure 13 shows the first two business types. Users will want to scroll all the way through the page to enter their tenant/business data in the most appropriate or suitable business category.

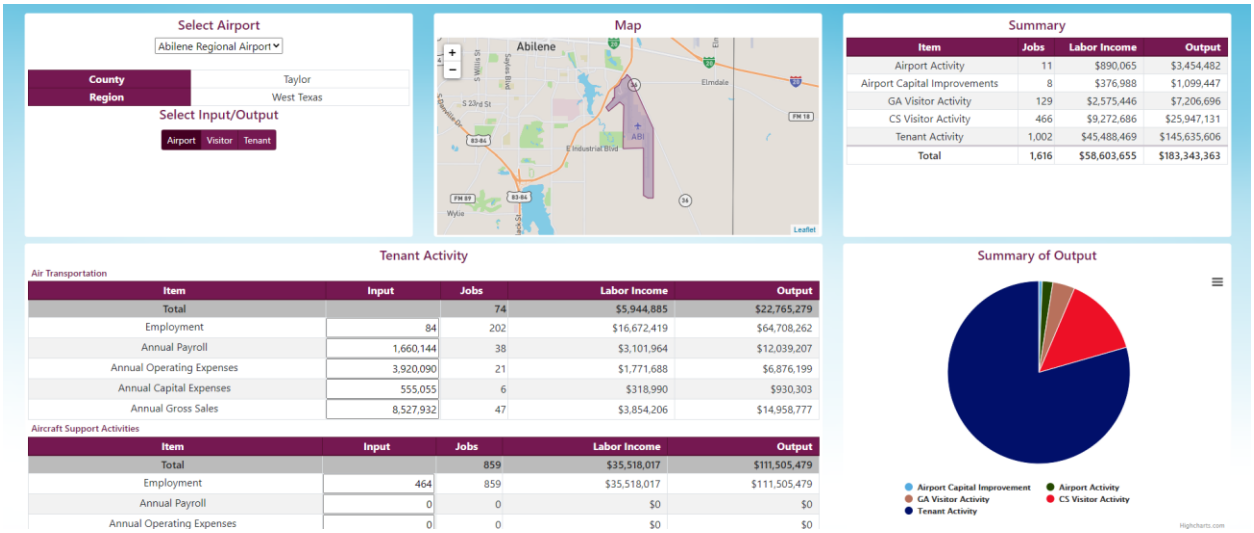


Figure 13. Tenant Activity Data Input Location.

The following section provides an overview of the industry sector and typical jobs or businesses that should be included within the sector. The user should enter the tenant or business activity information under the appropriate industry to derive the most accurate estimates. The inputs under the "Tenant" tab are similar to the "Airport" activity tab, with the addition of annual gross sales to represent businesses at the airport. These numbers can be edited, and new businesses can be added as the airport grows and changes.

Air Transportation and Related Activities

Air transportation refers to industries and job titles that relate to the transport of goods and people by air. The following business categories are included in the model:

- Air transportation.
- Aircraft support activities.
- Aviation schools.
- Air ambulance.

Air transportation includes businesses or tenants such as the FBOs or charter airlines. Aircraft support activities generally refer to the maintenance of aircraft and related equipment. Businesses included in this category are general aircraft maintenance and air traffic control. Aviation schools refer to flight schools and flight instructors or flight instruction that is provided

at the airport. Air ambulance activities refer to medical-related flights conducted by fixed-wing aircraft or helicopters.

Non-air Transportation

Parking and car rental facilities are typically located on airport property, but these services can be owned and operated by private companies. For example, airports may use a private company to manage their parking lots and garages. Two business categories in the model support these types of businesses:

- Rental cars.
- Parking garages/lots.

Recreation and Retail on Airport

Airports that accommodate visitors, either through general aviation activity or commercial service, often have a number of recreation, retail, and food outlets at the airport. The following business sectors in the model support the inclusion of visitor-related tenants:

- Food and drinking places.
- Retail/miscellaneous store retailers.
- Other amusement and recreation industries.

Available Space and Developable Land

Airports can have developable land that is not in use or needed to effectively maintain the services and facilities provided. In addition, buildings and structures can be leased out when no longer required for airport purposes. Common potential uses include museums, office space, and manufacturers. The model supports the following industry categories to account for this:

- Support activities for agriculture or oil and gas.
- Other professional services.
- Manufacturing.

In addition, the model supports the rental of property that is generally used for storage or event purposes with the following category:

- Hangar rental/development.

Government Employment

Government employment covers activity on airports that supports a government function such as the Transportation Security Administration, federal government offices, military offices, and state and local operations, such as police helicopters.

Other

If none of the industry categories apply to a particular tenant or tenants at your airport, the "Other" category allows for the entry of unique businesses into the model.

Summary of Results

Once the user has checked the inputs and made any necessary edits, the economic impact of the airport will be displayed in the results table, and the corresponding pie charts will generate. The results show the economic impact in terms of employment, the number of jobs the airport supports, labor income, payroll expenditures related to the supported employment, and output (the total economic activity in dollars) supported by the airport (Figure 14).

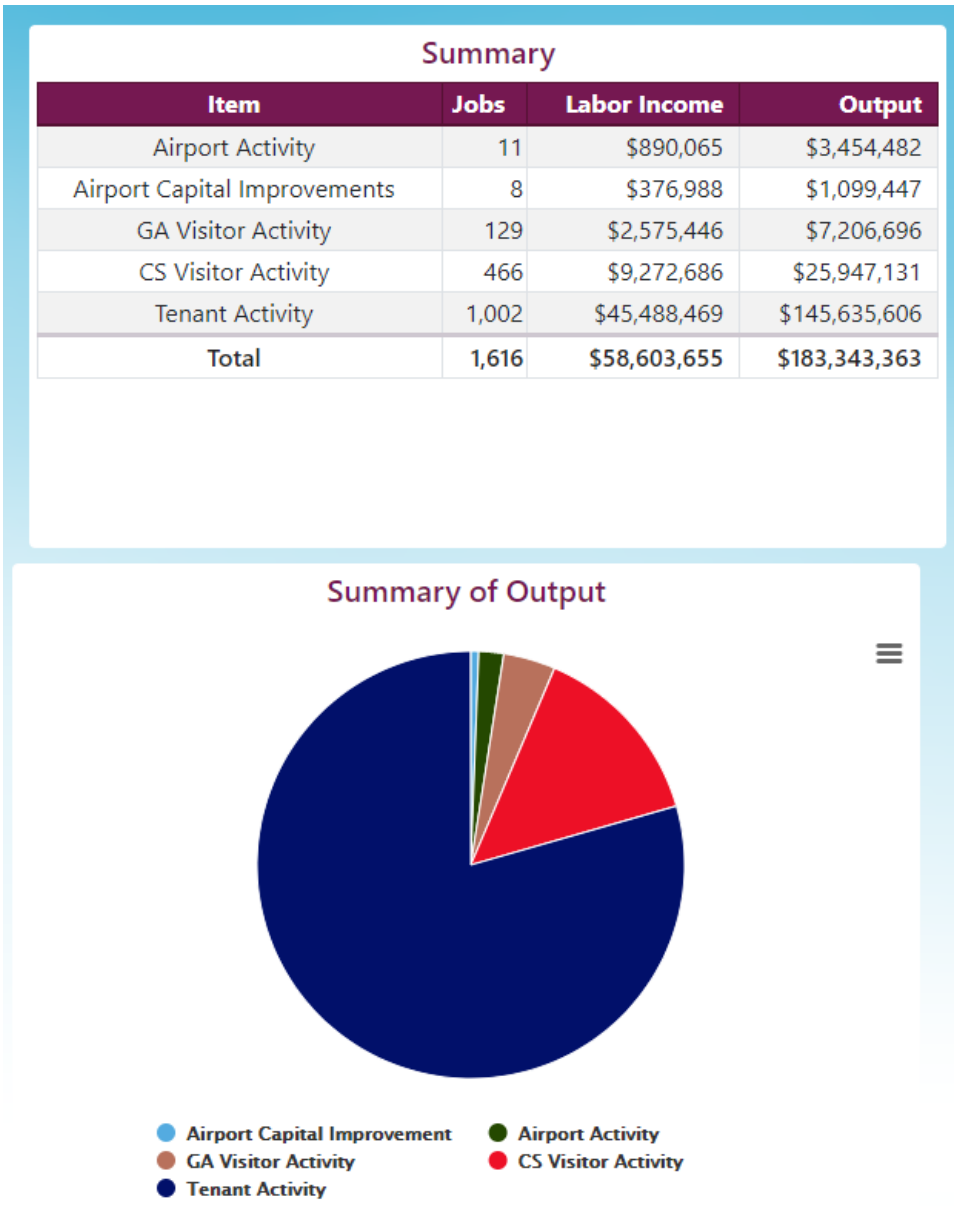


Figure 14. Summary Table and Pie Chart.

