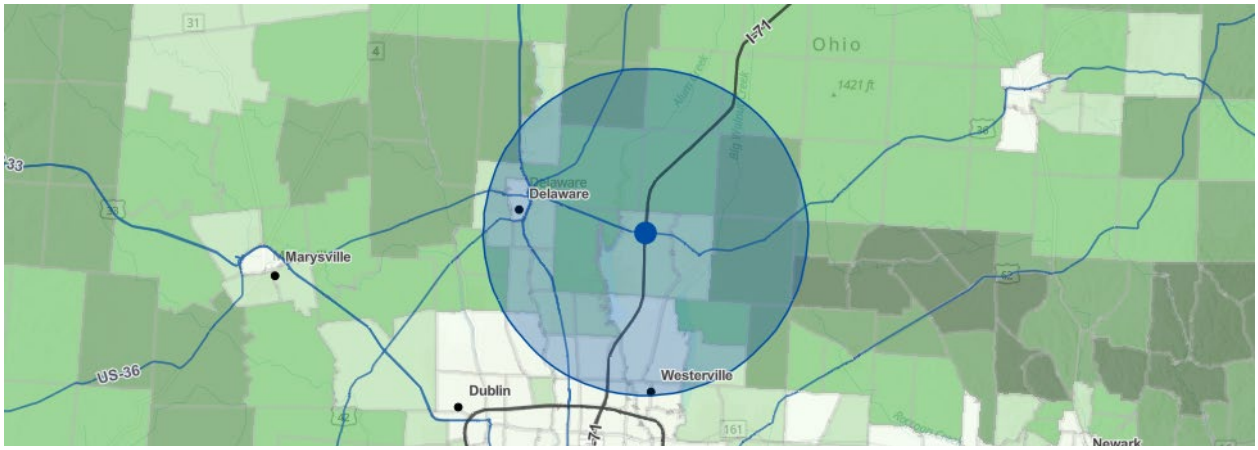
Economic Development Impact of ODOT Funding on Public Roadways



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Prepared for:
The Ohio Department of Transportation,
Office of Statewide Planning & Research

Project ID Number: *118083*

April 2024

Final Report

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RESEARCH

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U.S. Department of Transportation
Federal Highway Administration

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA/OH-2024/07		

4. Title and Subtitle	5. Report Date
Economic Development Impacts of ODOT Funding on Public Roadways	April 2024
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
Chandler Duncan, Prasanna Humagain, Dr. Zhenhua Chen, Nathan Strum, Chris Williges, Greg Giaimo	

9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Metro Analytics, LLC 14030 Harvington Dr. Huntersville, NC 28078	
	11. Contract or Grant No.
	39165

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
Ohio Department of Transportation 1980 West Broad Street Columbus, Ohio 43223	Final Report
	14. Sponsoring Agency Code

15. Supplementary Notes

Research is accompanied by the EDIT Geodatabase tool provided on ODOT server in an ESRI Experience Builder, an educational playbook, a quick-start guide, a glossary of terms and a compendium of supportive findings delivered on 14 February, 2024.

16. Abstract

While the Ohio Department of Transportation (ODOT) has several models that quantify the economic benefits and impacts of its investments, the Economic Development Impact Tool (EDIT) is the unique product of national research in market access, development capacity, and historical economic performance. A review of national literature and existing ODOT models provides the foundation for an interactive evidence-based process to assign new business attraction potential to ODOT projects and project areas. Findings include an overview of how the national body of literature applies to development settings faced by ODOT, observations of where development capacity, labor market access and freight market access are most sensitive to ODOT system performance, and empirical findings from a Machine-Learning model of economic responses to ODOT's investments over 10-20 years. Future research areas identified include expansion of the EDIT resources to address freight and transit access, international gateways and controlling for competing development sites within Ohio.

17. Keywords	18. Distribution Statement
Economic Development, Job Impact, Economic Impact, Transportation Economic Impact, GDP Impact, Development Capacity, Labor Market Access, Freight Market Access, Network Connectivity Impact, Predictive Transportation Economic Modeling.	No restrictions. This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classification (of this report)	20. Security Classification (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	19	$372,961.31

Form DOT F 1700.7 (8-72) Reproduction of completed pages authorized

Credits and Acknowledgments Page

Prepared in cooperation with the Ohio Department of Transportation
and the U.S. Department of Transportation, Federal Highway Administration

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Problem Statement

Knowledge & Research Need: The Ohio Department of Transportation (ODOT) requires a holistic tool to assess the impact of its highway investment choices on economic development throughout the state.

Gap in Existing Practice: While economic considerations play a role in ODOT's decision-making, its previously existing tools have focused more on individual statewide project performance than the local/regional development process where the project occurs. The department has required a consistent resource that goes beyond the previously existing methods applied in the Transportation Review Advisory Council (TRAC) economic performance scoring (which have addressed job creation, jobs served, gross state product impacts, and economic distress) as well as the local development investments scoring (such as existing local streets, water and sewer infrastructure and other complementary development investments).

Expectations for New Tool: The new tool has been expected to support project development in ways more specific and focused than the overall economic impact model included in the current update of ODOT's Economic Impact Module (EIM) of the Ohio Statewide Travel Demand Model (OSTM). Most notably, the new tool is required to consider the potential for *localized* business attraction following a project based on business conditions in the project context, historical performance of the local economy, and demonstrated responsiveness to state transportation investments over time.

Use-Cases: ODOT is expected to have a wide range of use-cases for the new tool. The research findings and associated tools can be applied by ODOT staff with diverse levels of technical expertise whenever ODOT is in dialogue with local planning or development stakeholders about the role an ODOT project or program can play in their ability to attract, create, retain, or expand business and associated tax base in an area. The project equips ODOT to answer the question "if we build it, will they come?" (and why).

Challenge #1: Reconcile State and Local Transportation Economic Perspectives: A principal challenge with ODOT's current economic intelligence is reconciling the importance of statewide transportation efficiency impacts with local opportunities to expand or diversify the economic base (even if placing additional demands on the state's transportation network). Factors such as local development capacity, the ability to leverage existing assets, and the unique labor and supplier market opportunities of local development sites must be reconciled with the broader economic perspective of ODOT's existing models which apply general modeling principles across the state.

Challenge #2: Address Development Capacity: ODOT's previously existing models have allocated overall forecasted economic activities into localized areas based on changes in accessibility and overall statewide projected growth of industries. However, factors of local growth such as capacity of local infrastructure factors identified in TRAC, workforce, supporting services or site-specific factors of the type identified in ODOT's START project are known to be key determinants of the economic implications of ODOT's investments. This research product integrates these resources in ways that readily identify where there is the greatest capacity and potential for impact from ODOT's program.

Challenge #3: Transparent and Ease of Use: ODOT's previously existing economic tools have been sophisticated, and often embedded into larger analytical processes. It has not been transparent to ODOT project development staff or local stakeholders how this information can answer questions

about specific local project opportunities. The tool resulting from this research provides an interface that is intuitive, transparent and that will answer practical questions about business conditions associated with projects in ODOT's program.

Success: The primary success factor is the development of a tool that adds value to ODOT's larger body of economic analysis resources while extending their view of project performance and impact to address factors and opportunities most relevant to local development and site prospect context.

Research Background

This section outlines the goals and objectives of the research along with a brief description of how the findings and resources created to build on (1) ODOT's existing research and tools as well as (2) the nationally published research on economic and land use impacts of transportation investment.

Goals: The goal of this research is to assist ODOT in making better decisions regarding transportation project selection as well as provide an understanding of how ODOT's investments affect economic development across the State. The goal is to provide this assistance by developing a methodology and tool to assess project-specific local economic development impacts of ODOT funding choices.

Objectives: The objectives of this research include the following:

- Define the economic impact of Ohio's transportation infrastructure systems.
- Quantify the economic impacts of past investments to forecast future impacts.
- Analyze economic outcomes of transportation investments.
- Develop a quantitative tool that can be used during the project development phase to estimate the effects of transportation investments on economic vitality.

The research builds on a large body of Ohio's research and tools as well as the national published research on the economic and land use impacts of transportation investments. While there are significant documented tools and methods within ODOT and nationally, ODOT has not previously had a tool that consistently applies transportation, economic and development impact methods to the unique mix of economic development, business attraction, creation, expansion and retention prospects of sites and communities in Ohio and the associated fiscal and economic implications for decision-making.