The results will change if the user goes back and alters the inputs. The results automatically calculate as changes are made to each tab. The summary pie chart presents the total output numbers by default, but the user can change the pie chart using the collapsed menu icon (hamburger button) highlighted in Figure 15. The user can then choose to display the summary results in terms of either jobs or labor income.

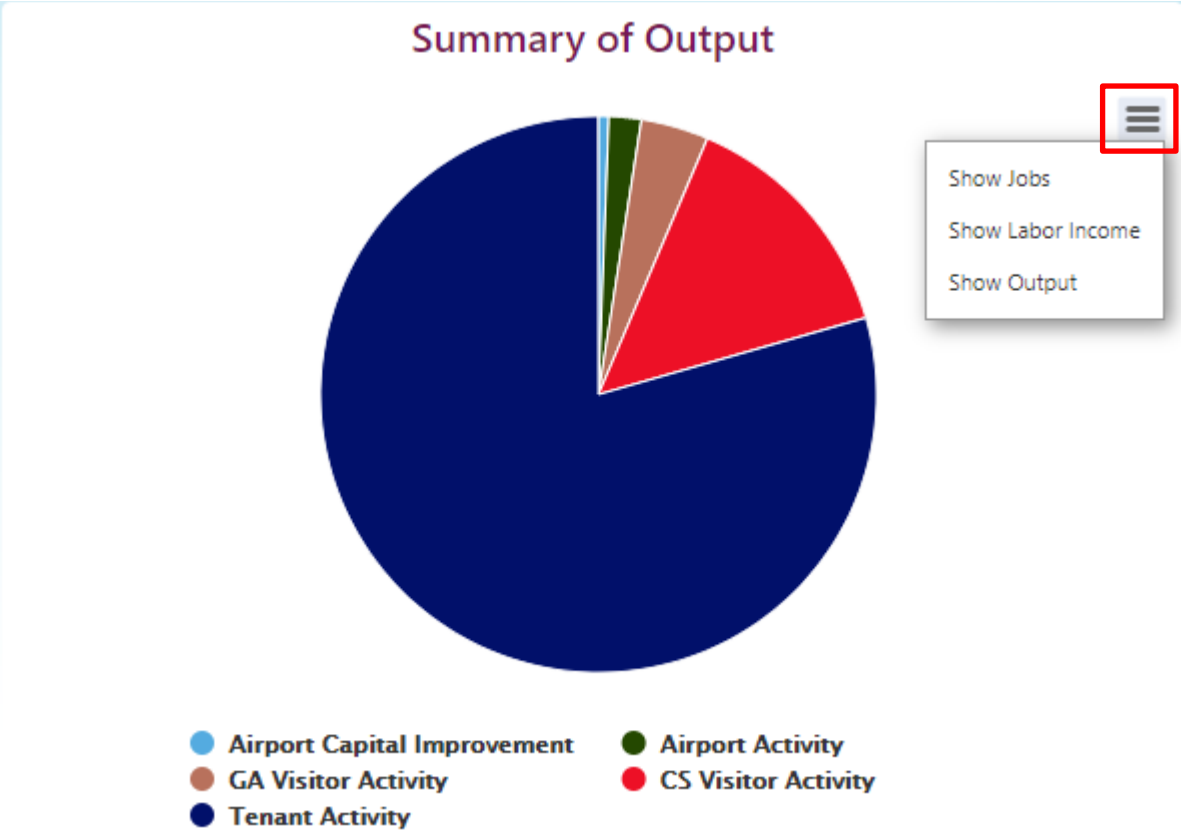


Figure 15. Pie Chart Selection Menu.

Once the user has finished editing the inputs and has the desired summary results displayed, the user can then print a PDF of these results. The "Print" button is located at the top of the screen (highlighted in Figure 16) and allows the user to save to PDF or print the results immediately.

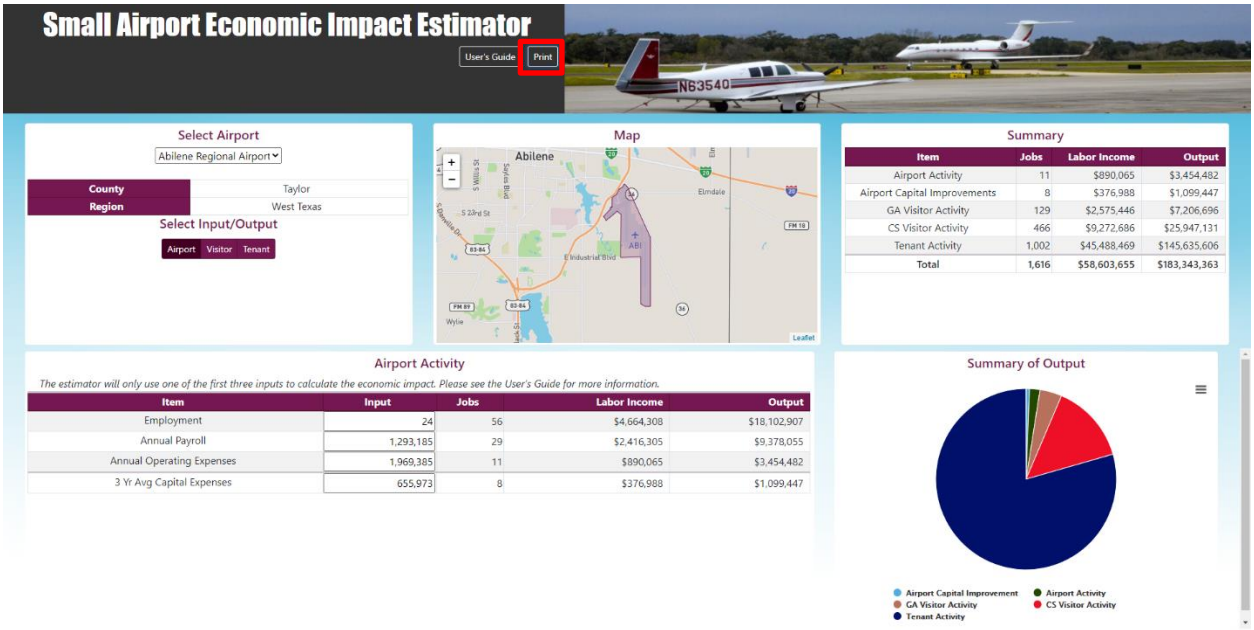


Figure 16. Model Input/Output Print Button.

CHAPTER 5: SUMMARY AND CONCLUSION

Knowing the current economic impact of an airport is critical to both airport sponsors and TxDOT. While TxDOT periodically commissions a statewide economic impact study, the ability to provide updated or more precise economic impact values to airport sponsors and other stakeholders is needed. A number of factors have led to the need for a more up-to-date accounting of an airport's economic impact, such as:

- Some airports' not being included in the statewide study (or incomplete information being used).
- Privacy concerns with respect to financial/economic data because the airport may only have one tenant or business, making it identifiable.
- Changes in an airport's activity levels since the last statewide study was performed.
- An airport's desire to have a more detailed analysis than that allowed when looking at 300 airports at one time.

Having updated and current numbers is important because many local officials use the airport's economic impact values to justify the authorization of grant-matching funds for state and federal airport grants. This allows the officials to better leverage local funds for airport improvements.

SUMMARY OF RESEARCH

The research team reviewed economic impact methodologies and determined that a traditional I/O model would provide the best estimates of the economic impact for a small airport. Researchers built the I/O model using IMPLAN multipliers, visitor spending data from the Texas Governor's Office, Terminal Area Forecast data from FAA, and the latest available data from the recently completed statewide economic impact study of Texas airports. The web tool, called the Small Airport Economic Impact Estimator, takes the model and provides an interface for users to calculate the economic impact of the airport of their choice. The user has the option to calculate using the default data or provide new inputs based on the user's knowledge of current conditions. The Estimator takes these inputs and generates summary outputs for three different types of activity:

- Airport activity—employment or expenses directly related to the functioning of the airport.
- Visitor activity—the impact of visitor spending on the region.
- Tenant/business activity—employment or expenses related to any tenants or businesses that are located on the airport.