ODOT Tools and Resources

The following is a summary of ODOT's internally available economic impact tools and methods integrated into the current research.

ODOT Statewide Travel Demand Model (OSTM): ODOT's STM produces both traditional volume metrics as well as land-use forecasts as a side-effect of its forecasting methodology. Model data and forecasts exist in 5-year increments from 2010 to 2050. The land-use models are simple allocation models that work from county control totals provided by IMPLAN/TREDIS and the Ohio Department of Development. The models start with traffic analysis zone level (3660 in-state zones) households (from Census), employment (from QCEW/BEA), and land-use acreages. The models then pivot off these base TAZ-level data by allocating county-level growth with transport accessibility influencing this allocation. The base land-use data was assembled from parcel data where available and then modeled using observed relationships in other areas, but it has not been updated in over 15 years. This data contain both building floorspace by development type

(agriculture, residential, industrial, etc.) and acreages by the same types. The land-use acreages are further segmented by vacant/developed and vacant acreage is further segmented by the existence of water/sewer service, 100-year flood plain, and slope (level, moderate, severe). The model includes a calibrated land consumption rate equation for each industry as well as an asserted land transition matrix that prioritizes which categories of land will be converted to satisfy excess demand in a zone. The household data is maintained by household size and income.

Quantifying Economic Impacts of ODOT Projects: ODOT has developed several tools to conduct economic analysis using the OSTM. The first, called CMSCOST, was developed as an extension of ODOT's congestion management/air quality post processor and implements the AASHTO User Benefits for Highways methodology to monetize direct user benefits from savings in travel time, vehicle operating costs, and crashes. An extended methodology incorporating features from HERS-ST (Highway Economic Requirements – State), called UCOST, was implemented by consultants. However, UCOST requires additional files produced during the travel demand model run beyond the final assigned network so to date it has not been used for systemwide benefit-cost analysis. Thus, UCOST has only been run for project-specific evaluations. Likewise, two Economic Impact Models (EIMs) were developed. The first is a spreadsheet model that takes simple VMT (Vehicle miles traveled)/VHT (Vehicle hours travelled) type inputs from the travel demand model runs and the second is a full EIM that can be run in concert with the travel demand model. As with UCOST, the full EIM has not been used for system-wide evaluations. However, the spreadsheet model is still used to arrive at system-wide economic benefit and impact estimates for use in ODOT's Transportation Review Advisory Council (TRAC) prioritization scoring. The full EIM has only been used for project-specific analyses. EIM is in the process of being replaced with native TREDIS (Transportation Economic Development Impact System) because it was due for an update since it is about 10 years old and because IMPLAN (Economic Impact Analysis for Planning) licensing changes made a stand-alone hosted solution infeasible.

The TRAC process is the prioritization process used for major new investments of all types. The OSTM and related economic tools described earlier are used as part of the evaluation of the projects submitted to the TRAC. However, TRAC includes various other metrics related to economic development. The scoring policy delineating these metrics can be found in ODOT's TRAC Policy.

National Best Practice and Published Literature

There is a long-standing and growing academic literature on models for addressing the impact of transportation investment on the economy. The research here is categorized into (1) models quantifying transportation impacts on economic development and (2) those quantifying transportation impacts on land development.

Transportation Economic Impact Methods: The AASHTO "Redbook" (1) has been the standard for quantifying the user and non-user benefits of transportation investments. However, the Redbook does not address wider impacts on jobs, business attraction or business vitality, land value, or factors such as productivity gains due to market access or the value of social equity improvement. The most common tools for assessing wider economic impacts of transportation include the general equilibrium model from Regional Economic Models Incorporated (REMI) with its Tran Sight interface, and the Transportation Regional Economic Development Information System (TREDIS) – an IMPLAN based input-output model currently used by ODOT in the above-mentioned EIM. Publications on the methods by which these models are applied date back over

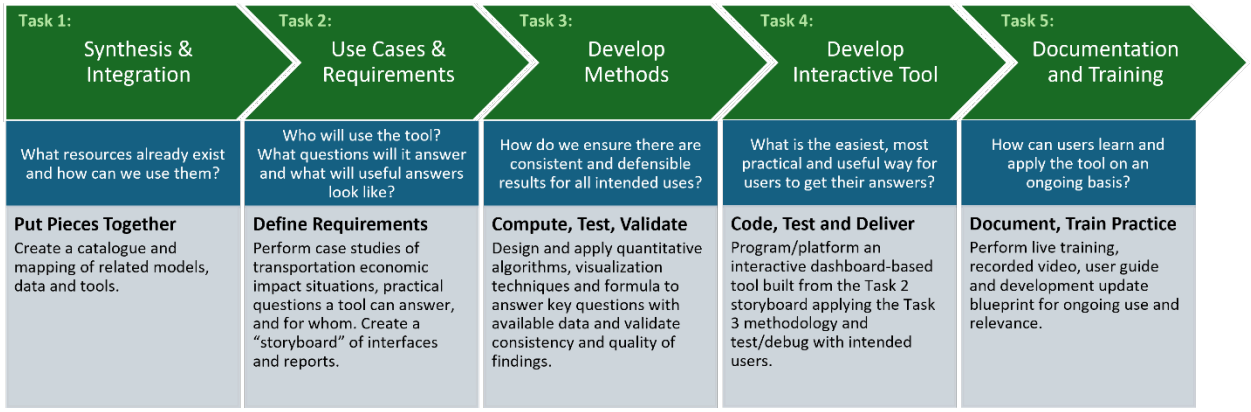
twenty years. They include Litman (2) who has published methods relating to how different transportation investment patterns may support or discourage urban sprawl and associated costs, Geurs & Ritsema (3) Weisbrod & Alstadt et. Al. (4) who have published on accessibility measures as predictors of economic performance and land development, Weisbrod (5) who offers guidance for selecting quantitative transportation economic impact techniques, Laird, Nelthorpe et. Al. (6) who have published on the network effects of transportation investments on economic performance. Both Kim, Ham et. Al (7) and Ooosterhaven, Heejo & Boyce (8) offer contrasting methods that combine travel network and input-output economic analysis techniques. Hudelson & Prim (9) have offered a long-standing assessment of transportation economic impact methods at both the regional and local level, and Hiatao (10) offers a comprehensive review of the treatment of different transportation market segments in input-output models.

Transportation Impact on Land Development: There is a series of "bid-rent" models that have been developed for use by public agencies which match development constraints "rents" against accessibility and other amenity attractors "bids." Models like the Diameter, UrbanSim, and CubeLand platforms utilize "bid-rent" methods to estimate how the likelihood of development in a traffic analysis zone will respond to changes in access resulting from a transportation improvement. This is the type of model listed above applied in the OSTM. Representative academic research supporting transportation-land development models include Badoe and Miller (11) have published empirical findings on the transportation-land-land use interactions and implications for modeling, in a publication underlying many of today's bid-rent models. Polzin (12) published similar work earlier in 1999 and even before that Litman (13) has published conceptual research on evaluating transportation and land use impacts. An overview of these models as they were coming into place in the early 21st century can be found in Iacono, Levinson and El-Geneidy's (14) 2008 guide.

Research Approach

The goals and objectives of the research are achieved through a sequence of 5 tasks, as described in the following Figure 3-1. The subsequent section contains an elaborate overview of each task along with their respective research outcomes. Each task is accompanied by a separate report and incorporated in the final deliverable document for ODOT.

Figure 3-1: Tasks, Questions and Activities



Task 1: Synthesis and Integration

Task 1 has addressed the consistent integration of all of Ohio's existing models, tools, prior studies, data, and other resources into a structure that can (1) serve as inputs/resources for the tool as well as (2) points for validation and consistency in its application. Task 1 involves examining the economic analysis tools presently utilized within ODOT and across the nation. Task 1 also has included interviewing ODOT personnel to understand the functionalities and constraints of the existing tools and datasets. Task 1 yielded observations that available economic tools and resources require a considerable number of inputs, possess longer processing times, and require technical expertise. Furthermore, very few tools are helpful in evaluating the location of new economic activity drawn to a project site, or identifying sites or facilities that are likely to play a role in business location choices. These limitations have been addressed by developing a tool requiring a limited amount of user inputs and being able to derive the projects' economic performance impacts as well as the business attraction, creation, expansion, or retention likelihood.