In addition, the Estimator calculates the annual impact of capital expenditures at the airport, based on an average of the past three years of capital expenses.

RESEARCH CONCLUSIONS

The research team found that building an estimator tool that can be tailored to each airport provides more precise estimates of that airport's impact. The model and tool move beyond the statewide study by using region-specific estimates and inputs, where possible, and allowing for

user input when conditions have changed since the last statewide economic impact report. In building the Estimator, researchers found that economic conditions vary widely across the state, which makes the use of local multipliers and input data key to providing accurate results.

The Small Airport Economic Impact Estimator Tool provides a resource for airport managers, planners, and local officials. As economic conditions change and the airport develops, the Estimator provides up-to-date economic impact numbers that can support grant applications and local funding matches, as well as attract new development. In addition, the Estimator can estimate economic impacts that may be realized if certain improvements are made that increase airport activity.

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15. Gartner, W., B. Tuck, and D. Erkkila. 2011. *Update of a Web-Based Economic Impact Calculator for Small and Medium-Sized Airports and a Study of the Economic Impact of Minnesota Airports.* Minnesota Department of Transportation.

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APPENDIX A:
ADDITIONAL RESOURCES

The following resources were identified and reviewed by the research team and are included to provide additional information for the reader. The abstracts, summaries, and descriptions provided for each document were taken from the report itself.

The Ohio State University Airport
Hammon, Douglas E.
2017
https://kb.osu.edu/bitstream/handle/1811/85476/ES_V5_2017_Hammon.pdf?sequence=1&isAllowed=y

The airport is the primary general aviation facility serving central Ohio, and a vital transportation link connecting Central Ohio businesses to the global economy, and visitors from across the country to the diverse attractions and activities found in our region. The airport is the fourth busiest airport in Ohio and one of the top 100 busiest general aviation airports in the United States. The airport is categorized by the Federal Aviation Administration as one of only 84 National Priority facility, which highlights its status relative to the nation's nearly 3,000 general aviation airports.

Montana Airports: 2016 Economic Impact Study
Keidel-Adams, P., S. Landau, P. Barkey, and J. Baldridge
2017
https://www.mdt.mt.gov/aviation/docs/2016/economic-impact/MT-EIS-Technical-Report.pdf

The Montana Airports 2016 Economic Impact Study analyzed the qualitative and quantitative impacts of the Montana airport system, including aviation and non-aviation related business, visitor spending, capital expenditures on construction, and additional spin-off (or "multiplier") effects. Specific activities and uses at each airport were also examined to understand and communicate the wide range of impacts and benefits derived from airport operations. Data was gathered via an extensive surveying effort and supplementary secondary data sources to complete data gaps. Economic modeling utilized the IMPLAN and vFreight software platforms. The study determined that Montana's airport system generates a $2.8 billion in total economic impact, supports nearly 24,000 jobs, and generates approximately $839 million in payroll. The results of the project can be used to support decision-making at all levels; promote economic activity and development; and provide a more comprehensive understanding of how broader economic, demographic, and other trends have affected aviation in Montana. This study updated a previous economic impact study conducted in 2007 and 2008.

Update of a Web-Based Economic Impact Calculator for Small- and Medium-Sized Airports and a Study of the Economic Impact of Minnesota Airports
Gartner, William C., B. Tuck, and D. L. Erkkila
2011
http://www.cts.umn.edu/Publications/ResearchReports/reportdetail.html?id=1990

This report details the process of updating the Web-based airport economic impact calculator and the calculation of the statewide economic impact of Minnesota's public airports. The end products of these efforts are: 1) an economic impact calculator that more adequately reflects current economic conditions with added flexibility to handle large, unique airport operations 2) and an estimate of the total economic impact of Minnesota's airports in 2009. The airport economic impact calculator prompts users to enter data on nine main types of economic activity to calculate the impact of their local airport. These include: public airport operations and capital investments, fixed based operators (FBOs), commercial scheduled air service, retail businesses, general aviation, freight operators, private corporations with flight departments, non-profit and government entities and other activities. The newly updated economic impact calculator allows for greater variability in the size and scale of these airport operations and contains new economic impact coefficients that reflect changes in the economy since the calculator was first developed. These nine activities also contribute to the economy of Minnesota. To calculate the economic impact of the airport system in Minnesota, primary data were collected from airport managers, FBOs, corporate flight departments and governmental units. Secondary data were obtained from Minneapolis-St. Paul International, Rochester International, and Duluth International airports to provide a comprehensive economic impact analysis for the state.

2011 Georgia Statewide Airport Economic Impact Study: Executive Summary
Georgia Department of Transportation
2011
http://www.dot.ga.gov/InvestSmart/Aviation/Documents/Georgia%20Economic%20Impact%20Study%20-%202011(GDOT).pdf

Georgia's airports are a major catalyst to the state's growing economy. In order to better understand the economic benefit of Georgia's airports to the economy, the Georgia Department of Transportation completed this study to quantify the economic contribution of the state's airport system. The total economic contribution of Georgia's 104 public-use airports is the sum of the on-airport businesses, the spending of visitors, and the additional activity of the recirculation of spending of on-airport businesses and visitors. Georgia's airports contribute significantly to the state's economy, supporting 471,175 jobs, $17.8 billion in payroll, and $62.6 billion in statewide economic impact. Annually, aviation contributes significant revenue to the state's general fund and local governments, providing nearly $137 million in revenue in 2009, a 37% increase from 2001 aviation-related tax revenues.

The Role of Small Airports in Economic Development
Button, Kenneth, Soogwan Doh, and Junyang Yuan
2010

As one of the most important transport modes in the USA, air transportation has both influenced economic development and been influenced by it. Knowing the scale of these effects is important both for the development and management of airports, and for policy makers who make strategic decisions regarding airport planning and investment. Prior studies of the economic impacts of air transportation have focused mainly on the ties between large airports and regional economic development. Much less attention has been paid to the impact of small airports on their local areas. Some argue that small airports operating a passenger model not unlike an urban transit service can contribute significantly to regional economic development. However, with the exception of some work on high-income tourist destinations, previous studies provide little clear evidence to support a strong positive correlation between local air transportation and economic development. Furthermore, the direction of causation between air traffic and economic development is not entirely clear: regional economic development driven by other factors can lead to more air traffic; however, it is also possible that by generating traffic, airports act as a catalyst for local investment. This study uses a sample of 66 small airports in Virginia to explore the functional relationship between local air transportation and regional economic development.

Applying Benefit-Cost Analysis for Airport Improvements: Challenges in a Multimodal World
Landau, Steven, Glen Weisbrod, and Brian Alstadt
2010
https://journals.sagepub.com/doi/pdf/10.3141/2177-01

Benefit–cost analysis (BCA) is widely used for airport investment analysis, for both ranking of alternatives and funding decisions. Although the technique is theoretically straightforward, its application can become complicated by a series of factors that are particularly problematic for aviation applications. For one, the requirement for ground access makes air travel intrinsically multimodal. In addition, the speed of air travel attracts classes of users and dependent parties with particular speed sensitivities and delay consequences. When BCA is applied to airport project proposals, it can raise issues of how to handle competing modes and intermodal interactions, and the definition of the real users and beneficiaries of airport improvements. To examine these issues, the authors compared benefit–cost guidance for airports with counterpart guidance for other travel modes and conducted a review of the current state of practice of benefit–cost studies for airport improvements. The findings point to challenges for improving methods of airport BCA.

Airport Economic Impact Methods and Models: A Synthesis of Practice
Karlsson, Joakim, J. Richard Ludders, Dale Wilde, Darren Mochrie, and Craig Seymour
2008
https://www.nap.edu/catalog/23267/airport-economic-impact-methods-and-models

This synthesis documents how airport economic impact studies are currently conducted. It focuses specifically on the methods and models used to define and identify, evaluate and measure, and communicate the different facets of the economic impact of airports. The report

discusses the various analysis methods, models, and tools that are available for local airport economic studies, as well as applicability and tradeoffs, including limitations, trends, and recent developments.