Through a combination of interviews and a literature review, a conceptual map of ODOT's transportation economic decision-making ecosystem has been constructed. This map links internal ODOT programs (like TRAC, Jobs & Commerce, and TIP) and associated entities (such as MPOs, RTPOs, and ODOT Districts) with pertinent tools and methodologies that address key economic questions for planning, prioritization, and grant applications. Task 1 findings have included a structure for the economic tool ensuring its integration with ODOT's current data and analytical resources.

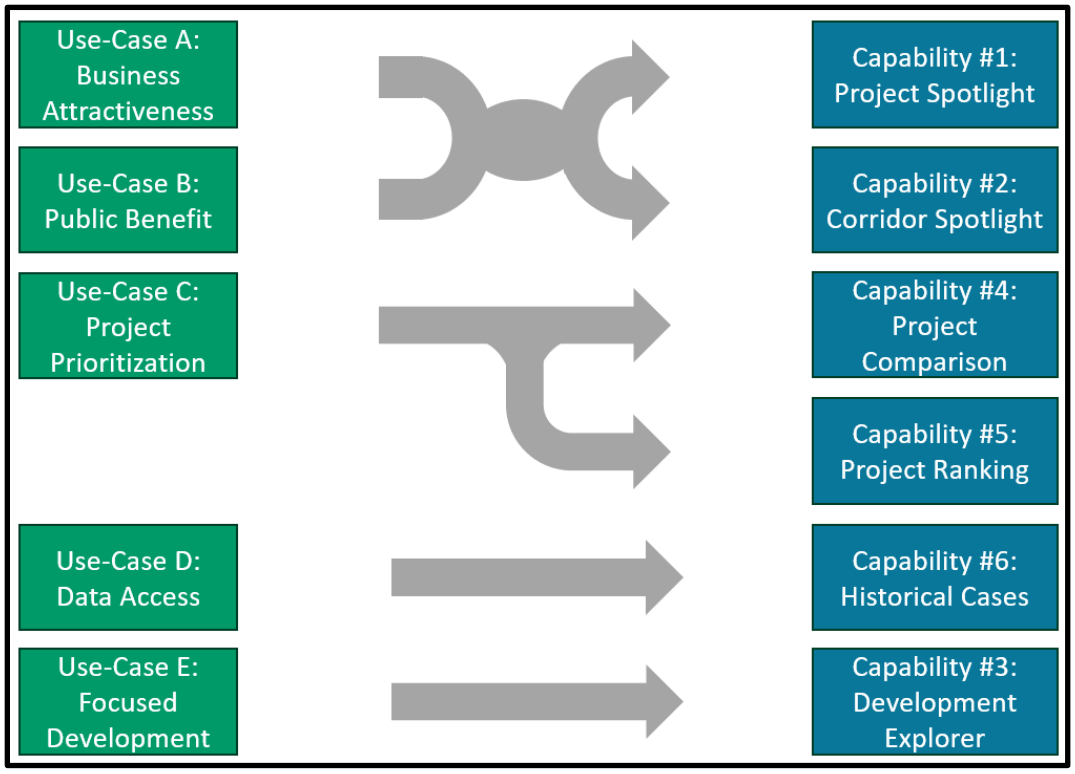
Task 2: Use Cases & Requirements

Task 2 has explored Ohio's experience of economic development impacts from transportation investments through case research into (1) transportation investment decisions where the potential for local/regional economic development has been a consideration, and (2) the observed outcomes of those situations. While the methodology of the tool is not primarily case-based (Task 3 explores the role of historical data in assessing impacts), case research has played a key role in both validating the tool and specifying its requirements. Case examples in Task 2 have been used to define use-cases for the tool and serve as a starting point for aligning the tool's capabilities with intended user goals. The case studies have been selected to ensure (1) a mix of urban, suburban, small-town, and rural project settings, (2) a mix of expansion, modernization, and preservation investments, (3) a mix of different geographic ODOT regions across the state, and (4) a mix of passenger and freight-intensive projects.

The findings of Task 2 have identified primary users of the tool as planners and decision makers within ODOT whose goal is to provide a consistent and easily defensible basis for articulating the department's conclusions regarding its role in business attraction, creation, retention, and expansion within the overall context of the public benefits of its program. The resulting use-cases describe a set of questions that ODOT may ask the proposed economic tool to help answer the question "if we build it, will they come?" Figure 3-2 maps the use-cases to potential tool capabilities. These capabilities map one-to-one with the use-cases with some exceptions. Use-cases A and B describe two types of analyses (business attractiveness and public benefit) that users may want to conduct. Users will want to see the results of both sets of analyses at the same time. The first set of tool capabilities combines these use-cases and provides two levels of analysis for exploring answers – project level and corridor level. Similarly, use-case C may be implemented as a comparison of two projects or a

ranking of multiple projects. These tool capabilities are described further in the research findings section that follows.

Figure 3-2: Development of Tool Capabilities from use-cases.



Task 3: Develop methods

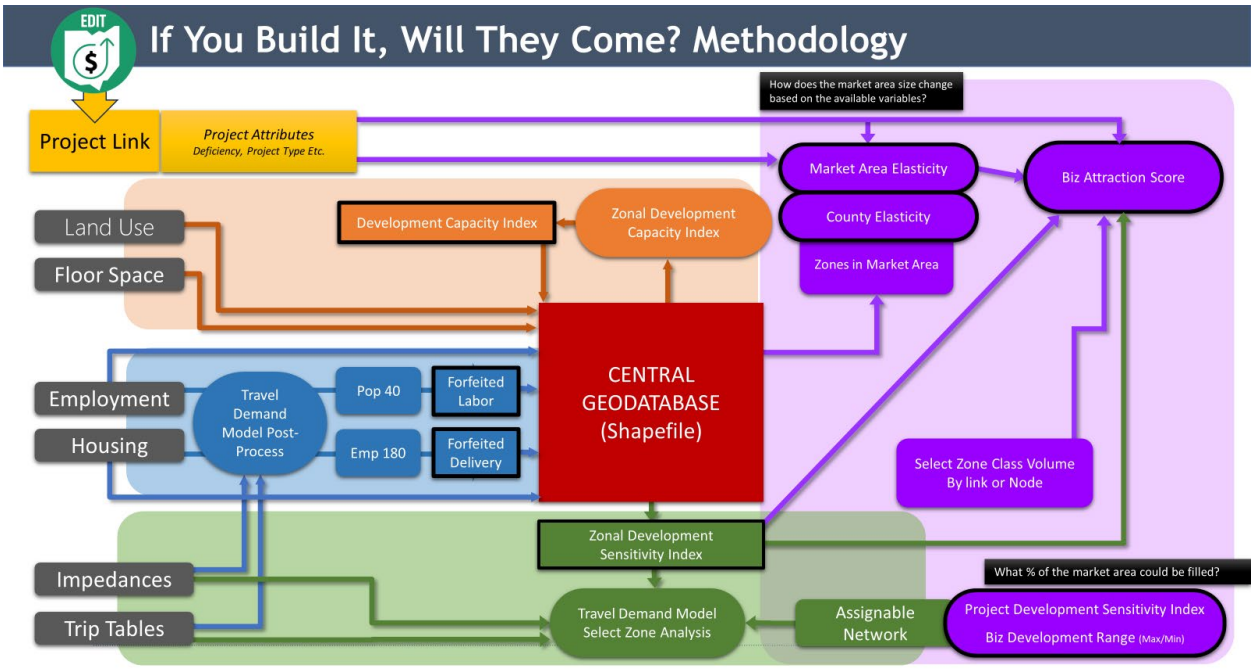
The Task 3 objective has been to document the methodology by which an economic development impact model and tool will assess and explain the potential localized development impacts of ODOT's projects and overall program. A key outcome of Task 3 includes a methodology for the tool to answer "If you build, will they come" based on the Task 1 findings which defined the requirements for the tool, and Task 2 findings which identified practical applications, capabilities, and test cases.