This study relies on three distinct data collection efforts: surveys targeting both users and authors of economic impact studies to collect information on the extent of the studies, their motivation and use; a literature review covering the economic impacts and community benefits of airports; and a case study analysis, where four specific studies were selected to illustrate various approaches to assessing economic impact.

Development of a Web-Based Economic Impact Calculator for Small and Medium-Sized Airports
Gartner, William, Daniel Erkkila, and Jo Hyunkuk
2005
http://www.lrrb.org/pdf/200519.pdf

This report details the development of a Web-based economic impact calculator for Minnesota's Small and Medium Size, General Aviation airports. In this case, "economic impact" is defined as the result of expenditures or sales transactions between businesses or other entities that can be directly traced to the presence of an airport. The process involved site visits to 51 airports, meetings with airport managers, Fixed Base Operators (FBO), and Metropolitan council officials, as well as data collection of financials from airport sponsors and FBOs. After testing on the calculator was completed, it was transferred to the Mn/DOT Aeronautics server and can be found at http://dotapp1.dot.state.mn.us:8080/aeic/main.htm. The authors recommend, however, that a new effort be considered to obtain more detailed financials for FBOs as a way to improve calculator accuracy. Although the current model provides a good estimation of FBO expenditures, greater accuracy could be obtained with more data.

Functions and Benefits of Rural Airports in Washington
Newkirk, Jon, and Ken Casavant
2002
https://www.wsdot.wa.gov/research/reports/fullreports/557.1.pdf

Washington's urban and rural communities are served by an airport system that provides mobility to Washington's citizens, visitors and other traveling public. The strong performance by Washington's airports has been integral in the development and sustaining of Washington State's role in international trade for the nation. The economic benefits of major airports are well known and acknowledged; less well known is the benefit to the state and rural communities provided by rural airports. The robust economic growth of the past ten years has not been experienced by all parts of the state's economy or people. Rural counties and cities, historically dependent on resource extractive industries such as forestry, mining, agriculture, and in some cases fishing have witnessed lower income levels and increased unemployment. A decline in resource extractive industries has direct consequences on the survival and preservation of the state's airport system and its attendant facilities. If the major airports are the arteries of the economic system, rural airports are the veins and capillaries necessary for a healthy and productive economic system. The rural airport systems, and its users, are caught on the horns of a dilemma. The need for local airport services is never more critical but the vitality of the rural Washington

airport system, and the capability to support that system, doesn't mirror the past vigor of the state economy. An understanding of the role played, functions performed and benefits (mobility, access, etc.) generated by the system of rural airports is a critical element as local decision makers, faced with competing demands, make choices about investment and support for the rural airports.

The Benefits of Aviation and Local Airports
Muia, M.
2000
https://docs.lib.purdue.edu/cgi/viewcontent.cgi?article=3698&context=roadschool

The aviation industry is an economic generator. It equates to jobs and income. There is an important link between an airport and a community's economic vitality. Many of Indiana's businesses depend on this important industry for access to markets and for access to the nation's air transportation system. The total annual economic impact of Indiana's airports on the state's economy is estimated to be more than $3.8 billion, while these airports employ more than 15,600 people throughout the state.

The Economic Significance of General Aviation Airports in Rural Areas
Babcock, Michael W.
1999

Some aspects of the decline in rural transportation infrastructure are well known, including deferred maintenance or rural roads and bridges and abandonment of railroad branch lines. However, there has been no recognition of the deterioration of rural area general aviation airports. The decline in the quality of rural general aviation airports could result in several negative impacts on rural communities. For example, poorly equipped airports force rural residents to travel longer distances to obtain suitable air service. The rural community may lose business development opportunities because the local airport does not have the capabilities required by potential new business firms. A poorly equipped, deteriorating airport increases the costs of local businesses when they are forced to rely on a more distant airport or use more costly modes of transportation. Inadequate airports also restrict the geographic market areas of rural business firms with a resulting negative impact on sales and profits. As general aviation airports deteriorate in rural areas their economic significance to the region will decline over time. The measurement of the economic significance of rural general aviation airports can be viewed as measurement of the cost of allowing airport deterioration to continue. Accordingly the objectives of this paper are: (1) Evaluate alternative methodologies for measuring the economic significance of general aviation airports in low population density states. (2) Using input-output techniques, specify a procedure for measuring economic impacts of rural general aviation airports and airport related business.

Economic Impacts and Land-Use Change around Major Airports: Some Examples from Sydney Kingsford Smith Airport Based on an Eighty-Year Analysis
Jatmika, H., and J. Black
1999

The paper discusses the role of transportation infrastructure in economic development both a general perspective of the theoretical stages of air traffic networks. The scope is confined to consideration about the economic impacts of airports and how these impacts manifest themselves on the ground in localities surrounding airports.

Ashland Municipal Airport
Kralman, R., D. Langlois, A. Larson, and J. Lukaszewicz
1997
http://www.ashland.or.us/Files/Airport%20Economic%20Impact%20Study%201997.pdf

The following is an economic impact study done of the Ashland Municipal Airport. It has been undertaken in order to determine the economic impact of the airport on the City of Ashland and surrounding areas. The study was requested by the City of Ashland Airport Commission. In order to determine economic impact, the Southern Oregon State College research team which undertook this project used a variety of primary and secondary sources. The two significant primary sources of data consisted of a survey of local users of the Ashland Municipal Airport and a survey of transient pilots who flew into the airport economic association with the airport. Finally, in an attempt to verify the approach taken to determine economic impact, various other economic impact studies of airports of similar size were reviewed. As a direct result of the research described above, the following information was obtained: The estimated total direct annual economic impact of the Ashland Municipal Airport on the City of Ashland is $1,132,160 The total of indirect impact is $16,255. ***The total induced impact, which is a combination of direct and indirect impacts multiplied by the economic multiplier is $2,871,037.*** This figure compares to a 1989 economic impact study done by another SOSC research team which arrived at an economic impact of $1,041,623 The paper which follows describes how the above number was calculated as well as providing other non-economic justifications for the existence and operations of the Ashland Municipal Airport.

The Economic Impact of General Aviation Airport Deterioration on Kansas Communities
Babcock, M. W., M. Prater, and E. R. Russell
1996
http://kdot1.ksdot.org/idmws/DocContent.dll?Library=PublicDocs^dt00mx38&ID=003670402

Given indications of the decline in the quality of Kansas General Aviation Airports and the potential negative effects of airport deterioration on Kansas communities, the objectives of the research are to document the deterioration of Kansas General Aviation Airports by obtaining information regarding the needed capital improvements at these airports; to measure the economic impacts of substandard airports on general aviation service users; and to identify the types of business firms whose location decisions are significantly affected by high quality air service. The objectives of the research are accomplished through the use of questionnaires distributed to managers of Kansas General Aviation Airports, to Kansas businesses that use airports, and to members of the Kansas Pilots Association (KPA). Airport managers provided a

long list of needed capital improvements with special emphasis on lengthening and resurfacing the runway. Managers revealed that they believe that the most important problem of General Aviation Airports is obtaining financing for airport maintenance and capital improvements. The principal effect of airport deterioration on the users of airports is a decrease in safety. The KPA and business firm respondents indicated that condition and length of the runway are two of the most important factors in the decision to base their aircraft at a particular airport. The implication of this finding is that deteriorating general aviation airports will lose based aircraft, possibly leading to closure of the airport. The KPA and business firm survey respondents described the impacts on airport users if the airports they use frequently were closed. A total of 53 Kansas companies said that they would collectively lose $35.3 million per year if the airports they frequently used are closed. The report concludes that some state program of airport investment could be justified, if it were to mitigate this loss and preserve the estimated $16 million direct economic impact of the Kansas General Aviation Airports.

Estimating the Regional Economic Significance of Airports
Butler, Stewart E., and Laurence J. Kiernan
1992
https://rosap.ntl.bts.gov/view/dot/35802

This report provides advice on how to measure the importance of an airport to the economy of the surrounding area. It defines various measures of economic significance, describes the circumstances in which they are applicable, and provides guidelines for their initial approximation and subsequent computation. The main areas covered are transportation benefits and economic impact. The analytical techniques described in this report can be used to estimate the positive economic effects of existing airports and the additional effects of increased aeronautical activity.

Evaluation of Economic Benefits of General Aviation Airports: Methodological Challenges
Wilson, A. Christopher
1991
https://www.library.northwestern.edu/find-borrow-request/requests-interlibrary-loan/lending-institutions.html

This document is not available online but can be requested through the above link.