To address the question of business attraction (parochially phrased as "if we build it, will they come?") the methodology resulting from Task 3 applies a set of criteria that are color-coded in the overall tool design to emphasize how each criterion found in the literature review is established, tested, and applied for any given ODOT investment, as shown in Figure 3-3. In keeping with the literature cited in Task 2, the tool is predicated on the understanding that for an ODOT investment to support new business attraction/location in the area served:
(1) the area must have developable land or vacant land eligible for development (with street access, water, sewer, and other amenities) (Orange System),
(2) the area must currently be missing some level of otherwise possible labor or business activity due to constraints in the transportation system (Blue System),
(3) the project must be on routes that can serve such areas and be shown to improve in its ability to do so (Green System), and

(4) the project must be in an overall local economic system that has an occupational and industry mix historically shown to be responsive to ODOT investment (Purple system).

A detailed explanation of each system will be provided in the following research findings section. A key result of Task 3 has been the creation of a central geodatabase, utilizing traffic analysis zone (TAZ) as the unit of analysis along with parameters from a machine-learning enabled model of how Ohio's county economies have historically responded to state transportation outlays.

Figure 3-3: Overall Methodology



Task 4: Develop interactive tool

Task 4 has entailed encapsulating the methodology into an interactive and easy to understand dashboard-style tool consistent with the storyboard offered in Task 2. Considering the specified tool requirements, the complexity of data and calculations, and the existence of the ArcGIS server within ODOT, ArcGIS Experience Builder has been determined as an appropriate platform. Task 2 has entailed creating the interactive tool in ArcGIS Experience Builder with the central geodatabase as its core component, complemented by various Excel tables that support different functionalities. The interactive tool and its application of the herein described research is named EDIT – *Economic Development Impact Tool*. The interactive EDIT tool houses five capabilities to answer questions relevant to ODOT decision makers:

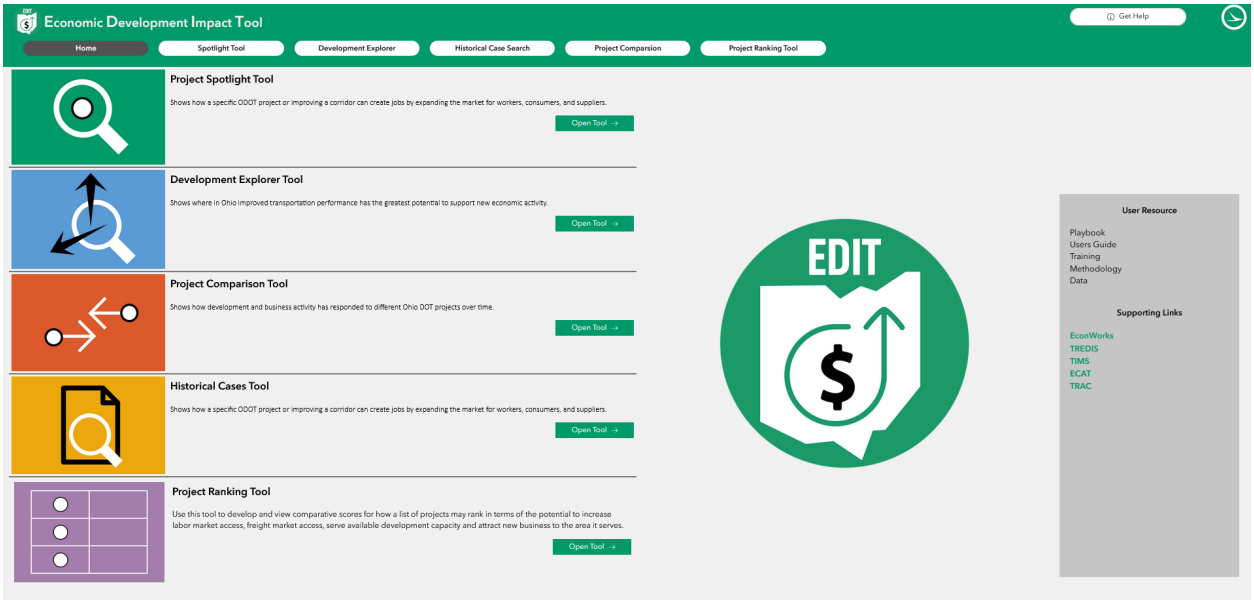


Figure 3-4: Functional capabilities present in EDIT Tool

(1) ***Project Spotlight***: Shows how a specific ODOT project or improving a corridor can create jobs by expanding the market for workers, consumers, and suppliers.
(2) ***Development Explorer:*** Shows where in Ohio improved transportation performance has the greatest potential to support new economic activity.
(3) ***Project Comparison:*** Shows how development and business activity has responded to different ODOT projects over time.
(4) ***Historical Cases:*** Shows how a specific ODOT project or improving a corridor can create jobs by expanding the market for workers, consumers, and suppliers.
(5) ***Project Ranking***: Shows comparative scores for how a list of projects may rank in terms of the potential to increase labor market access, freight market access, serve available development capacity, and attract new business to the area it serves.

Task 5: Documentation and Training

Task 5 has provided ODOT with documentation and training resources for ongoing use of the tool. The task findings/results include the following elements:

1. *Quick Start Guide and Playbook*: A written quick starter's guide walking through each capability and how to use them is provided. A more detailed description of findings and analysis is provided in a playbook that includes appropriate use cases, data inputs, user procedures and outputs, and interpretations from EDIT.
2. *Interactive Training*: The research provides for one facilitated training session either in Columbus or virtually for ODOT staff as well as three alternative dates for virtual training to be offered directly by the research team – and recorded with video recordings of training offered as leave-behind deliverables for ongoing ODOT use.
3. *System Updates:* A development blueprint with relevant methodology and expressions used for the development of the tool along with necessary steps to be taken to update the tools once newer socio-economic and models' data are available.
4. *Geodatabase and Update Instructions:* All the relevant shapefiles and Excel tables used for the development of EDIT are provided.

Tasks 1 through 5 advance the research systematically by initially identifying the gaps in the existing economic analysis tools (Task 1), determining the users and functionalities of the tool through different use cases (Task 2), developing a holistic methodology to answer the question of "If you build, will they come" through different colored systems (Task 3), transforming the methodology into an interactive ArcGIS Experience Builder tool (Task 4), and providing training and documentation for using the tool (Task 5). A more detailed exploration of concepts and findings from each of the tasks is provided in the subsequent section's research findings.

Research Findings

This section delves deeper into the research outcomes derived from tasks 1-5, while also offering statewide perspectives from the research underlying the EDIT research.

Initial Concepts: Context and Benefits/Impacts

An important consideration when engaging the "If we build it, will they come?" question is the relationship between benefits and wider impacts. An economic benefit is a net gain to society resulting from the ODOT project – always measured in dollar terms. By contrast, a wider economic impact considers how the economy will respond to the benefit in further transactions. In economic terms, wider impacts are associated with transactions (such as hiring workers, paying wages, or banking profits). If ODOT can reduce congestion in Columbus, enabling manufacturers in the area to save $5 Million over 20 years in what they pay for supplies– the $5 Million does not come at the expense of any other stakeholder, the $5 Million business savings is a benefit to Ohio's economy. However, if the businesses use the $5 Million over 20 years (or $250,000/year) to hire 5 workers at a wage of $50,000/year, and those workers produce $100,000/year worth of goods and services, for which the business retains a $20,000/year in profit – then the benefit has supported a wider economic impact that can be measured in these transactions.

While some projects can provide economic benefits regardless of where they occur, impacts on localized job creation and economic development depend on where the project is located. For a business to be attracted to an area, certain "ingredients" must be present. Employment growth requires an area to have (1) capacity to develop, (2) available workforce to take jobs that are made available, (3) available supplier's workers can use to make and sell goods and services, and (4) customers to purchase and use what is made.

The literature review in Task 2 finds that ODOT cannot spontaneously create any of the above ingredients of business attraction through its program, nor can it cause the ingredients to generate economic activity where they are already present but not present in a competitive way. However, ODOT's program can remove obstacles to development in areas where the ingredients exist, especially in areas where the economy has historically been shown to be responsive to state transportation infrastructure investment. To evaluate these opportunities – ODOT staff can ask:

1. Is an ODOT improvement needed to support the ingredients of business attraction; and
2. Is the investment in a local economy known to exhibit job growth due to state transportation investment?

Is Improvement needed? While capacity to develop and workforce/supplier activity are needed to attract, create, retain, and expand jobs in an area, not all ODOT projects undertaken where these

factors are present will result in new jobs or economic activity. Suppose these ingredients are already present, unimpeded by any transportation performance issue in the purview of ODOT's program, and economic activity is not occurring. In such a case, it is unlikely that an action of ODOT will attract development. For example, if an area has an ample accessible workforce, a robust freight delivery market, and plenty of sites with capacity to develop – then it is likely that ODOT is already providing sufficient transportation for commuters and freight, and other factors should be explored to stimulate economic activity before turning to ODOT's program. By contrast, if congestion or a lack of connectivity greatly limits how many workers can access a site in peak periods, bottlenecks reduce the number of suppliers that can reach a site that would otherwise be accessible, and eligible development sites do not have direct or convenient access points to the state transportation system – there could be significant opportunities for ODOT to enhance the ingredients for business attraction.

Development Capacity

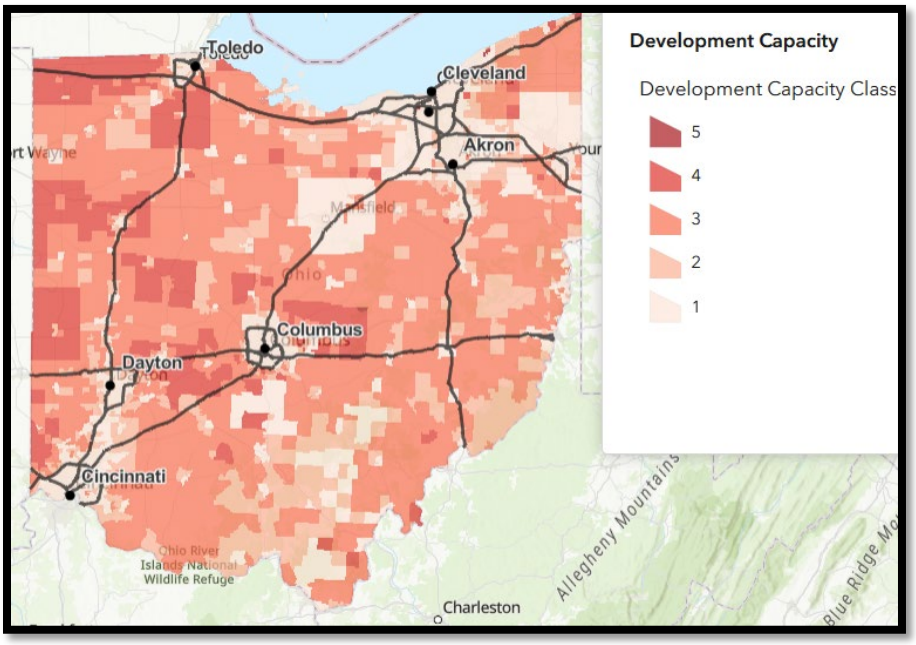
The term "development capacity" is defined as the proportion of land that is equipped with proper facilities (water/sewer) and is free of constraints (such as flood plains or extreme slopes). Hence, development capacity can be understood as a function of vacant land with utilities, agriculture, and farmstead land within the vicinity, and the density of an area. The drawback of this methodology lies in its failure to sufficiently account for the potential redevelopment of already occupied land, aside from factoring in density when calculating development capacity.

Development capacity for each TAZ in Ohio is calculated from the land-use inventory and socioeconomic data present in OSTM (found in Task 2). The OSTM encapsulates land use inventory data that consists of vacant and developed land use by industry type (Residential, Agricultural, Heavy and Light Industry, Government and Institutional, Farmstead, and Other) in a five-year increment from 2010-2050.

$$\boldsymbol{Development\ Capacity} = \boldsymbol{f}(\boldsymbol{Vacant\ land\ with\ utilities, Agricultural\ Land\ and\ Density})$$

Development capacity is important for ODOT because the business attraction potential of an ODOT project either cannot or should not exceed this capacity. In some cases, a project built to attract economic activity in an area lacking capacity will either (1) simply not create or attract jobs due to a lack of space or (2) lead to the area exceeding its capacity, imposing environmental, parking, utility, and other deficiencies on the area. Statewide development capacity maps are readily available in "project spotlight," "development explorer" and "project comparison" tools on the EDIT interface for accessing research findings. Figure 4-1 summarizes the development capacity of ODOT TAZs, demonstrating where in Ohio there is available capacity for sites to accommodate new development if better served by ODOT's network. All of Ohio's TAZs are categorized from 1 to 5 based on their ranking of the zone's overall percentage of Ohio's developable land as documented in OSTM's zonal data. For instance, a TAZ that falls in category 5 indicates that this TAZ is in the top 20% of potential Ohio areas in terms of available capacity for new business to come. An ODOT project serving this area can provide access to an exceptionally high concentration of potential development sites.

Figure 4-5: Development Capacity Score for each TAZ in Ohio



The state of Ohio has more than 11 million acres of developable land, with more than 3 million acres of vacant land with utilities and more than 6 million acres of agricultural and farmstead land. Figure 4-1 demonstrates that highly urban areas in Akron, Cincinnati, Cleveland, Columbus, and Dayton have lower development capacity due to their already dense built environment. Conversely, the areas adjacent to urban centers, and border cities to Indiana have higher development capacity, as shown by dark red patches in Figure 4-1.

Evaluate Labor Markets

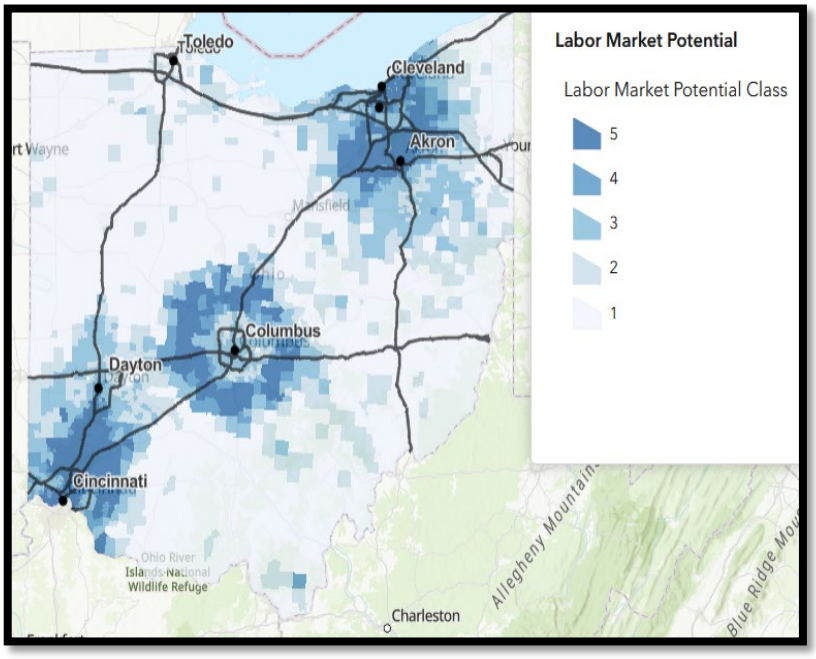
Another key finding of Task 2 has been that labor market access is a key determinant of business attraction. One of the significant ways that an ODOT project can bring jobs to an area is to make the area more accessible to a larger pool of workers. This is achieved by improving traffic operations or capacity, alleviating congestion, and expanding the size of the labor market that can get to a business site. The Task 3 methodology defines "forfeited labor market" as the workforce lost or "forfeited" from the 40-minute commuting shed for a site due to congestion. Effectively, the forfeited labor market is the only part of the labor market that ODOT can directly influence through its investment in transportation performance. This methodology does not account for the accessibility of the workforce due to alternative transportation modes such as transit, walking, and biking. Forfeited labor can be expressed in both numbers and percentages as described below:

$$\boldsymbol{Forfeited\ Labor\ Market}\ (\%) = \frac{\boldsymbol{Population\ within\ 40\ minutes\ of\ a\ site\ (Freeflow - Congested)}}{\boldsymbol{Population\ within\ 40\ minutes\ of\ a\ site, Freeflow}} * \mathbf{100}\%$$

The OSTM can estimate congested and free-flow travel times between zones (TAZs) for diverse types of travel (auto or truck). These time estimates are captured in a matrix with both free flow (uncongested) and congested travel times for every potential origin-destination trip in Ohio. The OSTM also includes information about the socio-economic attributes, the most relevant are total

population and total employment within each TAZ. Using socio-economic data and a travel time matrix for cars (representative of commuters), the population within a 40-minute radius is determined for both free flow and congested conditions. This data is then utilized to calculate the forfeited labor market for each TAZ. The labor market potential class (or score) is then assigned a value from 1-5 (areas forfeiting the most labor scored as 5, with the least scored below 1) based on each zone's ranking in its share of Ohio's overall forfeited labor market as shown in (Figure 4-2).