Airports and Economic Development: An Overview
R. Cooper
http://onlinepubs.trb.org/Onlinepubs/trr/1990/1274/1274-013.pdf

Airports and aviation make an important contribution to local, state, and regional economies. A review of literature on the links between airports and economic development indicates that air transport is usually associated with significant portions of local business. The influence on local and regional economic activity extends well beyond the airport site. The location of airports influences the geographic distribution of industries and can be a significant factor in the decisions of certain industries to locate in a specific state or region. Data indicate that access to air transport plays an increasingly important role in the ability of some high-technology industries, such as computers and electronics, to compete, and that the location of airport

facilities influences the location of these industries. Tourism industries have also been shown to be sensitive to air travel access.

A Normative Framework for Assessing the Economic Impacts of General Aviation Airports
Ghobrial, A., and K. Fleming
1990
https://www.worldcat.org/title/journal-of-advanced-transportation/oclc/5121625

Despite the significant contribution of general aviation airports to the economic development of communities and regions, very little work has been done to realistically measure the economic benefits of these airports. This paper presents a normative framework to forecast the economic impacts of general aviation airports. It also presents a conceptual design of a management information system to enhance the role of general aviation airports in the future economic development of regions.

Economic Impacts of Improving General Aviation Airports
Weisbrod, Glen
1990
http://onlinepubs.trb.org/Onlinepubs/trr/1990/1274/1274-014.pdf

Every state and many communities face the issue of setting priorities for investments in airport facilities. This issue has received the most public attention regarding the regional economic importance of investments in major new commercial airport facilities but relatively little attention has been given to the role of general aviation (GA) facilities. As a result, the issue of investment priorities is particularly problematic for GA airport facilities because their contribution to local and state economies is not well understood. The state and local economic impacts of GA airports are defined and measured, and the benefits of improvements to those airports are assessed. General aviation today is briefly summarized, and the measurement of airport benefits is examined with particular attention to the different approaches for economic impact analysis. Results are presented from a survey of businesses that use GA, which focused on the relative importance of GA for those businesses. A basic model system for evaluating GA benefits, developed for the Massachusetts Aeronautics Commission, is presented.

Measuring the Regional Economic Significance of Airports
Butler, Stewart E., and Laurence J. Kiernan
1986
https://apps.dtic.mil/dtic/tr/fulltext/u2/a176320.pdf

This report provides advice on how to measure the importance of an airport to the economy of the surrounding area. It defines various measures of economic significance, describes the circumstances in which they are applicable, and provides guidelines for their initial approximation and subsequent computation. The main areas covered are transportation benefits and economic impact. The analytical techniques described in this report can be used to estimate the positive economic effects of existing airports and the additional effects of increased aeronautical activity.

An Assessment of Economic Benefits from Airports: The Building of a Model
Burdg, Henry B., and Janell Granier
1985
https://ojs.library.okstate.edu/osu/index.php/CARI/article/view/7707/7106

Past research indicates that significant economic impacts are generated from airports. Over time several airports am statewide systems of airports have been studied am economic impacts determined. However, many airports remain unstudied and the knowledge of community economic impact is vital for airport public relations programs to demonstrate worthiness. Using a recent airport economic impact study conducted by the Illinois Department of Transportation data were subject to multiple regression and correlation procedures in order to build an estimation equation. The results of the study indicate that a very strong relationship exists between several typical airport operational variables such as employment, total based aircraft, and annual enplanements and total economic impact. Two regression equations were developed for commercial airports and non-commercial airports. These equations were found to be statistically useful as estimating tools for determining total economic impact at a given airport.

The Impact of Genesee County Airport on Genesee County
Kulka, Francis P.
1985
http://onlinepubs.trb.org/Onlinepubs/trr/1985/1025/1025-001.pdf

In this study of the Genesee County Airport and its economic impact on the local economy, the costs and benefits of the airport to the city of Batavia and the remainder of the county are examined. The goal of this study was to demonstrate that general aviation airports provide an essential service in complementing an area's entire transportation system. As such, any airport development will incur its share of local costs (for development and operation), but at the same time it will generate a set of economic benefits directly because of its use and indirectly through the creation of additional income and purchases of goods and services in the local economy. The point to be made is that the key for any local decision-making concerning airport development should reflect a balanced evaluation of an airport's costs and its benefits, placed in the context of how a community (or county) perceives the long-range need to provide public services to its residents, businesses, and other institutions. The conclusions drawn from this study provide some interesting perspectives on the behavior of general aviation in smaller urban areas and rural communities, A survey of airport operations in 1983 showed that 18 percent of all aircraft operations were for business purposes. Of the manufacturing firms that have 25 or more employees, 37, 5 percent use the airport to some degree. use of the airport ranges from a few trips to several hundred trips per year. What is interesting about the use of the airport by the manufacturing firms is that all the firms that use it have at least 100 employees. For small manufacturing. firms, the airport does not appear to be essential for conducting business. This point was brought out by discussions relating to local business expansions, As a recruiting tool for manufacturing firms, it is safe to conclude that in seeking firms that may hire or employ 100 or more people, the presence of the airport could be an essential part of any presentation to a prospective new company. In 1983 local airport businesses were employing 16 full-time and 4 part-time individuals and a total payroll of $159,876. These businesses contributed directly and indirectly more than $861,000 in local economic expenditures. As a conservative estimate there was $3,654,999 in direct and indirect economic expenditures within the local economy. These

expenditures in turn provided direct and indirect fiscal benefits that cannot be quantified, yet they exist. The range of these direct and indirect fiscal benefits reduces the county's average annual net operating cost of $37,400. Through a method of estimating the county's revenue capture rate, it appears that between 1978 and 1983 the county earned from $3,000 to $8,000 per year using the indirect revenue estimates to offset average annual operating costs.

Economic Benefits and Financing of General Aviation Airports: Introduction
Andrews, D. G.
1983
http://onlinepubs.trb.org/Onlinepubs/trcircular/259/259-intro.pdf

The Transportation Research Board Committee on the State Role in Air Transport has focused its attention over the past three years on the issue of the economic benefits of general aviation airports and hub airports which have a preponderance of general aviation activity. The committee sponsored a series of three conference sessions on various facets of this topic at the 1981, 1982 and 1983 Annual Meetings of the TRB. This circular is a documentation of the material presented at the conference sessions.

Estimating Economic Impact of a Non-hub Airport
Downs III, L. M.
1983
https://www.worldcat.org/title/international-conference-on-bridge-and-structure-management-tenth-international-conference-on-bridge-and-structure-management-october-20-22-2008-buffalo-new-york/oclc/664595354

Over the past few years numerous studies have been prepared to determine the economic impact of various airports around the country. The Air Transport Association has conducted several of these projects at major air carrier airports and various other groups and local commissions have completed similar analyses. The vast majority of these studies have been completed for large and medium hub airports. Very few have been conducted at the numerous nonhub air carrier facilities and large general aviation airports. However, it is these smaller terminals that most need to convince the local community of the importance of having a convenient, well maintained airport. The larger airports are in no real danger of being closed as a result of high property taxes, failure to operate at a profit, rising personnel costs and other problems facing the smaller single-carrier and general aviation airports.

Quantifying the Benefits of a New General Aviation Airport: A Return on Investment Approach
Wolfe, H. P.
1983
https://www.worldcat.org/title/international-conference-on-bridge-and-structure-management-tenth-international-conference-on-bridge-and-structure-management-october-20-22-2008-buffalo-new-york/oclc/664595354

This paper examines a return on investment approach for comparing the benefits and costs associated with an airport investment, as an alternative to traditional benefit-cost methodologies. It provides background information on the rationale for the construction of a new general

aviation airport in the Phoenix area; points out the weaknesses in benefit-cost methodologies that are used to justify such a project; and explains the application of a return on investment approach. The airport investment is viewed in terms of its contribution to net social welfare, rather than from an airport advocacy or purely local perspective.

The Socio-economic Impact of the Airport upon the Community
Eaton, Jr., Alfred F.
1977
https://trace.tennessee.edu/cgi/viewcontent.cgi?article=4439&context=utk_gradthes

The purpose of this study was to analyze the socio-economic impact that an airport has upon a community and to develop a method of determining that impact suitable for usage by an airport manager.

Data is presented which illustrates the magnitude and scope of the socio-economic impact of an airport. The various methods of analyzing this impact are discussed. Finally, a method of determining the impact, designed for airport managers, is presented.