Figure 4-6: Labor Market Potential Ranked Score for each TAZ in Ohio



Labor Market Potential Class	Values
5	> 2655
4	2124-2655
3	1062-2123
2	531-1061

Figure 4-2 reveals that areas surrounding, but not within Ohio's urban centers tend to have a more significant reduction in their labor force due to congestion than the core urban center or entirely rural areas. This pattern is evident in the form of concentric circles surrounding the urban centers of Akron, Cincinnati, Cleveland, and Columbus. ODOT investments in transportation infrastructure around the concentric areas that increase capacity or reduce travel time can allow this affected workforce to access a wider range of employment opportunities, and for the businesses around the region to access a larger pool of workforce. Suburban or rural areas forfeit 68% of the statewide workforce due to congestion, whereas only 30% of the workforce is lost in urban areas due to congestion.

Freight Delivery (Buyer and Supplier) Markets

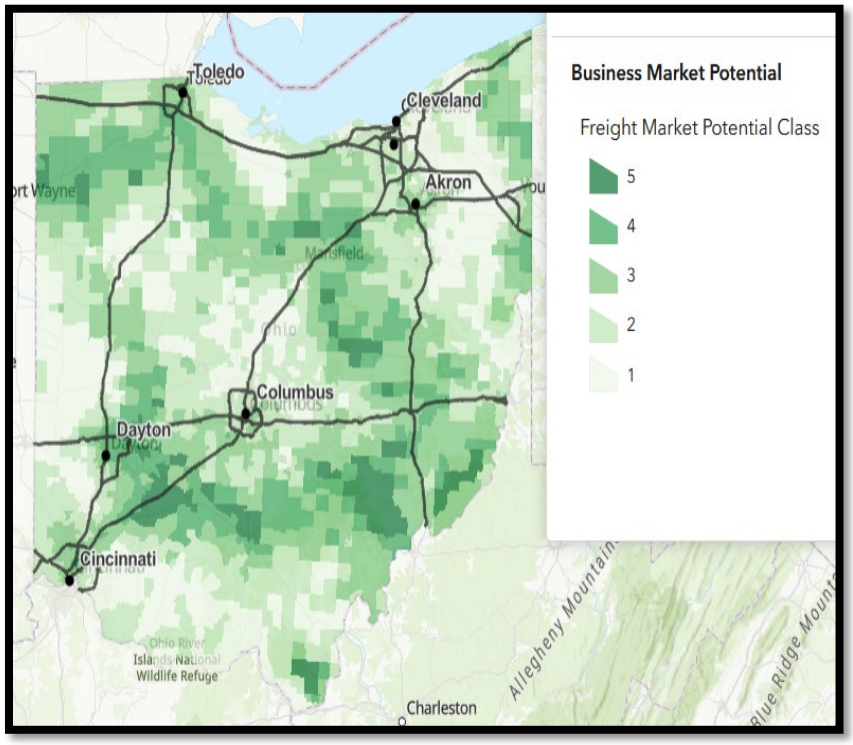
Task 2 literature has found that when transportation systems are congested, disrupted, or discontinuous –the size and quality of the buyer and supplier pool for businesses are reduced. These challenges make the site less productive and less attractive for business activity. Because ODOT cannot improve buyer and supplier market conditions in areas where transportation performance does not affect delivery times, the forfeited freight market is a key consideration when identifying areas where an ODOT project can affect business location. The forfeited freight market is the workforce lost or "forfeited" from a site's same-day (180-minute each-way) delivery shed due to

congestion. Effectively, the forfeited delivery market is the only part of the buyer and supplier market that ODOT can directly influence through its investment in transportation performance. The forfeited delivery market can be expressed in both numbers and percentages as described below:

$$\textbf{\textit{Forfeited Delivery Market}}\ (\%) = \frac{\textbf{\textit{Employees within 40 minutes of a site}}\ (\textbf{\textit{Freeflow}} - \textbf{\textit{Congested}})}{\textbf{\textit{Employees within 40 minutes of a site, Freeflow}}} * \mathbf{100}\%$$

Like the forfeited labor market, the calculation of the forfeited delivery market is also done at a TAZ level, and the same data source OSTM is used. Using socio-economic data and a travel time matrix for trucks (goods are transferred between buyers and suppliers through trucks), employees within a 180-minute radius are determined for both free flow and congested conditions. This data is then utilized to calculate the forfeited delivery market for each TAZ. The delivery market potential class (or score) is then assigned a value from 1-5 based on the distribution of the percentage labor market potential (%) of the entire state (as shown in Figure 4-3). It is important to note that the same-day delivery radius of many Ohio areas extends out of state, such that some areas with the highest forfeiture are not in proximity to Ohio cities but reflect access to multiple cities in the surrounding states as well.

Figure 4-7: Forfeited Delivery Market Ranked Score for each TAZ in Ohio



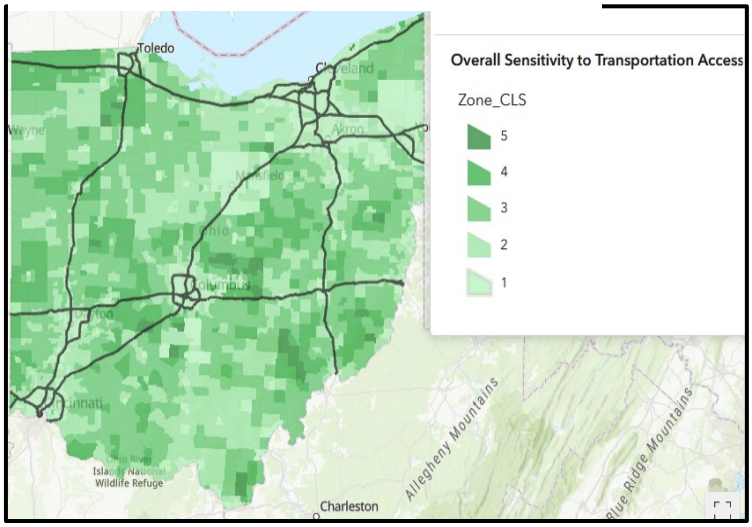
Business Market Potential Class	Value
5	> 4301
4	2688-4301
3	1344-2688
2	710-1344
1	<=710

Figure 4-3 demonstrates that rural areas further from interstates are associated with a greater reduction in their delivery markets due to congestion. This occurs because trucks operate on interstate highways, and congestion on arterial, collector, and local roads results in a reduced ability to access potential delivery markets. Overall, suburban and rural areas forfeit more than 80% of statewide delivery markets due to congestion, whereas only about 18% of the delivery market is lost in urban areas due to congestion.

Consider Non-Local Impacts

While "If we build it, will they come?" is often understood as a question arising in ODOT dialogue with local and regional stakeholders, the answer is not always evident from the ingredients of business attraction near the project. For example, it is possible that an ODOT project could expand the labor and freight markets for many sites that do not have nearby development capacity. Thus, limiting consideration only to opportunities where there is *immediate local* capacity and forfeited labor or freight markets could overlook projects of statewide importance. To address this issue, two approaches are considered (1) developing an overall transportation-sensitive development capacity index which is a combined index based on the combination of development capacity, forfeited labor, and forfeited freight markets, and (2) identifying and indexing specific ODOT facilities or corridors relative to ODOT's network as a whole in terms of its potential to provide statewide connections to areas with greater overall transportation sensitivity.