- Some of the main conclusions of the research are as follows: that it is very difficult to measure the total socio-economic impact of an airport upon the community, but a useful estimation of the magnitude can be obtained; that airports, with all factors considered, generally impact upon a community in a favorable manner; that the availability of air service is an important determinant of a community's growth rate; that the primary dis-benefits of an airport are ecological or environmental in nature; and that a good, active public relations program is a necessity.

The Influence of Small Airports and Air Transportation on Local Economic Development: A Study of Nebraska
Blair, Robert
https://digitalcommons.unomaha.edu/cparpublications/78/

Transportation networks and facilities play a critical role in the economic development of communities. They serve as important links to new or emerging markets, and sources of materials and services needed for processing for existing and new businesses in a community. Transportation costs affect the location and growth of local businesses and serve historically as a primary industrial location factor.

Economic Impact of Michael J. Smith Airport, Beaufort, NC

Michael J. Smith Airport is the third busiest of North Carolina’s 60 general aviation airports, serving 86 based aircraft and 52,500 operations per year. This study assesses the economic impact of the airport on the community. The study also reviews four options for the airport’s future: continuing as is, runway lengthening, moving to a new site, or closure. Activity at Michael J. Smith Airport has been growing steadily and is predicted to reach 115 based planes and 70,000 operations by 2010. The assessed valuation for based aircraft is about $4.2 million; local property taxes on based aircraft are about $37,800 per year. Detailed questionnaires were

administered to based aircraft owners, transient flyers, vehicle storage customers, residents, and businesses during the fall of 1998. The economic impact of Michael J. Smith Airport totals about $14.5 million annually, just over 1 percent of the region's economy. About 18 local businesses depend partially or substantially on the airport, and another 86 indicate that the airport is an important but not essential part of their business. The airport-related economic activity of these businesses is about $5.1 million. The 58 vehicle storage customers create about $1.4 million in economic activity, transient visiting flyers conservatively $2.8 million, and based aircraft owners $487,000. Indirect and induced economic activity adds another $4.7 million. On average, each operation generates about $276 in local economic activity. Other unquantified impacts include summer home construction and taxes, and local taxes from indirect business activity. Most area residents and businesses have favorable opinions toward the airport and want to see it improved at its present location. Recruitment of commercial service is the top interest of both groups, followed by runway lengthening and continuing as is. Only 8.5 percent of businesses and 18 percent of residents favor moving the airport to a new site, and only 3–4 percent in each group favor closure. Lengthening the airport's Runway 8-26 to 5,000 feet would cost about $950,000 but would increase local economic activity to about $15.1 million annually. Adding better aircraft guidance systems would cost an additional $400,000 but would increase local economic activity substantially, to $17.3 million annually. Constructing a new comparable facility at a new location would cost an estimated $20 million but would increase economic impacts to $17.8 million annually. Closing the airport would result in the loss of about $9.6 million in local economic activity, about two-thirds of the current impact. The study concludes that the economic impacts of Michael J. Smith Airport are substantial, extending well beyond the immediate benefits to local aircraft owners. Impacts would also increase if the airport's Runway 8-26 were lengthened and better aircraft guidance implemented.

APPENDIX B:
AIRPORT REFERENCE TABLE

Airport	County	Region	Associated City
Abilene Regional Airport	Taylor, Jones	West Texas	Abilene
Albany Municipal	Shackelford	West Texas	Albany
Alice International Airport	Jim Wells	South Texas	Alice
Alpine Casparis Municipal Airport	Brewster	West Texas	Alpine
Rick Husband Amarillo Int'l Airport	Potter	Panhandle	Amarillo
Tradewind	Potter	Panhandle	Amarillo
Chambers County-Anahuac	Chambers	Upper Gulf Coast	Anahuac
Andrews County Airport	Andrews	West Texas	Andrews
Texas Gulf Coast Regional	Brazoria	Upper Gulf Coast	Angleton/Lake Jackson
Arlington Municipal Airport	Tarrant	North Texas	Arlington
Stonewall County	Stonewall	West Texas	Aspermont
Athens Municipal	Henderson	East Texas	Athens
Hall-Miller Municipal	Cass	East Texas	Atlanta
Austin-Bergstrom International	Travis	Central Texas	Austin
Bruce Field	Runnels	West Texas	Ballinger
Bay City Regional Airport	Matagorda	Upper Gulf Coast	Bay City
Beaumont Municipal	Jefferson	East Texas	Beaumont
Jack Brooks Regional	Jefferson	East Texas	Beaumont/Port Arthur
Beeville Municipal	Bee	South Texas	Beeville
Reagan County	Reagan	West Texas	Big Lake
Big Spring McMahon-Wrinkle	Howard	West Texas	Big Spring
Bishop Municipal Airport	Potter	Panhandle	Bishop
Jones Field Airport	Fannin	North Texas	Bonham
Hutchinson County	Hutchinson	Panhandle	Borger
Bowie Municipal Airport	Montague	North Texas	Bowie
Curtis Field	McCulloch	West Texas	Brady
Stephens County	Stephens	West Texas	Breckenridge
Brenham Municipal	Washington	Central Texas	Brenham
Bridgeport Municipal Airport	Wise	North Texas	Bridgeport
Terry County	Terry	West Texas	Brownfield
Brownsville/South Padre Island International	Cameron	South Texas	Brownsville
Brownwood Regional	Brown	West Texas	Brownwood
Coulter Field	Brazos	Central Texas	Bryan
Burnet Municipal Airport	Burnet	Central Texas	Burnet
Caddo Mills Municipal	Hunt	North Texas	Caddo Mills

Airport	County	Region	Associated City
Caldwell Municipal	Burleson	Central Texas	Caldwell
Cameron Municipal Airpark	Milam	Central Texas	Cameron
Hemphill County	Hemphill	Panhandle	Canadian
Dimmit County Airport	Dimmit	South Texas	Carrizo Springs
Panola County-Sharpe Field	Panola	East Texas	Carthage
Castroville Municipal	Medina	South Texas	Castroville
Center Municipal	Shelby	East Texas	Center
Childress Municipal	Childress	Panhandle	Childress
Cisco Municipal	Eastland	West Texas	Cisco
Smiley Johnson/Bass Field	Donley	Panhandle	Clarendon
Clarksville/Red River County-J D Trissell Field	Red River	East Texas	Clarksville
Cleburne Regional Airport	Johnson	North Texas	Cleburne
Cleveland Municipal	Liberty	Upper Gulf Coast	Cleveland
Clifton Municipal	Bosque	West Texas	Clifton
Coleman Municipal	Coleman	West Texas	Coleman
Easterwood Field	Brazos	Central Texas	College Station
Colorado City Municipal Airport	Mitchell	West Texas	Colorado City
Robert R. Wells	Colorado	Upper Gulf Coast	Columbus
Comanche County-City	Comanche	West Texas	Comanche
Commerce Municipal	Hunt	North Texas	Commerce
Corpus Christi International	Nueces	South Texas	Corpus Christi
C David Campbell Field-Corsicana Municipal	Navarro	North Texas	Corsicana
Cotulla-La Salle County Airport	La Salle	South Texas	Cotulla
Crane County	Crane	West Texas	Crane
Houston County	Houston	East Texas	Crockett
Crosbyton Municipal Airport	Crosby	West Texas	Crosbyton
Crystal City Municipal	Zavala	South Texas	Crystal City
Cuero Muni	DeWitt	West Texas	Cuero
Greater Morris County	Morris	East Texas	Daingerfield
Dalhart Muni	Dallam	Panhandle	Dalhart
Addison Airport	Dallas	North Texas	Dallas
Dallas CBD Vertiport	Denton	North Texas	Dallas
Dallas Executive	Denton	North Texas	Dallas
Dallas Love Field	Denton	North Texas	Dallas
McKinney National	Denton	North Texas	Dallas
Dallas/Fort Worth International	Denton	North Texas	Dallas-Fort Worth
Decatur Municipal Airport	Wise	North Texas	Decatur
Del Rio International Airport	Val Verde	South Texas	Del Rio
Dell City Municipal Airport	Hudspeth	West Texas	Dell City
Denton Enterprise Airport	Denton	North Texas	Denton