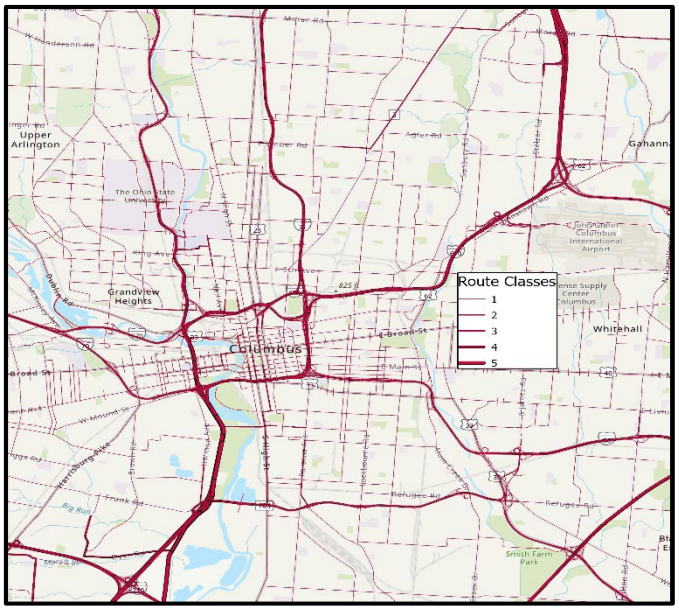
Figure 4-8: Overall Transportation Sensitive Development Capacity Score for each TAZ in Ohio



The overall "transportation sensitive development capacity" for a TAZ is calculated as a weighted sum of development capacity and forfeited labor and supplier market. The overall transportation sensitive transportation sensitivity (or score) is then assigned a value from 1-5 based on the distribution of its score (%) for the entire state (as shown in Figure 4-4). The Figure 4-4 demonstrates areas with high overall transportation sensitive development capacity with darker green patches, which are located all over the state of Ohio, without any definite visual pattern.

Using the network tools in Ohio's Statewide Travel Model (OSTM), it is possible to identify statewide passenger car and truck routes connecting areas shown in the above map with prominent levels of transportation-sensitive capacity. The trips carried by the ODOT network are classified into five classes based on the transportation-sensitive development capacity of the areas they serve or connect. The classes range from class-5 trips (those connecting areas with the highest transportation-sensitive development capacity shown in dark green on the above map) to class-1 trips (those connecting areas of the lowest transportation-sensitive development capacity shown in the lightest green on the above map). From Figure 4-5 it is observed that many of the facilities in the area, such as I-670, I-70, and some local roads have wider than average bandwidth and may exchange traffic with other areas of high-development potential throughout Ohio, even if not in the immediate vicinity of a project. The analysis suggests these are facilities where improved performance (especially for commuters) can support business attraction that may never be observed in the immediate proximity of a specific project. A similar analysis can be done from a statewide map available in the EDIT tool.

Figure 4-9: Snippet of route classes in Columbus



Accounting for Historical Experience

In addition to assessing how a project complements today's business conditions – it is critical to also understand how areas near ODOT projects in the past have fared in attracting businesses, and how such experience can be used to predict business attraction potential in the future. The following findings from Task 3 of the research provide such observations and direction.

Table 1 reports the observed census-reported Longitudinal Employer-Household Dynamics (LEHD) employment growth rate within a 1-mile radius of ODOT projects 1 year and 5 years post construction. The employment growth rate is observed to vary from -14% to 41.67% for different ODOT programs. Past projects related to Jobs & Commerce and Safety provided by ODOT were initiated after 2019/20, resulting in a decrease in job growth rates due to the impact of COVID-19. This finding also suggests that growth rates could be influenced by the location of the project, particularly the economic activity within the city/county. Additionally, it indicates that the growth rate may not solely be linked to the individual project but requires consideration of a broader context beyond the impacts of the specific project site. Therefore, an econometric methodology is employed to explore the relationships between ODOT investments and various local economic indicators such as employment, GDP, number of establishments, and income.

Table 1: Employment Growth Rate (minimum, average, and maximum) within 1-mile radius of ODOT projects 1-year and 5-year post-construction year

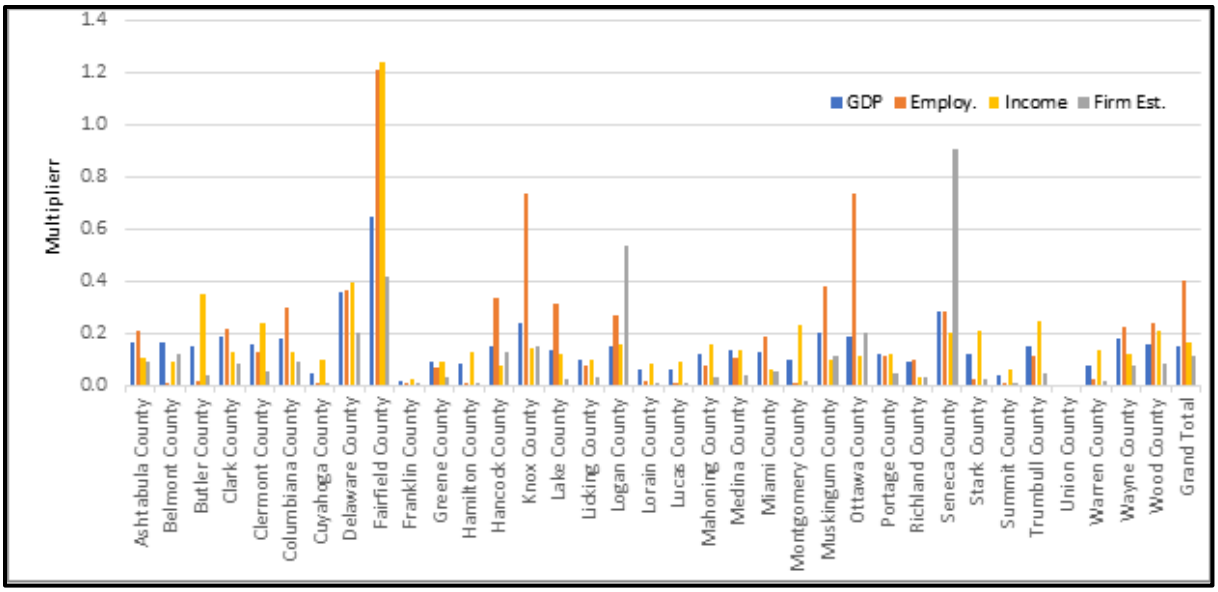
ODOT Program	Years of Analysis	Sample Size	Job growth rate within 1-mile radius (Minimum, average, Maximum)	
			1 Year Post Construction	5-Year Post Construction
TRAC	2011-2022	65	(-3.10, **1.41**, 8.16)	(-11.33, **6.43**, 15.38)
Jobs & Commerce	2019-2024	45	(-20.85, **-0.36**, 41.67)	NA
Safety	2019-2023	744	(-14.52, **-5.12**, 2.94)	NA

Using data from an eleven-year period from 2009 to 2020, Task 3 of the current research offers a regression/machine learning model observed how growth in overall employment, GDP, and income in Ohio counties has been responsive to distinct levels of statewide transportation investment. The model finds that across all counties in Ohio, for every 1% increase in state transportation investment, there can be a 0.4% increase in annual employment growth. The statewide analysis also shows that based on historical trends, a 1% increase in state transportation investment correlates with a 0.0175% to 0.02% increase in GDP, wage income, and number of establishments. Figure 4-6 below shows how these multipliers vary between representative counties throughout Ohio. Fairfield County, Knox County, Ottawa County, and Seneca County show greater responsiveness to ODOT transportation investments, as evidenced by their higher employment multipliers. These multipliers are used to predict the future employment, GDP, and business activity of a specific project.

Before applying these findings directly, it is important to control outliers in the statewide investment pattern. This control is important because an ODOT project may represent a significant increase over the 11-year historical trend of state investment in a county. For example, if ODOT implements a $100 Million bridge project, it may represent a 20x increase in state transportation investment in the county from the historical trend. However, treating it as a 20,000% increase and applying this to an employment multiplier could suggest growth beyond the county's development capacity and not represent a typical ongoing/long-term impact. For this reason, prudent control allows for a maximum county-level impact based on the multiplier, up to the highest increase that a county has had in employment in the last 20 years. Analysis of quarterly LEHD data across Ohio counties revealed the maximum increase in employment per year between the ranges of 5-15%. Figure 4.6 shows how different developments in representative Ohio counties are responsive to changes in state transportation investment, and the earlier reported findings regarding development capacity and forfeited markets serve as controls developed in Task 4 to control the impact assigned to any given TAZ location. The EDIT tool uses these findings to allow ODOT to estimate potential job creation at specific project areas throughout Ohio.

While the county-level multiplier provides a high-level statistical assessment of potential impact simply as a function of project cost, different aspects of performance may or may not support business attraction in an area. The "project spotlight" in the EDIT tool describes different project types (new construction, capacity, modernization) and project rationale (site access, reduce congestion, safety) which may affect business attraction in different ways (more details in play #7 of the playbook). Each of the performance expectations and project rationale are associated with their multipliers derived from the LEHD observed historical employment growth rates of the projects. These multipliers serve as adjustments for the county multiplier, generating varied job estimates based on project rationale and performance expectations.

Figure 4-10: County multipliers for GDP, Employment, Income, and Establishments



Evaluate Priorities

From the findings described above, the EDIT research has introduced several ways for ODOT to answer the question, "If we build it, will they come?" depending on the context, the historical experience of the area, and the rationale and performance expectations of the project. The research empowers ODOT and its staff to consistently engage stakeholders in informative and meaningful ways when asking, "If we build it, will they come?" and why based on a strategic assessment of the project context and a review of ODOT's available data. However – within the larger context of ODOT's planning and investment process, "If we build it, will they come?" is only one consideration. When projects are prioritized, the answer may need to be represented in a singular number or score that can be weighted consistently with a universe of competing priorities.

To address this issue, a host of scores and indicators as described in the subsections above can be readily incorporated into points-based prioritization of the type that ODOT may use for TRAC or other project ranking exercises. The scores of overall sensitivities to transportation access, forfeited labor market, forfeited delivery market, development capacity, and estimated jobs for a list of potential projects as shown in Figure 4-7 can assist ODOT staff in prioritizing and ranking.

ODOT EDIT Project Ranking Tool (Excel Version) ########## 8:17:24 AM

Project ID	Project Description	Business Market Potential	Devolopment Capacity	Labor Market Potential	Overall Sensitivity to Transportation Access	Jobs
1	Project Description 1	2.3	2.0	1.2	2.4	163
2	Project Description 2	2.0	3.7	1.0	3.3	627
3	Project Description 3	1.7	1.5	4.8	1.8	724
4	Project Description 4	2.3	2.0	1.2	2.4	163
5						
6						

Figure 4-11: Project Ranking Tool

Implementation

Recommendations for Implementation: The findings of this research can be implemented through (1) the incorporation of the EDIT tool in ODOT's dialogue with local stakeholders about potential economic development opportunities, (2) the application of EDIT's contextual findings and potential local impact rankings of different project locations and profiles in project prioritization, (3) ODOT's ongoing investment in improving the quality of data on existing development capacity and build out, and (4) complementary research addressing transit, freight and other aspects of the "if we build it, will they come" question.

Steps Needed to Implement: Key steps to implement can be undertaken in the first year from research completion.

(1) *Training with the Assessing Market Potential for State Transportation Improvement Projects playbook:* Use training videos and in-person sessions to walk through the "plays" of addressing business attraction opportunities using ODOT's data as applied in the EDIT system.
(2) *Training in Use of the EDIT System:* Staff use the quick-start guide (an appendix of the playbook) to prepare maps, tables and other reports assessing and comparing business attraction potential of ODOT projects.
(3) *Selection of Local Development Scoring Metrics for ODOT programs:* Use the project ranking tool from EDIT to assign weight to local business attraction potential in ODOT's prioritization of project investments.
(4) *Scoping of Ongoing development of EDIT/Local Development Intelligence:* Support ongoing improvement of the EDIT geodatabase and available assessment methods to account for improved data currency, freight and transit project opportunities and ways to guard against investing in projects that attract development to one Ohio community at the expense of others.

Expected Benefits from Implementation:

(1) *Consistent Approach to Local Development Opportunities:* ODOT can consistently identify and explain to stakeholders the basis for investing in projects likely to support local business attraction conditions.
(2) *Higher Impact Projects:* ODOT consistently invests in business attraction opportunities where known factors of workforce, supplier markets and development capacity are conducive to business attraction associated with the project.
(3) *Improved Awareness of Economic Performance Needs:* ODOT can educate both its staff and its stakeholders about how to identify where and why ODOT's investments can support business conditions – leading to higher impact projects over time.

Potential Risks and Obstacles to Implementation:

(1) *Reliance on Antiquated Data:* The current research and EDIT system are based on development capacity data that are not regularly updated and may not reflect real capacity in all areas.
(2) *Over-Simplification or Rigidity in Assessing Opportunities:* The current research focuses on the best-documented ingredients of business attraction from the national body of research to date, however some opportunities can arise from unique circumstances not captured in the research. Failure to consider unique/new opportunities could be an abuse of the research.
(3) *Cannibalization of Development Potential:* Neither this research nor the larger body of knowledge on business attraction offers a method for quantifying the likelihood that a project can attract businesses to a site at the expense of another Ohio location.

Strategies to Overcome Risks and Obstacles:

(1) *Develop Business Intelligence/Data Currency Plan:* If ODOT collaborates with allied state agencies (especially agencies focused on economic development, housing, and environmental quality) in a statewide development capacity program, the results could directly add value to the EDIT research and reduce the risk of data antiquation.
(2) Perform Context Reviews: In the near term, ODOT can remedy both the reliance on antiquated data and the risk of over-simplification or rigidity of conclusions can be remedied using the context assessment techniques/worksheets in Play #2 of the EDIT playbook to scan for recent changes in conditions.
(3) *Subsequent Research on Sources of Business Attraction:* The remedy for the potential cannibalization of Development Potential will require a subsequent research effort of a comparable magnitude as the original EDIT research. Emerging machine-learning, big-data, and AI techniques are currently being used for experimental models as the sources of business attraction. While the scope of the EDIT research has focused on the likelihood of such attraction – new methods and tools may further explore its sources.

Potential Users and Organizations Affected:

(1) *ODOT Jobs and Commerce and Planning Staff:* The primary users of the EDIT research and its associated resources are ODOT Jobs and Commerce and planning staff. The research products enable them to produce maps, statistics, and other assessments when confronted with the question "If we build it, will they come?" in different contexts.
(2) *Local Development and Land Use Partners:* While the EDIT research is intended to be directly used only by ODOT staff, local development and land use partners/stakeholders can expect to have a consistent discussion with ODOT staff, based on consistent measurements and criteria when engaging the department in discussions about business attraction opportunities.
(3) *Elected and Appointed Decision Makers:* Elected and appointed decision makers in Ohio will be affected by the EDIT research in the way that ODOT provides clear and consistent information about how and why their jurisdictions or constituents may benefit from business attraction opportunities associated with ODOT's investments.

Implementation Timeframe: The implementation steps given can be achieved within one calendar year of acceptance of the research.

Implementation Costs: The EDIT research provides resources that can be readily applied within existing ODOT business processes. For this reason, the only implementation costs include (1) staff time to attend the training with materials provided in the findings, (2) periodic updates for ODOT modeling and GIS staff to the EDIT geo-database when models or sources are updated (approximately 40 person-hours per update) and (3) staff time for ODOT staff to engage with stakeholders in performing contexts assessments and sharing findings (4-16 hours per project where implemented). Additional cost may be warranted for ODOT to build out EDIT to consider inter-modal and multi-modal freight and transit opportunities.

Evaluating Ongoing Performance and Return on Investment: ODOT can evaluate the ongoing performance return on investment through (1) annual surveys showing stakeholder reviews/tracking of ODOT's responsiveness and transparency in business attraction opportunities and (2) updating the historical cases tool of EDIT, and comparing the average, maximum and minimum development in areas directly served by ODOT project to the levels given in the tables in Chapter 4 of this report.

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