Airport	County	Region	Associated City
Denver City Airport	Yoakum	West Texas	Denver City
Desoto Heliport	Dallas	North Texas	Desoto
Devine Municipal Airport	Medina	South Texas	Devine
Dilley Airport	Frio	South Texas	Dilley
Dimmit Municipal	Dimmit	South Texas	Dimmitt
Terrell County Airport	Terrell	West Texas	Dryden
Dublin Municipal Airport	Erath	North Texas	Dublin
Moore County Airport	Moore	Panhandle	Dumas
Eagle Lake Regional	Colorado	Upper Gulf Coast	Eagle Lake
Maverick County Memorial International	Mason	West Texas	Eagle Pass
Eastland Municipal	Eastland	West Texas	Eastland
South Texas Intl at Edinburg	Hidalgo	South Texas	Edinburg
Jackson County	Jackson	South Texas	Edna
El Paso International	El Paso	West Texas	El Paso
Eldorado Airport	Schleicher	West Texas	Eldorado
Ennis Municipal	Ellis	North Texas	Ennis
Fabens	El Paso	West Texas	Fabens
Brooks County	Brooks	South Texas	Falfurrias
Floydada Municipal Airport	Floyd	West Texas	Floydada
Follett/Lipscomb County	Lipscomb	Panhandle	Follett
Ft. Stockton/Pecos County	Pecos	West Texas	Fort Stockton
Ft. Worth Alliance	Denton	North Texas	Fort Worth
Ft. Worth Meacham	Denton	North Texas	Fort Worth
Ft. Worth Spinks	Denton	North Texas	Fort Worth
Gillespie County Airport	Gillespie	South Texas	Fredericksburg
Duval-Freer	Duval	South Texas	Freer
Gainesville Municipal	Cooke	North Texas	Gainesville
Scholes Int'l at Galveston	Galveston	Upper Gulf Coast	Galveston
Garland/DFW Heliport	Dallas	North Texas	Garland
Gatesville Municipal Airport	Coryell	Central Texas	Gatesville
Live Oak County	Live Oak	South Texas	George West
Georgetown Municipal	Williamson	Central Texas	Georgetown
Giddings-Lee County Airport	Lee	Central Texas	Giddings
Fox Stephens Field-Gilmer Municipal	Upshur	East Texas	Gilmer
Gladewater Municipal Airport	Gregg	East Texas	Gladewater
Goldthwaite Airport	Mills	Central Texas	Goldthwaite
Roger M. Dreyer Memorial	Gonzales	South Texas	Gonzales
Possum Kingdom Airport	Palo Pinto	North Texas	Graford
Graham Municipal Airport	Young	North Texas	Graham
Granbury Regional Airport	Hood	North Texas	Granbury

Airport	County	Region	Associated City
Grand Prairie Municipal	Tarrant	North Texas	Grand Prairie
Greenville Municipal	Hunt	North Texas	Greenville
Groveton-Trinity County	Trinity	East Texas	Groveton
Gruver Municipal	Hansford	Panhandle	Gruver
Hallettsville Muni	Lavaca	South Texas	Hallettsville
Hamilton Municipal	Hamilton	Central Texas	Hamilton
Valley International	Cameron	South Texas	Harlingen
Haskell Municipal Airport	Haskell	West Texas	Haskell
Hearne Municipal	Robertson	Central Texas	Hearne
Jim Hogg County	Jim Hogg	South Texas	Hebbronville
Rusk County Airport	Rusk	East Texas	Henderson
Hereford Municipal	Deaf Smith	Panhandle	Hereford
Higgs/Lipscomb County	Lipscomb	Panhandle	Higgins
Hillsboro Municipal Airport	Hill	Central Texas	Hillsboro
South Texas Regional Airport	Cameron	South Texas	Hondo
Conroe North-Houston Regional	Harris	Upper Gulf Coast	Houston
David Wayne Hooks Memorial	Harris	Upper Gulf Coast	Houston
Ellington Field	Harris	Upper Gulf Coast	Houston
George Bush Intercontinental/Houston	Harris	Upper Gulf Coast	Houston
Houston Southwest	Harris	Upper Gulf Coast	Houston
Pearland Regional	Brazoria	Upper Gulf Coast	Houston
Sugarland Regional	Harris	Upper Gulf Coast	Houston
West Houston Airport	Harris	Upper Gulf Coast	Houston
William P Hobby	Harris	Upper Gulf Coast	Houston
Huntsville Municipal	Walker	Upper Gulf Coast	Huntsville
McCampbell-Porter Airport	San Patricio	South Texas	Ingleside
Jacksboro Municipal	Jack	North Texas	Jacksboro
Cherokee County Airport	Cherokee	East Texas	Jacksonville
Jasper County-Bell Field	Jasper	East Texas	Jasper
Kent County	Kent	West Texas	Jayton
Cypress River	Marion	East Texas	Jefferson
Kimble County	Kimble	West Texas	Junction
Karnes County	Karnes	South Texas	Kenedy
Kerrville-Kerr County	Kerr	South Texas	Kerrville

Airport	County	Region	Associated City
Killeen-Ft. Hood Regional	Bell	Central Texas	Killeen
Killeen-Skylark Field	Bell	Central Texas	Killeen
Kleberg County Airport	Kleberg	South Texas	Kingsville
Kirbyville Airport	Jasper	East Texas	Kirbyville
Harrison Field	Knox	West Texas	Knox City
Hawthorne Field	Hardin	East Texas	Kountze/Silsbee
Fayette Regional Air Center	Fayette	Central Texas	La Grange
La Porte Municipal	Harris	Upper Gulf Coast	La Porte
Lago Vista Rusty Allen Airport	Travis	Central Texas	Lago Vista
Lamesa Municipal Airport	Dawson	West Texas	Lamesa
Lampasas Municipal Airport	Lampasas	Central Texas	Lampasas
Lancaster Regional	Dallas	North Texas	Lancaster
Laredo International	Webb	South Texas	Laredo
Real County	Real	South Texas	Leakey
Levelland Municipal	Hockley	West Texas	Levelland
Liberty Municipal	Gregg	East Texas	Liberty
Taylor Brown Municipal	Lamb	West Texas	Littlefield
Livingston Municipal	Polk	East Texas	Livingston
Llano Municipal Airport	Llano	Central Texas	Llano
Lockhart Municipal	Caldwell	Central Texas	Lockhart
East Texas Regional	Gregg	East Texas	Longview
Lubbock Preston Smith International	Lubbock	West Texas	Lubbock
Angelina County Airport	Angelina	East Texas	Lufkin
The Carter Memorial	Caldwell	Central Texas	Luling
Madisonville Municipal	Madison	Central Texas	Madisonville
Marfa Municipal	Presidio	West Texas	Marfa
Marlin	Falls	Central Texas	Marlin
Harrison County Airport	Harrison	East Texas	Marshall
Mason County Airport	Mason	West Texas	Mason
McAllen Miller International	Hidalgo	South Texas	McAllen
Upton County Airport	Upton	West Texas	McCamey
McLean/Gray County	Gray	Panhandle	McLean
Memphis Municipal	Hall	Panhandle	Memphis
Menard County Airport	Menard	West Texas	Menard
Mesquite Metro	Dallas	North Texas	Mesquite
Mexia-Limestone County	Limestone	Central Texas	Mexia
Miami-Roberts County	Roberts	Panhandle	Miami
Midland Airpark	Midland	West Texas	Midland
Midland International Air & Space Port	Midland	West Texas	Midland
Mid-way Regional	Ellis	North Texas	Midlothian/ Waxahachie

Airport	County	Region	Associated City
Wood County	Wood	East Texas	Mineola/Quitman
Mineral Wells Airport	Palo Pinto	North Texas	Mineral Wells
Roy Hurd Memorial	Ward	West Texas	Monahans
Cochran County	Cochran	West Texas	Morton
Mt. Pleasant Regional Airport	Titus	East Texas	Mount Pleasant
Franklin County	Franklin	East Texas	Mount Vernon
Muleshoe Municipal	Bailey	West Texas	Muleshoe
Munday Municipal Airport	Knox	West Texas	Munday
A. L. Mangham Jr. Regional Airport	Nacogdoches	East Texas	Nacogdoches
Navasota Municipal Airport	Grimes	Central Texas	Navasota
New Braunfels Regional	Comal	South Texas	New Braunfels
Newton Municipal	Newton	East Texas	Newton
Odessa-Schlemeyer Field	Ector	West Texas	Odessa
Olney Municipal	Young	North Texas	Olney
Orange County Airport	Orange	Panhandle	Orange
Ozona Municipal	Crockett	West Texas	Ozona
Dan E Richards	Cottle	North Texas	Paducah
Palacios Municipal Airport	Matagorda	Upper Gulf Coast	Palacios
Palestine Municipal Airport	Anderson	East Texas	Palestine
Perry Lefors Field	Gray	Panhandle	Pampa
Panhandle-Carson County Airport	Carson	Panhandle	Panhandle
Cox Field	Lamar	East Texas	Paris
McKinley Field	Frio	South Texas	Pearsall
Pecos Municipal	Reeves	West Texas	Pecos
Perryton/Ochiltree County Airport	Ochiltree	Panhandle	Perryton
Pineland Municipal Airport	Sabine	East Texas	Pineland
Yoakum County Airport	Yoakum	West Texas	Plains
Hale County	Hale	West Texas	Plainview
Pleasanton Municipal Airport	Atascosa	South Texas	Pleasanton
Mustang Beach	Nueces	South Texas	Port Aransas
Port Isabel Cameron County Airport	Cameron	South Texas	Port Isabel
Calhoun County Airport	Calhoun	South Texas	Port Lavaca
Charles R Johnson	Willacy	South Texas	Port Mansfield
Post/Garza County Airport	Garza	West Texas	Post
Presidio Lely international	Presidio	West Texas	Presidio
Quanah Municipal	Hardeman	North Texas	Quanah
Refugio County Airport-Rooke Field	Refugio	South Texas	Refugio
Rio Grande City Municipal Airport	Starr	South Texas	Rio Grande City
Northwest Regional Airport	Denton	North Texas	Roanoke
Robert Lee	Coke	West Texas	Robert Lee

Airport	County	Region	Associated City
Nueces County Airport	Nueces	South Texas	Robstown
H H Coffield Regional	Milam	Central Texas	Rockdale
Aransas County Airport	Aransas	South Texas	Rockport
Edwards County Airport	Edwards	South Texas	Rocksprings
Ralph M. Hall/Rockwall Municipal Airport	Rockwall	North Texas	Rockwall
Fisher County Airport	Fisher	West Texas	Rotan/Roby
San Angelo Regional-Mathis Field	Tom Green	West Texas	San Angelo
Kelly Field	Bexar	South Texas	San Antonio
San Antonio International	Bexar	South Texas	San Antonio
Stinson Municipal	Bexar	South Texas	San Antonio
San Augustine County	San Augustine	East Texas	San Augustine
San Marcos Regional	Travis	Central Texas	San Marcos
San Saba Municipal Airport	San Saba	Central Texas	San Saba
Gaines County Airport	Gaines	West Texas	Seminole
Seymour Municipal Airport	Baylor	North Texas	Seymour
City of Shamrock	Wheeler	Panhandle	Shamrock
Sherman Municipal	Grayson	North Texas	Sherman
North Texas Regional Airport	Grayson	North Texas	Sherman/Denison
Alfred C. Bubba Thomas Airport	San Patricio	South Texas	Sinton
Slaton Municipal	Lubbock	West Texas	Slaton
Smithville Crawford Municipal Airport	Bastrop	Central Texas	Smithville
Winston Field	Scurry	West Texas	Snyder
Sonora Airport	Sutton	West Texas	Sonora
Major Samuel B Cornelius Field	Hansford	Panhandle	Spearman
Arledge Field	Haskell	West Texas	Stamford
Stanton Municipal	Martin	West Texas	Stanton
Stephenville Clark Regional Airport	Erath	North Texas	Stephenville
Sulphur Springs Municipal	Hopkins	East Texas	Sulphur Springs
Sunray Municipal	Moore	Panhandle	Sunray
Avenger Field	Nolan	West Texas	Sweetwater
T-Bar Airport	Lynn	West Texas	Tahoka
Taylor Municipal	Williamson	Central Texas	Taylor
Teague Municipal Airport	Freestone	Central Texas	Teague
Draughon-Miller Central Texas Regional Airport	Bell	Central Texas	Temple
Terrell Municipal Airport	Kaufman	North Texas	Terrell
Texarkana Regional Airport-Webb Field	Bowie	East Texas	Texarkana
Throckmorton Municipal	Throckmorton	West Texas	Throckmorton
City of Tulia/Swisher County Municipal	Swisher	Panhandle	Tulia
Tyler Pounds Regional	Upton	West Texas	Tyler

Airport	County	Region	Associated City
Garner Field Airport	Uvalde	South Texas	Uvalde
Culberson County	Culberson	West Texas	Van Horn
Oldham County	Oldham	Panhandle	Vega
Wilbarger County Airport	Wilbarger	North Texas	Vernon
Victoria Regional	Victoria	South Texas	Victoria
McGregor Executive	McLennan	Central Texas	Waco
TSTC Waco	McLennan	Central Texas	Waco
Waco Regional	McLennan	Central Texas	Waco
Marian Airpark	Collingsworth	Panhandle	Wellington
Mid Valley	Hidalgo	South Texas	Weslaco
Wharton Regional Airport	Wharton	Upper Gulf Coast	Wharton
Wheeler Municipal	Wheeler	Panhandle	Wheeler
Kickapoo Downtown	Wichita	North Texas	Wichita Falls
Sheppard AFB/Wichita Falls Municipal	Wichita	North Texas	Wichita Falls
Van Zandt County Regional Airport	Van Zandt	East Texas	Wills Point
Winkler County	Winkler	West Texas	Wink
Chambers County-Winnie Stowell	Chambers	Upper Gulf Coast	Winnie/Stowell
Winnsboro Municipal Airport	Franklin	East Texas	Winnsboro
Winters Municipal	Runnels	West Texas	Winters
Tyler County	Tyler	East Texas	Woodville
Yoakum Muni	DeWitt	West Texas	Yoakum
Zapata County Airport	Zapata	South Texas	Zapata

APPENDIX C:
GLOSSARY

Air Transportation—industries and job titles that relate to the transport of goods and people by air.

Aircraft Support Activities—the maintenance of aircraft and related equipment. Businesses included in this category are general aircraft maintenance and air traffic control.

Airport Activity—activity that is directly related to the operation of the airport and related facilities, including the terminal building(s) and runway(s). Airport activity does not include activity related to businesses on airport (see **Tenant Activity)**.

Airport Sponsor—an airport's owner/operator, including a city, county, or state.

Annual Operating Expenses—operating expenses can be divided into four categories: airfield area expenses, terminal expenses, hangars and other buildings and grounds expenses, and general and administrative expenses.[1]

Capital Expenses—represent construction improvements made to the airport, in terms of runway rehabilitation or terminal improvements.

Commercial Service Airport—a publicly owned airport that has at least 2,500 passenger boardings each calendar year and receives scheduled passenger service.

Employment—full- and part-time jobs offered by airports or business owners, with part-time jobs being calculated to create a full-time equivalent number of positions.

Enplanement—a person boarding in the United States in scheduled or nonscheduled service.

General Aviation Airport—a public-use airport that does not have scheduled service or have less than 2,500 annual passenger boardings.

I/O Model—a type of applied economic analysis that tracks the interdependence among various producing and consuming sectors of an economy. More particularly, it measures the relationship between a given set of demands for final goods and services and the inputs required to satisfy those demands.[2]

Itinerant Operations—the takeoff or landing of airplanes going from one airport to another.

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[1] Aviation World. Airport Financial Management. http://worldaboutaviation.blogspot.com/2012/01/ch8-airport-ainancial-management.html.

[2] IMPLAN. Input-Output (I-O) Analysis. https://implanhelp.zendesk.com/hc/en-us/articles/115009666948-Input-Output-I-O-Analysis.

Multipliers—a measure of an industry's connection to the wider local economy by way of input purchases, payments of wages and taxes, and other transactions.[3]

Output—goods and services that are generated by the airport on an annual basis, expressed in dollar amounts.

Payroll—the expenses related to salaries, wages, and benefits earned by all employees and business owners at the airport.

Tenant Activity—on-airport activity that is not managed or run by the airport itself, including airport tenants that are businesses with employees, such as airlines, fixed-base operators, concessionaires, and flight schools.

Visitor Activity—typical spending per person for a stay in that region.

[3] IMPLAN. Multipliers. https://implanhelp.zendesk.com/hc/en-us/articles/115009499487-Multipliers.